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**CORNELIS DREBBEL (1572-1633): FAME AND THE MAKING OF
MODERNITY**

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A DISSERTATION

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ABSTRACT

Cornelis Drebbel (1572-1633): Fame and the Making of Modernity

The invention of the submarine, the discovery of a chemical scarlet dye, and the contrivance of a celebrated perpetual motion machine were just a few of Cornelis Drebbel's many projects. Yet besides his career as a projector in London and Prague, Drebbel also gained fame across Europe as a natural philosopher. The acceptance of Drebbel's claim to philosophical authority runs counter to current historiography. Shapin and Schaffer have suggested that the soberly rational gentleman distinguished himself as a philosopher from the foolish empiric, yet many authorities embraced Drebbel as an artisanal philosopher. Following the ways in which Drebbel's claims and accomplishments were used sheds light on the emerging public, on the culture of *liefhebbers*, and on the numerous ways in which enthusiasm played a vital role in this supposedly dry philosophical period.

This study devotes equal attention to Drebbel and to those who championed his authority. Political theorists such as Jakob Bornitz and Christoph Besold upheld the role of artisans in an age when a market connected producers and consumers. The consumer's appetite for novelty spurred innovation and could be channeled by the state for the recovery of lost arts and the invention of new ones. Desire, once a vice and always reason's foe, could point the way to a better future.

The desiring consumer or "lover" (*liefhebber, liebhaber, amateur*) placed a high value on art and artisans. Lovers such as Joachim Morsius, Johann Ernst Burggrav, and Nicolas-Claude Fabri de Peiresc invested themselves in spreading Drebbel's fame. The example of someone who achieved the seemingly impossible supported the idea of man's limitless abilities.

The figure of the projector has never been entirely absent from historiography, but it has also never been fully integrated with the history of more canonical figures. Bacon, Boyle, Becher, and Leibniz were well aware of how the folly of empirics could further invention. Studies of long-canonized achievements obscure the utility of appetite and even folly in all seventeenth century discovery; Drebbel's story recoups the daring felt in his own time to mark a period of innovation, without rendering the idea of progress relentlessly rational or inevitable.

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Dedicated

to

Hana L. Takusagawa

and in memory of

Robert T. Farrell
(1939-2003)

Introduction: The World of Tomorrow

I: A Journey to a New World
II: Modernity
III: Enthusiasm
IV: A Public of *Lieſhebbers*
V: Notes Toward a Biography
VI: Drebbeliana

I: A Journey to a New World

In his 1670 *Journey to a New World Without a Ship or a Sail*, Johann Daniel Major, member of the Holy Roman Imperial Academy and Professor at the University of Kiel, described the progress of the arts and sciences as a fantastic journey into the future.¹ We might consider the progress of the arts and sciences as though it were a ship swimming in a vast sea searching for the port of Perfection as though for a new Indies, he said. If we do so, we realize that there have been three inventions – the compass, gunpowder, and printing – which have made our age different from all previous ones, so that it has become another New World. Gunpowder has recently been made even more dangerous through Cornelis Drebbel’s newly invented torpedo.²

Mankind has abused these three new inventions, transforming the world in horrible ways. Through the compass, we have discovered new lands, but the Turks too have used it to conquer even more parts of the world. Gunpowder has destroyed the worth of noble German valor; now hidden killers shoot their prey from afar. Printing has sapped the

¹ Johann Daniel Major, *See-Farth nach der Neuen Welt ohne Schiff und Segel* (Kiel: Reuman, 1670). I cite the paginated 1683 edition (Hamburg: G. Wolff, 1683), 4-5. “Wenn wir gleichwol gut Philosophisch betrachten/ was es mit freyen Kunsten und Wiſſenſchaften fur eine Bewandnuſſ hat/ und wie weit ſolche / als ein Schiff/ auff dem wüſten Meer dero von Jahr zu Jahr ſich verändernden Zeiten herumb geſchwommen/ umb/ an den Hafen der Vollkommenheit/ durch vieles Nachdencken und Müh/ ja wüurcklich durch unterſchiedene herzlich curieus-und koſtbahre Experimente/ gleichſam als ein Neues Indien zu gelangen; ſo finden wir/ das fürnemlich dreyerley Dinge ſind/ durch derer Erfindung die biſſanherige Zeit warhafftig gantz ein ander Ausſehen bekommen/ als ſie for tauſend Jahren gehabt/ in eine gantz andere Form/ als vor alters/ gegossen/ und gleichſam zu einer gantz Anderen Neuen Welt worden iſt: verſtehe den See-Compaſſ; das Büchſen-Pulver, und die Buch-druckerey. . . .”

² *Ibid.*, 7. “ſonſten noch eine andere/ gleich gefährliche Invention, ſo der hochehrfharne Drebbelius, ſeinem Schwiegerſohn in Engelland/ hintergelassen zu haben/ von Herrn Monconys erzehlet wird.”

Empire's strength. The Turks don't allow printing and make their youth spend all their time in military training.³ Useless farces, fables, prophecies, and pornography fill our bookstores.⁴ Soon, the fourth new invention – the art of flying - would be discovered. How horrible and perilous would the world then become? That invention alone would make the world a thousand times more despicable than the abuse of the compass, gunpowder, and printing together.⁵

But, continued Major, let us set a more appealing spectacle before the eyes of the mind. Imagine a beautiful palace of Perfection lying far beyond the sea in a yet unknown land. There men live like gods in an eternal springtime, flying up to the heavens on golden chains and beholding all the most hidden treasures of Nature with enlightened Lynx and Argus eyes. They have as well the history of all previous times and all the arts and sciences of men and will be able to discover the rules for future discoveries to the glory of God.⁶ The Venetians often perform the opera of Daedalus flying about the world and being blown to

³ *Ibid*, 10. "die Erfahrung Lehret/ dass die Türcken bis dato nicht das geringste Papierchen auf Erden vorsetzlich liegen/ viel minder einen grossen Theil ihrer Jugend studiren/ und am allermindesten viel Bücher/ ja keine/ drucken/ sondern die meisten Leute der Ihrigen zu Martialischen ubungen zeitlich angewehnen lassen/ und unsere Furcht gegen sie grossen theils hiedurch erhalten."

⁴ *Ibid*, 9. "mancher Phantast/ kranck liegend am Durchlauff des Gehirns und Feder/ die Buchläden mit albern Possen/ Schmahcharten/ Leibes-Träumen/ unnützen Fabeln/ Planetenbüchern/ Warsagungen/ und andern dergleichen Dingen füllet/ und under die Banck gesteckt werden." Major also complained of "Francion, la Pottana errante, L'escuole des Filles, und andre Feuer-würdige Schriften."

⁵ *Ibid*, 11-12. "Über angeregte Dinge so fern schlüsslich noch diess vierdte dazu kommen solte/ das Menschen fliegen könnten/ gestalt ich diese Kunst gar practicabel halte/ und klärer nicht davon schreiben mag; was würde nicht vollends die Welt fur en Neu und gefährliches aussehen/ fur eine abendtheurliche ja abscheuliche Umbstaltung ihrer selbst/ bey aller Posterität gewinnen? Was für Verrätherey/ Diebstahl und Meuchelmord/ was für andre Sünd und Schanden würden umb so viel mehr sich häuffen? . . . Von welchem handel allein die Welt tausentmahl hesslich-und zerrütteter aussehen würde/ als ingesamt von lobberühmten Misbrauch des Compasses/ des Pulvers/ und der Buchdruckerey."

⁶ *Ibid*, 12-3. "Aber lasset uns ein viel lieblicher Spectacul vor Augen des Gemüthes nehmen: eine herrliche grundveste der zeitlichen Glückseeligkeit; einen prächtig und mehr als Königlichen Pallast der Vollkommenheit; gelegen weit über Meer/ in einem noch-unbekanten Lande/ darin die Menschen bey lebendigem Leibe gleichsam zu Irrdischen Göttern werden/ und bey continuirlicher fegunder Frühlings-Lufft auff güldenen Kettenhaken gen Himmel steigende/ alles was zwischen Himmel und Erden ist/ alle offene und verborgene Schätze der Natur/ und innerste Klüffte derselben mit verklärten Luchs-und Argus-Augen besehen/ den Geschichten voriger Zeit/ ja allen Menschlichen Wissenschaften und Künsten/ allen jemals gehabt und künfttig-folgenden Sinn-reichen Erfindungen/ zur Ehre Gottes/ ihr Maas und Gesetze geben können."

new lands. Let us imagine if Daedalus had been blown off course into such a New World.

What would he see?

Daedalus would first spy a land ringed round with craggy mountains, protecting it from the onslaught of barbarians, that is, of people who do not respect the arts and sciences. Such people would not pass into the New World. Only those who proved themselves to be ingenious and experienced could gain entrance. They would find there the long-sought Golden Age, just like the Golden Age discovered, to their immortal fame, by Aristotle with Alexander the Great, Kepler with Emperor Rudolf, Tycho Brahe with Frederick King of Denmark, Harvey and Drebbel with King James in England, and many more art-loving (*kunst-liebende*) people, such as the chemists and mathematicians with Duke Frederick of Hollstein.⁷

Daedalus, it would appear, liked to make lists. He noted down what he saw concerning every branch of learning in the New World. This entailed copying down what had already been copied down before, since the inhabitants of the New World were themselves excellent copyists. They had a thorough knowledge of what had already been achieved in the Old World, past and present. For instance, their alchemists could even make flexible glass, which had been lost since classical times in the Old World, as well as wonderful eternally burning lamps.⁸

But what most excited Daedalus was the New World pleasure-house of nature, called “Physica” which he decided to choose as his main theme, devoting himself entirely to noting

⁷ *Ibid*, 16. “die hingegen in unserer Neuen Welt nicht gelten/ sondern wie sich geziemet/ Sinn-Reich und erfahrene Männer daselbst Ihre so hoch-gesuchte güldene Zeit habe/ dergleichen Aristoteles bey grossen Alexander, Keplerus bey Kaeyser Rudolph, Tycho de Brahe bey Friderico I. Glorwürdigsten König in Dennemarck: Bey Jacobo, König in Engelland/ Harvaeus und Drebbelius; und veil wackere Kunst-liebende Leute mehr/ Chimiçi und Mathematici, bey Ihr. Hoch. Fürstl. Durchl. Herzog Friedrich, seel. Herzogen in Hollstein u. Christmilden Gedächtnüss zu dessen unsterblichem Nachruhm empfunden.”

⁸ *Ibid*, 59. The alchemists know how “die Natur des Glases/ das es den Hammer und beugung leide/ nach vorlängstem Tode Tiberii, wiederum zur schmeidigkeit zubringen: ein vermeintes unverbrennliches öhl und Tacht/ zu Ewigbrennenden Lichtern/ zu machen.”

the information found there.⁹ Painted on the walls of the pleasure-house, he saw copies of all the famous *kunstkammern*, museums, and other collections of the world, which he spent the next thirty pages recording.¹⁰ Such collections of rarities were intended for the lovers (“*Liebhabern*,” discussed further below). Collecting allowed them to see the treasures of Nature in person without travelling.¹¹

The lovers also joined in associations to research the treasures of Nature, to philosophize freely about them, and also to perfect their native tongues.¹² A long list of such associations followed. And even though Daedalus said he would not note down any more information besides “*Physica*,” he continued to copy what he saw of various other arts, including optics. For instance, through perspective, the denizens of the New World were able to transform their appearances, just as long ago Drebbel had transformed himself from beggar to king, and from beast to tree, to the great amazement of his onlookers.¹³

Those who wished, like Daedalus, to travel to this New World would themselves require a substantial list of provisions for the journey. Appetite, or the desire for wisdom,

⁹ *Ibid*, 84-5. “Lust-hauss der Natura, Physica gennent, von auss und innen in fleissige consideration zu ziehen/ worauff er dann selbst für sich sein Thema machen/ und ohne Benötigung fernerer Information, sich seines gefassten Kummers grossen Theils entledigen würde können.”

¹⁰ *Ibid*, 86. “Zierlich geschildert und an den Wänden ringsumb im Vor-Sal copylich anzuschauen vorgestellt unterschieden ruhmwürdige Kunst- und Naturalien-Kammern/ Musea, Gazophylacia, Antiquaria, Gallerein/ Cimeliarchia, Pinacothecas, Cabinette/ oder Raritäten-Gemächer der Welt. . . .”

¹¹ *Ibid*, 112. “Dergleichen Raritäten-Gemacher denen Liebhabern/ die etwa nicht wol bemittelt/ und deswegen nicht füglich in fremden Landen/ die Geburts/ und Ruh-Stadt dero durch die Welt ungleich-ausgetheilten Schätze der Natur/ persönlich oder selbst in Augenschein nehmen können/ zu besehen/ sehr nützlich und bequem.”

¹² *Ibid*, 113. “. . . die Schätze der Natur zu erforschen/ und gutten theils davon frey und ungehindert zu philosophiren/ oder auch sonst/ die gewonliche Muttersprachen zu perfection zu bringen.”

¹³ *Ibid*, 168-9. “Zu geschweigen was Drebbelius schon vorlängst gethan/ welcher in einem Gemach sitzend/ durchs Perspectiv, in einem Augenblick veränderlich anzusehn gewesen/ bald in allerley Farben Altass/ bald Sammet gekleidet/ bald als ein König/ bald als ein Bettler: oder sich verändernd in einem Baum/ mit bebenden Blättern/ in einen Leuen/ Pferd/ Beeren/ oder ein ander Their. Ja/ dass er aus sich-öffnender Erdeherauffsteigende Geister/ Wolcken/ Riesen/ Alexandrum Magnum &c. den Augen der Zuseher/ mit höchster Bestärtzung derer/ vorgestellt.”

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topped the list, besides many other qualities including *ingenium* (talent or ingenuity), wonder, optimism, hard work, previous travels, technical abilities, and acute senses.¹⁴

II: Modernity

This dissertation represents a flight back to an Old World of once envisioned futures. Major saw the world of tomorrow as a place of nigh infinite possibilities brought about largely through technical innovations. That might not seem surprising, given the importance of artisans and technology to the development of the idea of progress.¹⁵ Yet there were other features of Major's view of the New World that we might not expect. The literature on the idea of progress often emphasizes reason.¹⁶ When the term "early modernity" itself was coined, it referred to progress in the disenchantment of the world through the secularizing force of scientific reason.¹⁷

Yet, in Major's formulation, it was desire sparked by the fame of past achievements which charted a course to a New World. Reason did not appear upon Major's list of required supplies. The historicization of both nature and art suggested by *Kunstkammer* collections encouraged the idea that future transformations would arise from the contingencies of

¹⁴ *Ibid.*, 242. "Appetitus (oder ein sonderbahres unverfälschichtes Verlangen nach der rechtschaffenen Welt-Weisheit), Ingenium, Memoria, Iudicium, Indifferentia, Admiratio, Dubitatio, Opinio, Disciplinarum Notitia, Pietas & Preces, Fiducia boni Successus, Aequanimitas, Liberalitas, Frugalitas, labor & Sedulitas, Peregrinatio praegressa, Constantia in Labore, Patientia in Labore, Munditiei Studium, Technica Manualis, Sanitas & Robus, aetas Virilis, Sensuum Acrimonia (oder Wackerkeit der funff Euserlichen Sinnen/ die Natur dadurch in gutte Kundschaft zu nehmen), Ambidexteritas, Agilitas Corporis, Locus Commodus, Tempus, und endlich, Fortuna."

¹⁵ Edgar Zilsel, "The Genesis of the Concept of Scientific Progress" *Journal of the History of Ideas* 6 (1945): 325-349, Paolo Rossi, *Philosophy, Technology and the Arts in the Early Modern Era*, (New York: Harper & Row, 1970), Pamela O. Long, "Invention, Authorship, 'Intellectual Property,' and the Origin of Patents," *Technology and Culture* 32:4 (Oct., 1991), 846-884.

¹⁶ J.B. Bury, *The Idea of Progress* (London: Macmillan, 1920) and R. F. Jones, *Ancients and Moderns; a study of the Rise of the Scientific Movement in seventeenth-century England* (St. Louis: Washington University, 1936).

¹⁷ Jerry H. Bentley dated the widespread use of the term to the 1960's. Bentley further argued that the term should be used to apply to a period of cross-cultural interchange in the early modern world. See Jerry H. Bentley, "Early Modern Europe and the Early Modern World" in *Between the Middle Ages and Modernity: Individual and Community in the Early Modern World*, Charles H. Parker and Jerry H. Bentley, eds. (Lanham: Rowman & Littlefield, 2007). Lorraine Daston in "The Nature of Nature in Early Modern Europe," *Configurations* 6:2 (1998) 149-172 decried the term as "screamingly anachronistic."

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history, not reason.¹⁸ Neither could reason predict the form of this future world; inventions such as the torpedo might destroy the world, while the wonderful art of optical transformations might make it a beautiful spectacle indeed.

Major placed his hopes for the future among the art lovers. Their love of human ability and what it could achieve encouraged them to be patient students of history, adventurous travelers, comprehensive collectors, assiduous copyists, and above all, careful sifters of the fragments of worlds past and present. Through communication and association, they would bring together the pieces to build the best possible world of the future.

The fame of the great men of yore buoyed the art lovers in this monumental task. Of the famous men Major mentioned as models for the New World inhabitants, Cornelis Drebbel (1572-1633) is surely the least known today. A Dutch artisan who enjoyed royal patronage in London and Prague and fame across Europe, Drebbel ought to be the ideal subject of research into the role of artisanal knowledge in the Scientific Revolution. Yet his renown, which seemed at the end of the seventeenth century so established, has evaporated.

The emphasis upon sobriety and civility in addition to rationality in a narrative of modernity can be held partially responsible for this. Civility has been seen as part of a genealogy of modernity which outlawed the violence, vulgarity, and blending of public and private of pre-modern eras.¹⁹ The importance of civil discipline and reason has informed our view of the model seventeenth-century natural philosopher as soberly rational. As a result, influential studies have shown how natural philosophers deployed social hierarchies to

¹⁸ Horst Bredekamp, *The Lure of Antiquity and the Cult of the Machine: the Kunstkammer and the Evolution of Nature, Art and Technology*, Allison Brown, trans. (Princeton: Markus Wiener, 1995) and Anthony Grafton, "Renaissance Histories of Art and Nature." *The Artificial and the Natural: An Evolving Polarity*, Bernadette Bensaude-Vincent and William R. Newman, eds. (Cambridge: MIT Press, 2007), 185-210.

¹⁹ Norbert Elias, *The Civilizing Process*, Edmund Jephcott, trans. (Oxford: Basil Blackwood, 1978), Anna Bryson, *From Courtesy to Civility: Changing Codes of Conduct in Early Modern England* (Oxford: Clarendon Press, 1998).

distinguish between the rational philosopher and the irrational mechanic.²⁰ Due to the ongoing recognition of the importance of artisanal knowledge to the rise of experimental science, efforts have continued to reveal those invisible technicians whose authority the philosophers denied and to uncover those forms of implicit knowledge not captured in the writings of the famous men who succeeded in becoming canonized.²¹

But what of those technicians who were all too visible and vocal? Drebbel, it seems, was too much of a personality to warrant study either as an invisible technician or as a soberly rational philosopher. Drebbel typified enthusiasm – or the claim to authority far beyond what one’s social standing should allow. He asserted his philosophical authority, and shockingly, this authority was accepted by many academic natural philosophers across the continent. To them, Drebbel symbolized man’s claim to know and master nature in transformative new ways. Drebbel’s past fame thus sheds light on what it meant to be an innovative philosopher in the seventeenth century.

It further shows the role enthusiasm played even for those who cast themselves as soberly rational. Many of the thinkers discussed in this dissertation such as Bacon, Boyle, Becher, and Leibniz were well aware of how the folly of empirics could further invention and reform, even as they sought new methods to control that playful folly. Theories seen today as central to the Scientific Revolution were often first posed as paradoxes contrary to

²⁰ Steven Shapin, *A Social History of Truth: Civility and Science in Seventeenth-century England* (Chicago: University of Chicago Press, 1994) and Steven Shapin and Simon Schaffer, *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life* (Princeton, N.J.: Princeton University Press, 1985).

²¹ Mary Henninger-Voss, “Working Machines and Noble Mechanics: Guidobaldo del Monte and the Translation of Knowledge,” *Isis*, 91: 2 (Jun, 2000), 233-259, Marcus Popplow, “Why Draw Pictures of Machines? The Social Contexts of Early Modern Machine Drawings,” *Picturing Machines 1400-1700*, Wolfgang Lefèvre, ed. (Cambridge: MIT, 2004), 17-48, Graham Hollister Short, “The Formation of Knowledge Concerning Atmospheric Pressure and Steam Power in Europe from Aleotti (1589) to Papin (1690),” *History of Technology* 25 (2004), 137-150, and Pamela Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: University of Chicago Press, 2004).

reason.²² The example of someone who claimed and achieved the seemingly impossible could shatter the idols of the mind, transforming the paradox to the possible. The fame of such enthusiasts as Drebbel expanded the notion of the possible to infinity, helping to defend empiricism against the authority of *ratio*.

In 1786, J. C. Adelung joined in an Enlightenment project of distinguishing between folly and enthusiasm on the one hand, and reason on the other. In his *History of Human Folly*, Adelung cast Drebbel firmly among the ranks of the charlatans, from whence he has never emerged.²³ Such was not Drebbel's position in the seventeenth century. Adelung's emphasis upon reason as a characteristic feature of modernity, which survives in much writing on the idea of progress to this day, does not reflect the sense of exploration, wonder, contingency and danger that formed many seventeenth-century views of the future, including Major's.²⁴

To Adelung, folly, like charlatanism itself, was a self-explanatory category. Folly was far less hard-edged in the seventeenth century. It enjoyed, like the Copernican hypothesis, an august history as a paradox, praised by Erasmus and his rhetorical imitators thereafter, and inspiring many a serious game.²⁵ It was unclear at the time which of the almost infinite

²² Rosalie Colie, *Paradoxia Epidemica: the Renaissance Tradition of Paradox* (Hamden, Ct.: Archon, 1976), 300-328.

²³ See J. C. Adelung, "Cornelis van Drebbel, ein Charlatan," *Geschichte Der Menschlichen Narrheit*, Vol. 2 (Leipzig: Weygand, 1786).

²⁴ Studies of magic, wonder, curiosity, hermetism, paradox, science fiction and utopianism suggest that the world remained enchanted. See for example Frances Yates, *Giordano Bruno and the Hermetic Tradition* (London: Routledge & K. Paul, 1964), Rosalie Colie, *Paradoxia Epidemica: the Renaissance Tradition of Paradox* (Hamden, Ct.: Archon, 1976), Herbert Breger, "Elias Artista – A Precursor of the Messiah in Natural Science," *Nineteen Eighty-Four: Science Between Utopia and Dystopia*, Everett Mendelsohn and Helga Nowotny, eds. (Boston: Reidel, 1984), 49-72, Stephen J. Greenblatt, *Marvelous Possessions: the Wonder of the New World* (Chicago: University of Chicago Press, 1991), Amy Boesky, *Founding Fictions: Utopias in Early Modern Europe England* (Athens: University of Georgia Press, 1996), Donald Dickson, *The Tessera of Antilia: Utopian Brotherhoods & Secret Societies in the Early Seventeenth Century* (Boston, MA: Brill, 1998), Lorraine Daston and Katherine Park, *Wonders and the Order of Nature, 1150-1750* (New York: Zone, 1998), Ladina Bezzola Lambert, *Imagining the Unimaginable: the Poetics of Early Modern Astronomy* (Amsterdam: Rodopi, 2002), Anthony Grafton, *Magic and Technology in Early Modern Europe* (Washington D.C.: Smithsonian Institution Libraries, 2005).

²⁵ Jan Huizinga, *Homo Ludens: a study of the play element in culture* (New York: Roy, 1950), Mikhail Bakhtin, *Rabelais and His World*, Helene Iswolsky, trans. (Cambridge: MIT Press, 1968), A. Bartlett Giamatti, "Proteus Unbound: Some Versions of the Sea God in the Renaissance," *The Disciplines of Criticism: Essays in Literary Theory, Interpretation, and History*, P. Demetz, T. Greene, and L. Nelson. Jr. eds. (New Haven: Yale University Press,

number of possible discoveries would be found, and which would appear in retrospect a fool's errand. Would it be phosphorus or the philosopher's stone? Flight or perpetual motion? Longitude or the quadrature of the circle?²⁶ Studies of long-canonized achievements in the history of science run the risk of obscuring the utility of appetite, passion, and even folly of all seventeenth century discovery.

Drebbel's story recoups the audacity felt in his own time to mark a period of innovation, without rendering the idea of progress relentlessly rational or inevitable. Drebbel's inventions and innovative natural philosophy once enjoyed fame alongside the names marking today's timelines of the Scientific Revolution. The invention for which he was most famous in his century – the perpetual motion – is considered today one of the greatest follies in history. Certain aspects of his inventions have been recuperated only by mercilessly slashing away their magical context.²⁷ Yet I will not be attempting to remake Drebbel into a hero of the Scientific Revolution by translating his ideas into the language of current science. Rather, I will try to clarify Drebbel's thought in his own time, the appeal it held for a century, and how his fame informed visions of modernity during an age of enthusiasm.

A certain sort of enthusiasm, or self-assertion, did play a role in Hans Blumenberg's classic account of modernity, *The Legitimacy of the Modern Age*.²⁸ For Blumenberg, an infinite universe of *res extensa* provided the space and the material for the self-assertion of man

1968), 437-75, and Paula Findlen, "Between Carnival and Lent: The Scientific Revolution at the Margins of Culture," *Configurations* 6:2 (1998), 246-47.

²⁶ In the seventeenth century, the discovery of longitude was considered as difficult as the quadrature of the circle and the discovery of the philosopher's stone. See the paper on longitude by Dr. Bainbridge read at the Royal Society in 1684. Thomas Birch, *The History of the Royal Society of London*, Vol. IV (London: Davis and Reymsers, 1760), 311. ". . . in quo solvendo mathematici non minus laborant, quam in duplicatione cubi aut quadraturâ circuli, nec minus desudant quam chrysopaei chymistae in lapide suo excoquendo."

²⁷ See for example, Gene F. Franklin, J. David Powell, and Abbas Emami-Naeini, *Feedback Control of Dynamic Systems* (Boston: Addison-Wesley, 1993), 8.

²⁸ *The Legitimacy of the Modern Age*, Robert M. Wallace, trans. (Cambridge: MIT Press, 1983).

through rational technology. Blumenberg therefore pointed to self-assertive reason and the mathematical arts within an infinite space as key markers of modernity. I agree with Blumenberg's stress on self-assertion, infinity, and an optimistic view of man's ability to transform his world as important phenomena in the development of an orientation of man to the world and to society which we call modernity. However, I disagree with his emphasis on rationality and mathematics. Blumenberg developed his view in the context of a polemical debate over the valuation of modernity. He was thus eager to point to not only what was new, but was good about modernity, leading to an emphasis upon its rationality.

Frances Yates long ago offered another way to conceptualize modernity in *The Rosicrucian Enlightenment*.²⁹ According to the majority of scholars today, no society of Rosicrucians operated in the early seventeenth century. Since there never was such an entity as the Rosicrucians, they could not serve as actors in a historical argument. The study of Rosicrucianism's role in the making of modernity thus stalled following the critical reception of Frances Yates' *Rosicrucian Enlightenment*.³⁰ According to Brian Vickers, Yates herself fell prey to enthusiasm, adopting a style of "infectious energy" rather than the "sober weighing up of the evidence."³¹

However, the reality of Rosicrucianism as a print phenomenon cannot be denied. Hundreds of works concerning the Rosicrucians remain from the period. Thus a history of the period which avoids the topic as suspect also evades an important event. Analyzing

²⁹ Frances A. Yates, *The Rosicrucian Enlightenment* (Boston: Routledge and Kegan Paul, 1972).

³⁰ As her critics pointed out, Yates failed to substantiate her claims for the particular role "Rosicrucians" played in the courtly settings she described. See for example R.J.W. Evans' scathing review in "The Rosicrucian Enlightenment," *The Historical Journal* 16:4 (Dec. 1973), 865-868. Evans faulted Yates for claiming a Rosicrucian influence upon major figures ranging from Shakespeare to Descartes while ignoring individuals for whom Rosicrucianism might be more pertinent, such as the Moravian Jan Amos Comenius and the Czech Vaclav Budovec. For the actual origin of Rosicrucian scare in France as a schoolboy's prank, see Didier Kahn, "The Rosicrucian Hoax in France (1623-24)," in *Secrets of Nature: Astrology and Alchemy in Early Modern Europe*, William R. Newman and Anthony Grafton, eds. (Cambridge, Mass.: MIT Press, 2001) 235-344.

³¹ Brian Vickers, "Frances Yates and the Writing of History," *The Journal of Modern History* 51:2 (1979), 316.

Rosicrucianism as a textual phenomenon obviates the historical problem of the Rosicrucians' actual existence, and offers a way to investigate enthusiastic texts in an historically accurate manner.³²

Several studies of intellectual communication have shown that radical changes of the seventeenth century can be analyzed through networks of personalities, widely dispersed social practices and textual techniques.³³ Studying Rosicrucianism as one among many enthusiastic utopian societies of the seventeenth century makes sense of the Rosicrucian claims and their appeal. As Leo Braudy put it in his sweeping survey of fame in the Western tradition, “. . . the Rosicrucian manifesto [the *Fama Fraternitatis*] is the evidence of a community of book readers who all want to be in on the tremendous secret of how book reading itself links together all the wise men of the world in a “fame” beyond all boundaries of class or nation.”³⁴ Whether or not any actual Rosicrucians existed, Rosicrucianism was a means for many individuals to dilate upon the role of collaboration and communication in reform. As purely a print phenomenon, Rosicrucianism shows how texts might offer an abstract arena, or a public, in which such universal collaboration and communication could occur.

As Yates and others have argued, this period saw the destruction of older hierarchies. People, ideas, and methods circulated in new ways. While earlier scholars—e.g. Habermas—have called attention to this phenomenon, they, like Blumenberg have emphasized the role of reason.³⁵ I contend that Yates was correct in her central thesis concerning the importance

³² See D. R. Dickson, *The Tessera of Antilia: Utopian Brotherhoods & Secret Societies in the Early Seventeenth Century* (Boston, MA: Brill, 1998).

³³ H. Hotson, *Johann Heinrich Alsted, 1588-1638: between Renaissance, Reformation, and Universal Reform* (New York: Oxford University Press, 2000) and *Samuel Hartlib and Universal Reformation: Studies in Intellectual Communication*, eds. Mark Greengrass, Michael Leslie, and Timothy Raylor (New York: Cambridge University Press, 1994).

³⁴ Leo Braudy, *The Frenzy of Renown: Fame & its History* (New York: Vintage Books, 1997), 354-5.

³⁵ Habermas' emphasis upon reasonable enunciation has been criticized by feminists, historians of the body, and theorists of the public emphasizing uptake rather than influence such as Michael Warner. See J. Alway,

of seventeenth-century optimistic associations supporting the role of man as discoverer within a divine yet non-sectarian framework. Yates' work suffered, however, due to a concentration on England and upon canonical figures. I return to the Yates thesis in my own work, but I do so by applying methods drawn from the history of the book, the history of art, and the history of science to an extensive corpus of sources stretching from Eastern Europe to the Atlantic world. The story of Drebbel and his fame which emerges suggests a genealogy of modernity in which desire and enthusiasm played vital roles.³⁶

III: Enthusiasm

Enthusiasm – an irrational claim to authority – often served as an epithet in the seventeenth and eighteenth centuries, but never exclusively so. It was a Senecan commonplace that “there was never a great talent (ingenium) without some mixture of madness” (Nullum magnum ingenium sine mixtura dementiae fuit). Early modern apologists for enthusiasm argued that all great men had been inspired by a divine passion. Only through enthusiasm, or the “god within” (en theos), could anything new be brought into the world.

So argued the alchemist Heinrich Khunrath in 1597. In a forward addressed to the Lovers of Natural, Universal, and invincible Truth (“Liebhabern der Naturgemessen Catholischen unüberwindlichen Wahrheit”), Khunrath wrote that he stood accused of being an enthusiast for his visions and revelations. This condemnation showed that his accuser did

“No Body There: Habermas and Feminism,” *Current Perspectives in Social Theory* 19 (2000), 117-41, Michael Warner, *Publics and Counterpublics* (New York: Zone, 2002), and Michael Gardiner, “Wild Publics and Grotesque Symposiums: Habermas and Bakhtin on Dialogue, Everyday Life and the Public Sphere,” *Sociological Review*, 2004, 28-48.

³⁶ Michael Heyd in his study of the critique of enthusiasm, *Be sober and reasonable: the critique of enthusiasm in the seventeenth and early eighteenth centuries* (New York: Brill, 1995), oddly maintained the “disenchantment of the world” through reason thesis in spite of his own evidence showing that all new forms of philosophy from the Cartesian to the experimental were criticized as enthusiastic. See Lawrence Klein’s review in *The Journal of Modern History* 71:1 (Mar. 1999), 168-9.

not have the faintest idea what the word signified. Enthusiasm meant divine inspiration, without which, as Cicero wrote, it was impossible to become great. How did so many wonderful *ingenia* arise since the beginning of the world until now without an internal calling and instruction from God? God has communicated with us many times enthusiastically, without any paper books or human instruction. How else were all the arts first discovered, as still happens today?³⁷ Not only did Khunrath claim the title of an enthusiastic writer, but he intended his works only for enthusiastic readers. He wrote in a hidden manner only those who were enthusiastic, that is, divinely inspired to understand all the secrets of nature, could comprehend.³⁸

The idea of a divinely inspired mad genius in the guise of the melancholic is familiar to historians of the Renaissance.³⁹ Enthusiasm, however, differed from melancholy. Melancholy was considered to be an imbalance of the cold black bile, leading to withdrawn solitude and the freezing of the attention upon particular obsessions. Enthusiasm derived

³⁷ Heinrich Khunrath, *Von Hylealischen, Das ist, Pri-Materialischen Catholischen oder Allgemeinen natürlichen Chaos, Der Naturgemessen Alchymiae und Alchymisten* (Magdeburg: Gehne, 1597), Forward. "Höre du Lestermaul/ sprichstu spöttlich/ ich sey ein Enthusiast/ die weil ich in tegenwertigen meinem Buch von Visionibus oder Gesichtern/ und sonderlichen (iedoch Gut-Geistlichen) Offenbarungen sage; so spreche Ich mit Warheit du seyst ein Narrischer Phantast; Der noch nicht wisse/ oder aus unbesonnenheit je nicht bedencke/ was das wörtlein Enthusiast eigentlich heisse; wil geschweigen was Enthusiast recht sey. Ist Enthusiasmus, h. e. Afflatio Numinis, das Göttliche anhauchen (sinè quo afflatu, teste etiam Cicerone, nemo unquam vir magnus, ohne welches niemals eine fürtreffliche hochbegabte geschickte Person sey worden) schwermery/ so müssen auch Bezaleel/ Achaliab/ und allerley Weissen/ denen GOTT die Weisheit ins hert gegeben/ etc. . . . Woher seint vom anfang der Weld her/ bis auff diese unsere zeit/ so viel fürtreffliche ingenia, in quovis scibili, in allerley Künsten unnd Wissensschafften funden/ as furnemlich aus GOTTES sonderbarer Eingestung/ innerlicher vocation oder Berueffung/ Unterweisung und Antreibung? [marginal So Gott auch ohne papirne Bücher und Menschliche unterweisung Enthusiasticè vielmals mit zuteilen pflaget. . . . Wie seind all-Künste erstmals erfunden? Und was geschicht disfals noch heutiges Tages?]"

³⁸ *De igne magorum philosophorumque secreto externo et visibili, das ist philosophische Erklärung von und über dem geheymen eusserlichen, sichtbaren Gludt und Flammenfeuer der ubralten "Magorum" oder Weysen, und andern wahren Philosophen* (Strassburg: L. Zetzner, 1608), 24. ". . . verborgener wise/ nur allein den verstendigen und fleissigen Doctrinae filiis (so auch Biblisch gemess Enthusiasticè, hoc est afflatu divino, das ist/ durch Gottes einhauchen oder eingestung uber innen den verborgenen Geheimnissen der natur Christlich erleuchtet und instituiert zuwerdent/ sich Theosophisch das ist/ in Gott-weisslich/ bemühen/ dardurch in Erkenntnis und verstendniss angedeutet ende aller handen verborgenheit der Natur recht und gründlich zugerathen) zu wissen hinter sich verlassen:"

³⁹ See, for example, Raymond Klibansky, Erwin Panofsky, and Fritz Saxl, *Saturn and Melancholy: Studies in the History of Natural Philosophy, Religion, and Art* (London: Nelson, 1964).

from an overabundance of blood. The overheating that ensued encouraged extreme sociability, laughter, and rapid shifts from one idea to the next.

Robert Burton, for instance, called all imbalances of the humors melancholies, but differentiated between cold melancholies (such as that proceeding from black bile – melancholy – itself) and hot ones. Those sick from blood, “are much inclined to laughter, witty and merry, conceited in discourse, pleasant, if they bee not farre gone, much giuen to musicke, dancing, and to bee in womens company.” They act as if they are characters upon a stage, mightily amused by their own performance.

As hee of *Argus* in the Poet that sate laughing all day long, as if he had been at a Theater. Such another is mentioned by *Aristotle*, liuing at *Abidos* a towne of *Asia minor*, that would sit after the same fashion as if he had beene vpon a stage, and sometimes act himselfe, sometimes clap his hands, and laugh as if hee had beene well pleased with the sight. Such a one was old *Sophocles*, and *Democritus* himselfe had *bilare delirium*, much in this vaine.

This laughing disease could be productive. Burton cited the opinion of the medical theorist André du Laurens, who “thinkes this kind of melancholy . . . to be that which *Aristotle* meant, when he said melancholy men of all others are most witty, which causeth many times a divine ravishment, and a kind of *Enthusiasmus*, which stirreth them vp to be excellent Philosophers, Poets, Prophets.”⁴⁰

Hobbes too differentiated between different sorts of madness, and described the overheating of enthusiasm as a disease of the crowd, rather than of the frigid, melancholic loner. Yet the madness, although more visible in large groups, pertained equally to each member of the crowd. “Though the effect of folly, in them that are possessed of an opinion of being inspired, be not visible alwayes in one man, by any very extravagant action, that proceedeth from such Passion; yet when many of them conspire together, the Rage of the

⁴⁰ Robert Burton, *Anatomy of Melancholy* (Oxford: Lichfield and Short, 1621), 245-6.

whole multitude is visible enough. . . . And if this be Madnesse in the multitude, it is the same in every particular man.”⁴¹ As an example of how this hot madness drove crowds, Hobbes told of the “great conflux of people in *Abdera*, a City of the Greeks, at the acting of the Tragedy of *Andromeda*, upon an extream hot day: whereupon, a great many of the spectators falling into Fevers, had this accident from the heat, and from the Tragedy together, that they did nothing but pronounce Iambiques, with the names of *Perseus* and *Andromeda*; which together with the Fever, was cured, by the comming on of Winter.”⁴² Enthusiastic spectators could never be passive observers. They must themselves join in a collective performance.

Thomas Adam also emphasized the performative aspects of enthusiasm. The enthusiast’s desire to be noticed drove him to new ideas, since “they hate, not to be obserued, and had rather be notorious, then not notable.” This desire for notoriety drove them to champion new and controversial ideas. While Adams agreed that “New *Physicke* may bee better then olde, so may new *Philosophy*; our studies, obseruation, and experience perfecting theirs but hardly new *Diuinitie*.” The enthusiast promoted novelty only out of a desire

to be crosse to regularity; and should he be enioined a *Hatte*, a *Cappe* would extremely please him: were he confined to extemporall and enthusiastically labours, he would commend premeditation and studie; which now he abhorres, because they are put on him. He is vnwise in being so bitter against Ceremonies: for therein hee is palpably against himselfe, himselfe being nothing else but Ceremonie. Hee loues not the beaten path; and because euery foole (sayth he) enters at the gate, hee will climbe ouer the wall.”⁴³

Enthusiasm operated between an individual and society. It applied to the individual author, self-sufficiently instructed by the “god inside,” but also to the readers who

⁴¹ Thomas Hobbes, *Leviathan* (London: Andrew Crooke, 1651), 36.

⁴² *Ibid.*, 37.

⁴³ Thomas Adams, *Diseases of the soule a discourse diuine, morall, and physicall* (London: George Purslowe, 1616), 4-5.

responded to those inspired writings according to their own inner light. It drove crowds to act in concert but also applied to each member of the crowd. In German the simultaneously particular yet collective nature of enthusiasm appeared in its relationship to the term *schwärmer* (swarmer). As Anthony La Vopa has written,

When Luther wanted to castigate the mobs that followed self-appointed field preachers or rampaged through churches, smashing the statues, the verb *schwärmen* was ready to hand. It evoked bees swarming around the hive; a flock of birds zigzagging across a field; a pack of hounds straying off the scent. One could hear an ominous buzzing and flapping (or murmuring) and imagine the erratic movement of an aggregate, a kind of perverse order in frenzied disorder. The epithet derived much of its force from this cluster of metaphors, evoking all sorts of implications about deviance and conformity, selfhood and collectivity, private fantasy and public authority. It retained that force in the passage from religious polemics to a secular language of medical science.⁴⁴

As La Vopa argued, Enlightenment philosophers attempted to distinguish between the *schwärmer* and a laudable sort of enthusiasm through the proper use of print culture. Print mediated between individual and society, allowing one “to engage ideas in socially connected solitude.” Thus, the “enlightened reader avoided the Schwärmer’s extremes of isolation and total immersion, introversion and total conformity.” However, by the end of the eighteenth century, disillusion with print culture set in as the mass consumption of sentimental novels heralded a new age of reading mania, even as philosophical systematizers were themselves branded as projectors (*Projektenmacherei*).

Ironically, this reading mania had been triggered by the aesthetic emphasis upon sensibility, that is, by the same aesthetic philosophers who had attempted to distinguish between a rational, natural style and the enthusiastic, “dark style” of German Baroque literature. Joseph P. Clark has connected the discourse of reason in Enlightenment aesthetics

⁴⁴ Anthony La Vopa, “The Philosopher and the ‘Schwärmer’: On the Career of a German Epithet from Luther to Kant,” *The Huntington Library Quarterly* 60:1/2 (1997), 88.

to seventeenth-century religious opposition to Schwärmerei.⁴⁵ In the seventeenth century, authors such as Jakob Böhme and Quirinus Kühlmann were labeled as enthusiasts by a religious orthodoxy fearful for its authority. Eighteenth-century aesthetic critics applied the same label to the same authors to denigrate a style of writing depending upon an inspired reader for its comprehension.

Aesthetic criticism itself, however, owed its existence to the idea of a critic gifted with special powers of discernment. Such a critic must be able to perceive that *je-ne-sais-quoi* that was above reason. The *je-ne-sais-quoi* first saw its apotheosis in the works of Père Bouhours and Roger de Piles, during what has been called the age of conversation. The critic of the French salon assumed an authority to judge this inexplicable entity based on his supra-rational powers of discernment.⁴⁶

This authority grew during eras of privileged status for the cultural consumer. Marc Fumaroli has seen a precursor to the culture of conversation of the Parisian salon in the Antwerp of Peter Paul Rubens.⁴⁷ As discussed further in Chapter Three, it was in Antwerp that the commodification of art gave the consumer agency. In a market based on supply and demand, the tastes and desires of the consumer grant him a portion of responsibility for the supply. An enthusiastic public determined the value of authors, artists, and other cultural producers. Some individuals would be judged to have that certain something, and others would not.

⁴⁵ Jonathan P. Clark, "Beyond Rhyme or Reason. Fanaticism and the Transference of Interpretive Paradigms from the Seventeenth-Century Orthodoxy to the Aesthetics of Enlightenment," *Modern Language Notes* 105:3 (1990), 563-582.

⁴⁶ Roger Scholer, *The Je-ne-sais-quoi in early modern Europe: encounters with a certain something* (New York: Oxford University Press, 2005) and Larry Shiner, *The Invention of Art: a Cultural History* (Chicago: University of Chicago Press, 2001), 73-4.

⁴⁷ Marc Fumaroli, *Le Genre des Genres Littéraire Français: La Conversation* (Oxford: Clarendon Press, 1992), 23-4.

Taste thus served to mark out certain individuals, as well as to unite those who shared the same tastes. For Rojek, the history of taste is intimately linked to the emergence of celebrity.

Taste became a mark of recognition in which individuals acknowledged solidarity in regard to specific cultural mores and values. Groupings of fans in celebrity culture can be regarded as taste cultures, cultivating and refining standards of emulation and solidarity in respect of the celebrity to whom they are attached.⁴⁸

Taste, like enthusiasm, unified groups vis à vis individuals invested with a special authority.

For Leibniz, taste also had a unifying function. The *je-ne-sais-quoi* permitted an enthusiastic reader to find new meanings in opaque, occult, or seemingly disconnected ideas. In contrast to the clear and distinct idea, the *je-ne-sais-quoi* was clear but not distinct, that is, it was a powerful but fused feeling. Rather than delineating ideas through reason, Leibniz sought to forge new fusions through feeling.⁴⁹ The *je-ne-sais-quoi* offered a means to build a concordance of philosophical opinion, and in particular, a hybrid of vitalism and mechanism. As discussed in the next chapter, Drebbel's persona served Leibniz as a model for an inspired creator of fusions.

Since Elizabeth Eisenstein's *The Printing Press as an Agent of Change*, scholars have debated print's ability to fix meaning and transfer it uncorrupted from author to reader.⁵⁰ Yet, as many have pointed out, enthusiastic readers have always accompanied print.⁵¹ Such readers did not necessarily see the printed work as authoritative, but depended on their own

⁴⁸ Chris Rojek, *Celebrity* (London: Reaktion, 2001), 102.

⁴⁹ Scholer, 119-124.

⁵⁰ Elizabeth Eisenstein, *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early Modern Europe* (Cambridge: Cambridge University Press, 1979).

⁵¹ Peter Lake and Steve Pincus, "Rethinking the Public Sphere in Early Modern England," *Journal of British Studies* 45 (April 2006), 270–292 and Adrian Johns, "The Physiology of Reading and the Anatomy of Enthusiasm," *Religio Medici: Medicine and Religion in Seventeenth-Century England*, Ole Peter Grell and Andrew Cunningham, eds. (Brookfield, VT: Ashgate, 1996), 136-170.

authority to use the flood of printed material as they sought fit.⁵² This dissertation is not a traditional study of a great man and his reception. Rather, I offer an account of the creative uses enthusiastic readers made of a persona who, in their opinion, had that certain something.

Drebbel was a model enthusiast. He claimed authority far beyond the bounds of his social status, training, and it might seem, the human condition itself. He departed from his hometown and the guild structure to lead the life of an international projector and natural philosopher. He combined several disciplines in a career ranging from London to Prague and from engraving to fountain design. He built innovative “living instruments” by fusing alchemy and mechanics, thereby transgressing the divide between nature and art. Although an artisan by training and trade, he claimed status as a natural philosopher and the ability to discover universal truths about nature through the work of his own hands.

In his cosmology he denied any divide between the nature of heavens and earth, and claimed that the lowliest earth could transmute into celestial fire. God, he said, had even granted man the ability to perfect nature through art, continuing God’s work of purification where He left off.⁵³ Displaying little patience for traditional social hierarchies, Drebbel bemoaned, in his *On the Nature of the Elements*, the lack of understanding (*onverstandt*) causing the different lots of man.⁵⁴ If we test ourselves, we find that we are all created by God as bejeweled Kings, with all of nature for our inheritance.⁵⁵ It is through maker’s knowledge

⁵² Adrian Johns, *Nature of the Book* (Chicago: University of Chicago Press, 1998).

⁵³ Drebbel, *On the Nature of the Elements*. See Appendix, Chapter Eleven. “Ob mochtest u fragen wie ist es möglich die dinge also zu verbessern sehen wir nicht das alle sahmen ihres gleichen vorbringen etwan besser etwan schlimmer? wie solten wir durchs Feuer mehr Clarificieren können dan Gott durch die Sonne? Hier auff andtworte das unser Clarificieren auf eine andere weise geschicht dan wir nehmen die Corpora die Gott durch die natur gelcarificiert hatt unnd Clarificieren die wieder durchs Feuer unnd Wasser.”

⁵⁴ Drebbel, “Dedication.” See Appendix. “. . . dat onverstandt is de oorsaeck van den verscheyden wil/ oordeel en leven des Menschen.”

⁵⁵ Drebbel, *On the Nature of the Elements*, preface. “. . . lasser uns uns selber prufen/ sein wir nicht Könige des kostlichsten kleinods so Gott geschaffen? haben wir nicht allen reichtumb der Welt zu unserm dienst?”

and self-testing that man can gain understanding of nature and of himself, love God, avoid evil, and partake equally in the sweetness of natural knowledge. In his own life, Drebbel connected artisanal philosophy to social egalitarianism, appearing to his contemporaries as a classically ragged philosopher reborn.⁵⁶ As his son-in-law told Peiresc in 1624, “he lived always as a philosopher, concerning himself only with his observations, and, not caring for worldly things or aristocrats, he would sooner acknowledge a poor man than a great lord.”⁵⁷

His inventions also allowed him to leave the bounds of normal mortals. Through his submarine, he explored the underwater world to the depth of six fathoms.⁵⁸ Fittingly, as his son-in-law informed Samuel Hartlib, “Ars Volandi [the art of flying] was the last Invention in pursuit of which Drebbel dyed.”⁵⁹ Drebbel’s optical instruments were employed in London, Cologne, Paris, and Rome to explore past the limits of visibility. As Gassendi wrote, Drebbel used a telescope to observe habitations on the moon just like those here on earth. And as son-in-law informed Samuel Hartlib, his father-in-law was still improving the telescope at his death, working upon “the Invention of bringing the Moone so neare to ones face, as to see things in it.”⁶⁰

⁵⁶ Constantijn Huygens called Drebbel “magne Senex” who “fronte Batavum Agrigolam, sermone Sophum Samiumque referret et Siculum.” See his “Vita Propria,” *De Gedichten van Constantijn Huygens* (Groningen: B. Wolters, 1898), 203-4.

⁵⁷ Bibliothèque Carpentras, Ms. 1776, fol 410r. “Il vit tout a faict en filosofe ne se soucie que de ses observations, et mesprisé toutes les choses du monde et les Grands, et saluera plustot un pauvre homme qu’un grand seigneur.”

⁵⁸ As Küffler informed Samuel Hartlib in *The Hartlib Papers CD*, 2nd ed. (Sheffield, UK: HROnline, Humanities Research Institute, University of Sheffield, 2002), *Ephemerides*, 29/5/73A, 1656. “Its experimented that 6. fathom deepe there is no abiding vnder the Water with Boates or Men. For both will bee squeezed together. This also Greatrix hath found and though hee may have devices to fence his body yet his head will bee pressed together. This Drebbel did find out by Experience.” Hereafter the Hartlib Papers CD will be cited as Hartlib, *Ephemerides*.

⁵⁹ Hartlib, *Ephemerides*, 29/5/74A, 1656.

⁶⁰ *Ephemerides*, 29/8/12B, 1660. “Dr Kuffler confessed that his Father in Law Drebbel was vpon the Invention of bringing the Moone so neare to ones face, as to see things in it. Hee did labor with great earnestnes in it. Pronounced that Optical knowledge was not much yet advanced. His Tube was but very short being made vp of Liquors and these divers one brighter then the others. Also another kind of Circle or segment or section. etc. Hee dyed in the pursuit of this Invention. Dr Kuffler.”

Seeing the moon alone did not satisfy Drebbel. The Polish Comenian pansophist John Jonston reported that Drebbel hoped to find a telescope, “whereby out of our Horizon in the Opposite Hemisphere, beyond the bounder of the Hemispheres he might observe all the Stars there, as if they were apparent in that part of the world we live in.”⁶¹ Jonston also observed flies with Drebbel in London through the latter’s compound microscope.⁶² As Constantijn Huygens wrote of this device, “Even had Drebbel done nothing else in his entire life, he would have gained immortal fame through this wonderful little tube. It is as though you are standing before a new theater of nature, upon another earth. Had de Gheyn the Elder lived longer, I believe he would have undertaken . . . to draw the tiniest objects and insects with a very fine pen. He would have compiled it into a little book which he would have had engraved, giving it the title *The New World*.”⁶³

Perhaps Drebbel’s most spectacular optical breaking of boundaries can be found in the optical display which Johann Daniel Major included in his own New World. This display has been described as a magic lantern, but it appears to have been an arrangement of mirrors.⁶⁴ In this display, Drebbel transformed his form through art, as he shape-shifted

⁶¹ John Jonston, *Constancy of Nature* (London: John Streater, 1657), 112.

⁶² Jonston, *Historiae Naturalis de Insectis Libri III* (Frankfurt: Merian, 1653), 67. “Variis depingi cancellatim quasi coloribus, pavonis instar, per microscopium apud celebrem illum mechanicum Drebellium Londini observavimus.” On the microscope, Edward Ruestow, *The Microscope in the Dutch Republic: The Shaping of Discovery* (New York: Cambridge University Press, 1996), 6-12.

⁶³ “Fragment Eener Autobiographie van Constantijn Huygens,” *Bijdragen en Mededeelingen van het Historisch Genootschap* 18 (1897), 119-120. “Hoc mirabili tubulo, ut nihil omni vitâ aliud praestitisset, nominis immortalitatem Drebbelius non dubie promeruit Revera enim istud novo in theatro naturae, alio in terrarum orbe versari est et, si Geinio patri diuturnior vitae usus obtigisset, aggressurum fuisse credo, quo impellere hominem non invitum coeperam, minutissima quaeque rerum et insectorum delicatiore penicillo exprimere compilatisque in libellum, cuius aeri exemplaria incidi potuissent, Novis Orbis vocabulum imponere.”

⁶⁴ For the display as a magic lantern, see Thomas L. Hankins and Robert J. Silverman, *Instruments and the Imagination* (Princeton: Princeton University Press, 1995), 47. Küffler described this display as the work of concave mirrors. See Hartlib, *Ephemerides*, 29/5/95A, 1656. “Drebbel could by a certain placing of diverse Concave Glasses bring in the whole shape of any mans body from one roome to another, which relation is attested by Dr. Kuffler.” Around Drebbel’s inscription in Morsius’ album amicorum, Morsius also noted down the letter on the “mirabili optico speculo.” This interpretation provides support for my reading of Van Goose as a parody of Drebbel in Jonson’s *Masque of the Augurs* (see Chapter One). Van Goose produced an optical display by the “*ars van de Catoptricks, by de refleshie van de glassen*.”

from beggar to king and from beast to tree, while maintaining a strong sense of his own identity as an innovator. As he boasted to his friend Ijsbrandt van Rietwijck in a letter on the optical display mentioned above, “I do this through a new invention, which I have discovered through the art of optics” (Ende dit doe *ick* altesamen door een nieuwe inventie, die *ick* door de oochconst gevonden hebbe,” emphasis added).⁶⁵ Similarly, in 1632, according to Comenius, Drebbel was still at work on the perpetual motion, claiming that he would find the perpetual motion or nobody would.⁶⁶

He stressed his independence also within his natural philosophy, presenting himself as an enthusiastic author writing for enthusiastic readers. Both Drebbel’s writing of his book, *On the Nature of the Elements*, and the reader’s reading of it required personal discovery. He included a special demonstration, the subject of the only illustration in the text, which he encouraged the reader to reconstruct for himself in order, as Drebbel said, to understand his theory better than he could express it in words.⁶⁷

This demonstration went far beyond the “virtual witnessing” of another’s experiment.⁶⁸ Drebbel’s style of writing hovered at the very edge of literate communication, as close to embodied experience as possible. He claimed to discover his philosophy with his

⁶⁵ Furthermore, during the performance of his transformation, he sat entirely alone (“Ick set mij in een camer opentlijck, sonder ijemant anders bij mij te hebben”). A copy of Drebbel’s letter to Ijsbrandt van Rietwijck can be found in the Huygens Papers at the Koninklijke Bibliotheek, the Hague, Vol. 47, 207r-207v. Reprinted in F. M. Jaeger, *Cornelis Drebbel en zijne tijdgenooten* (Groningen: Noordhoff, 1922), 110.

⁶⁶ Jan Amos Comenius, *De Arte Spontanei Motus*, KB Huygens. “Ante septennium hoc Anno 1632 reversus ex Anglia vir generosus, gentilis meus, inter alia retulit, Drebbelium eatenus perpetui mobilis vestigationi insudare, sed frustra, quanquam praesumat et jactat/: ex ore eius auditam sibi referre vocem:/ se reperiturum aut neminem.”

⁶⁷ *On the Nature of the Elements*, Chapter Five. “Darumb mein Bruder was du dis im grunde betrachttest wirstu recht verstehen die vorgehende exempel vom winde, mehr dan ich schreiben konte derowegen habe ich nicht mehr geschriben dan zum fundament und zu dem das wir weiter verstehen werden notig.” Chapter Six, “welche ursachen man mit naturlichen Rationibus beweisen kündte, aber der vorgehende ursachen verstedet, wirdt das volkömlicher verstehen dan ich beschreiben kondte.” And they did so. Isaac Beeckman noted reproducing the demonstration in 1619. See Isaac Beeckman, *Journal tenu par Isaac Beeckman de 1604 à 1634*, Vol. I (Hague: M. Nijhoff, 1939), 346.

⁶⁸ Shapin and Schaffer discuss the way Boyle deployed engravings of his experimental equipment, the air-pump, in order to give his readers a sense of being “virtual witnesses” at an experiment in *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985), 55.

own hands (“mit der handt”), and to be able to reproduce that bodily knowledge in others.⁶⁹ He did not cite any ancient writers, he said, because he hadn’t read them. Instead, he gave the reader only what he himself had found. The reader would discover in his writings what had been hidden from many. However, if the reader did not understand him correctly, he would not know how to use that knowledge. Drebbel did not wish to give himself away too openly to people of little understanding, but he did hope that it would all become clear after his death.⁷⁰

Drebbel appeared to his contemporaries as the standard-bearer of a new approach to the knowledge of nature based in the physical manipulation of art, rather than the verbosity of reason. So wrote G. P. Schagen, Drebbel’s friend from his hometown Alkmaar, in a dedicatory foreword to his edition of Drebbel’s letter to King James I concerning his perpetually moving microcosm (discussed further in Chapter Six).

If this knowledge [of building microcosm] was common among astronomers, one would not require so many theorems in calculating the planets and other stars, but astronomy would be easy and Copernicus would prosper, since he demonstrated through reasoning [*reden*] that the Earth goes around every 24 hours, but this Alkmaarian philosopher can demonstrate the same not only with reason but also with living instruments.⁷¹

Knowledge of nature based in personal discovery rather than language allowed everyone to act as their own authority, each of them independently experiencing the truth of the

⁶⁹ See Drebbel, *On the Nature of the Elements*. “Dieses lieber Bruder habe ich von der natur geschriben wie ich solches mit der handt befunden,” and in the “Dedication,” “Want verclare door den levendigen Godt/ dat noch die schriften van de Ouden/ noch eenighen Mensch my de minste hulp hier in ghedaen heeft: maer heb dit alleen ghevonden/ door gestadich opmercken/ in’t ondersoecken van de Elementen.”

⁷⁰ Forward, *On the Nature of the Elements*. See Appendix. “. . .ich die warheit zu sagen keinen hieruber gelesen, sondern ich gebe dir solches wie ich es von der Natur empfangen habe ich vergewisse dich das du alhie finden wirst das vor vielen verborgen ist und so du mich nicht recht verstehst so ist dir unbekant war zu es dienstlich, welches ich deines unverstands wegen verschweige, damit ich mich nicht zu viel blos gebe, aber wan meine Sehle meinen leib wirdt uber wunden haben hoff ich es solle offentlich an den tag komen.”

⁷¹ See Schagen’s preface, included in the Appendix. “So dese wetenschap onder de Sterkondigers ghemeen was soo en soudemen niet behoeven soo veel stellingen en rekenigh der Planeten en ander Sterren maer de Sterkonst soude licht zyn en Copernicus soude bloeyen: want die bewyist (met reden) dat het Aerdrÿck alle 24. uren ront om gaet: Maer desen Alckmaersche Philosooph cant selfde niet alleen met reden maer oock met levendige Instrumenten bewyisen.”

Copernican hypothesis. Drebbel's personal authority in his claim to build the world granted authority to all.

The optimistic anthropology, social egalitarianism, and perfectibility apparent in Drebbel's natural philosophy have led historians to label him an Anabaptist.⁷² Yet if we inspect the evidence for this claim, we find it consists only in Drebbel's evocation of "brotherly love," and in a remark by Hugo Grotius that the two inventors of the telescope were perhaps Anabaptists.⁷³ However, the language of love was too widespread to offer evidence of membership in elusive groups such as the Family of Love or Anabaptists.⁷⁴ Such claims of fraternal affection do not point to membership in an exclusive sect, but rather to a wider sense of brotherhood, association, and shared endeavor.

The trends toward tolerance, cosmopolitanism, and Utopianism in northern Europe supported the emergence of idiosyncratic philosophies and radical fusions of the human and the divine which might shock the historian today.⁷⁵ Willem Frijhoff, in his study of a seemingly "peculiar" individual, Evert Willimsz, and his integration into educational and spiritual institutions, has suggested that historians "tend to exaggerate conformity," disregarding the latitude provided by early modern social structures.⁷⁶ Richard Popkin has pointed to enthusiastic, millenarian natural philosophers as what he called "the third force in

⁷² H. A. M. Snelders, "Alkmaarse Natuur wetenschappers uit de 16de en 17de eeuw" in van der Bijl, et al, *Van Spaans beleg tot Bataafse tijd. Alkmaars stedelijk leven in de 17de en 18de eeuw* (Zutphen: Walburg, 1980), 119.

⁷³ Jaeger, 10 and Tierie, 21.

⁷⁴ On the Family of Love and their elusiveness, see Christopher Marsh, *The Family of Love in English Society, 1550-1630* (New York: Cambridge University Press, 1994).

⁷⁵ For the continuance of Coornhert's thought, see the collection of essays, *The Emergence of Tolerance in the Dutch Republic*, C. Berkvens-Stevelinck, J. Israel, and G.H.M. Posthumus Meyes, eds. (Leiden: Brill, 1997), in particular, Jonathan Israel, "The Intellectual Debate about Toleration in the Dutch Republic," 3-36. Such traditions of the Low Country tolerance supplemented the pluralism of ideas available elsewhere in Europe. See *Heterodoxy in Early Modern Science and Religion*, John Brooke and Ian Maclean, eds. (New York: Oxford University Press, 2005). For the pluralism of religious groups in the Netherlands, see J.J. Woltjer, "De Plaats van de Calvinisten in de Nederlands Samenleving," *De Zeventiende eeuw* 10 (1994), 3-23.

⁷⁶ Frijhoff studied an orphan through whom the Holy Ghost spoke, and who later became a Calvinist minister in the New Netherlands. See "Identity achievement, education, and social legitimation in early modern Dutch society: the Case of Evert Willemsz (1622-1623)," *Embodied Belief* (Hilversum: Verloren, 2002), 67-91.

seventeenth century thought” besides Cartesian rationalism and British empiricism.⁷⁷ I emphasize the importance of the same frequently marginalized group of philosophers (with the addition of Drebbel) as Popkin. I do not, however, link them to skepticism as he does, but to an optimistic blend of the Hermetic tradition, alchemy, Coornhertian spiritualism, and a permissive theosophy.⁷⁸

This blend appeared in Drebbel’s own works, as well as in the reception and context provided for his works by others.⁷⁹ Drebbel’s letter to King James I on the perpetual motion machine was printed by G.P. Schagen alongside the first printed Dutch translation of the Hermetic *Poemandres*. Despite Isaac Casaubon’s objections, many at the time believed the *Poemandres* to be a divinely sanctioned text dating to before the time of Moses and containing the *prisca sapientia*. The *Poemandres* offered a version of Genesis without any original sin, it suggested that man was a microcosm containing all the powers of the universe within him, and it linked man’s knowledge and manipulation of those powers to knowledge of and ascension to the divine.⁸⁰ Schagen’s version set various sections of the text to ballads and

⁷⁷ Richard Popkin, “The Third Force in Seventeenth-century Thought: Scepticism, Science, and Millenarianism,” *The Third Force in Seventeenth Century Thought* (New York: Brill, 1992), 90-119.

⁷⁸ As an engraver and teacher of Goltzius in Haarlem, it seems probable that the model of Coornhert as a vernacular philosopher and perhaps the content of his philosophy would have been known to Drebbel in some form. For Coornhert’s biography and his teachings on the freedom of thought, see Gerrit Voogt, *Constraint on Trial: Dirck Volkertsz. Coornhert and Religious Freedom* (Kirksville, Mo: Truman State University Press, 2000).

⁷⁹ Drebbel’s text was occasionally collected as a spiritual rather than a natural philosophical work. This was particularly so toward the end of the seventeenth century, when the theosophical nexus producing Drebbel’s work began to be distanced from more mainstream practices of natural philosophy. A Hamburg manuscript, Theol 1921, now lost, contained the works of such nonconformists as Paul Felgenhauer, Jane Leade, Abraham von Franckenberg, and others, including on pages 162-192, a new German translation of Drebbel’s *On the Nature of the Elements* out of the Latin (“Cornelius Drebbel, traktat von der natur der elementen. Nach dem von Joachim Morsius, Hamburg, 1621, edit. lat. Text ins. Dt. ubersetzt von Aletodulo Engytatophilo, 1700”). See Nilüfer Krüger, *Die Theologischen Handschriften der Staats- und Universitätsbibliothek Hamburg. Part 3. Quarthandschriften und kleinere Formate (Cod. theol. 1751-2228)* (Stuttgart: Hauswedell, 1993). A Ritman Library manuscript, *Grondige oplossinge van De natuur en eigenschappen Der elementen en De eenwige werkelijkheit Gods, in het Geschep. Geschreven en nagelaten, voor De ondersoekers Der waarheijt. Door S.D.I. nagesien en Gecorrigiert Door H.P.* (1712), incorporated parts of Drebbel’s *On the Nature of the Elements* with Hermetic psalms and other theosophic meditations.

⁸⁰ See Frances Yates, *Giordano Bruno and the Hermetic Tradition* (London: Routledge & K. Paul, 1964). Special thanks to Christian Wildberg, with whom I studied the *Poemandres*. For a study of the Greco-Egyptian original context of the *Poemandres*, see Brian P. Copenhaver, ed. *Hermetica* (Cambridge: Cambridge University Press,

religious songs, suggesting that the *Poemandres* could be used in a spiritual way (“*Dat heylighe Sermoen van Mercurio*” could be sung to “*Het daghet nyt den Oosten*,” “*Dat het meeste quaet van de Menschen is, Godt niet te kennen*” to “*Dat ickse nu moet laten*,” and “*den Hymnus, ofte Lofsangh van Hermes*” could be sung like grace, “*Op de wijze van die gratias: O Heer ny dancken dijner goedt*”).⁸¹

The wider enthusiasm of the period for the possibilities of human art in general and for a *Tausendkünstler* (universal artist) such as Drebbel in particular responded to Drebbel’s daring departure from traditional social and craft structures. The Dutch editions of Drebbel’s major work, *On the Nature of the Elements*, show what appear to be a scandalously permissive conflation of religiosity and the study of nature, not to mention an outrageously high status accorded to a mortal such as Drebbel. This appears not only in the substance of Drebbel’s natural philosophy, but in the paratext in a “praise-poem” to Drebbel, which I cite and translate in full.

O what unheard of things still coming to light! Everyone well may rejoice who has enjoyed himself in knowledge. Now man can taste what the pleasure of learning can lead us to. You who reason without any prattle, be calm, stay so easily, but trust more to the sense of sight, and come quickly to Drebbel’s side. Today before you go back, you shall gain what you want. Has ever anyone appeared who, like this traveler (Drebbelaer) has traveled (Drebbel’d) so close to nature? Nay forsooth. We do not read of anyone who has so clarified and shown the nature of principles. Here you may hear the thunder, a rolling fury that follows after the lightening flash before. I can feel rain and hail about my ears, [and]

1992) and Garth Fowden, *The Egyptian Hermes: a Historical Approach to the Late Pagan Mind* (Princeton: Princeton University Press, 1993).

⁸¹ See Cornelis Drebbel, *Wonder-vondt* (Almaar: Jacob de Meester, 1607). Schagen’s edition might not appear to support the idea that Drebbel’s views were not due to an exclusive radical sect, but to wider ideas available in society, since Schagen himself has been linked to the Anabaptists. While it is true that Schagen had an eighteenth-century Anabaptist relative, at the time Schagen was a member of one of the leading Counter-Remonstrant families in Alkmaar. Marten Schagen identified himself as a “doopsgezinde leerar” in Utrecht in his *De Kerke der Nederlandsche Doopsgezinden* (Harlem: Schagen, 1743). Jonathan Israel described Maurits’ purge of Arminian supporters from the Holland towns. In Alkmaar, Maurits “summoned the *vroedschap* and removed sixteen regents . . . Only eight members of the old *vroedschap* remained, among them Pieter Jansz. Schagen, a zealous Counter-Remonstrant selected as one of Oldenbarnevelt’s judges.” Jonathan Israel, *The Dutch Republic: its Rise, Greatness, and Fall, 1477-1806* (New York: Oxford University Press, 1995), 453. See also M. van der Bijl, “Familie en Factie in de Alkmaarse Stedelijke Politiek,” *Van Spaans beleg tot Bataafse tijd. Alkmaars stedelijk leven in de 17de en 18de eeuw* (Zutphen: Walburg, 1980), 12-32.

as you will, cold or heat, wind or quiet. Here you see the pleasure of life! Stars turn, round their axle, not too slow, not too fast, but as though driven by the Macrocosm. Will you then give honor and praise to the one who has described this matter? He who has described it makes it stronger with instruments, which appear living, although they are natural. More than a man⁸² according to the characteristics of men! Build then temples in his honor. There one should praise him, and learn his teachings.⁸³

⁸² “Als” can mean “dan” in early modern Dutch, as it does colloquially today. Special thanks to Wijnie de Groot.

⁸³ Lof-lied Dicht/op de Natuer-kund/K.I. Drebbel.

O Wat on-gehoorde zaken!
Noch geraken, an den dag:
Yder wel verblyden mach,
Die in't weten heft vermaken:
Nu men smaken, mach, waer an
Onz de Weet-lust leyden kan. Gy die met geen laffe reden
u te vreden, houd zoo licht,
Maer vel meer betraut 'tgezicht:
Kom doch ras by Drebbel-treden:
Eer gy heden weder keert
Zult verkrygen u begeert.

Is wel oyt een opgerezzen,
Die, als dezen, Drebbelaer
Drebbel'd de Natuere naer?
Neen voorwaer: Van geen wy lezen,
Die bewezen, en verklaert
Zoo heeft, der Begins'len aerd. (the nature of principles)

Hier gy magt den Donder hooren
Van te vooren, bald'ren gram,
Daer volgt naer een Bliksem-vlam:
Regen, Hagel-Steen om d'ooren,
Me kond spooren, (als gy wilt)
Koud, of Hitte, Wind of Stilt.
Hier gy ziet de Lust van't leven!
Sterren zweven, om haer As,wef
Noch te langzaem, noch te ras,
Maer als 't Groote-rond gedreven.
Wilt dan geven, Eer en Lof,
Die beschreven heft dez' stof.

Die 't beschreven doet versterken,
Met Tuyg-werken, die in schyn
Levend', (doch Natuerlyk) zyn.
Meer als Mensch! naer menschen merken:
Baut dan Kerken, t'zynder eer,
Daer m'hem love, en leer zyn Leer.
'tVernoegen heft Wils Genoog.

Introduction: The World of Tomorrow

This exhortation to build temples (*kerken*) to the superman Drebbel was published openly in 1621 in Haarlem and did not, it seems, incite any furor.

Furthermore, this was not an isolated incident. We find very similar sentiments expressed by Balthasar Gerbier in his poem published in 1620 in honor of the death of Hendrick Goltzius. In this thirty-seven page poem, a pageant of artists and other notables come to lay tributes upon Goltzius' tomb. While the others all present the gifts of their particular skills, Drebbel stands in a peculiar category, as one, far above the limits of normal man, who possesses all the arts.

What does Drebbel, nature's darling, not bring here? Here Drebbel more than Man, thinks that he is more than one man. He, who lacks no Art, would undertake to swim like a fish, to fly on the winds, to soar up to the Moon and into the depths of the sea, to sail without mast, tiller, oars, sail, or, yard-arm. Come Archimedes here, come here all the Schools, come suck from this tree that which was hidden in previous eras, which no man had discovered, although Nature allows Drebbel to play [with it] in plain view like a clear day. The perpetual motion which he obtained through his wit he puts on this tomb as a kind of offering, that just as it perpetually moves, that just as it has no end, the soul of this spirit shall live eternally with Jupiter.⁸⁴

We find several similarities between Gerbier's poem and that published in the 1621 Haarlem edition of Drebbel's works. Drebbel has discovered what no man, not even the ancients nor

⁸⁴ Mon heur est en gerbe [Balthasar Gerbier], Clacht-dicht ('S-Gravenhaghe: Aert Meurs, 1620). Reprinted in *Oud holland*, 112.

Wat brengt hier Drebbel niet, Naturas Troetel kint?
Hier Drebbel meer dan Mensch, meer dan een Mensch versint.
Hem die gheen Const ontbreeckt, die sich sou onderwinden
Te swemmen g'lijck een Visch, te flighen op de winden,
Te stijghen tot de Maen, in d'afgront van de Zee,
Te seylen sonder Mast, Stuer, Riemen, Zeyl, oft' Ree.
Comt Archimedes hier, comt alle hier ter Schoolen,
Comt suyght uyt desen Boom, 't gheen eertijts was verholen,
'Tgheen noeyt geen Menschen vont, al wat Natuer fermach
Speel Drebbel in 'tghesicht ghelijck een claren Dach.
't Perpetuum Mobile door sijn vernuft verkregghen
Stelt hy op dese Tomb', tot teecken van een zegghen,
Dat g'lijck 'tsich steeds beweeght, dat g'lijckt gheen eyndt en heeft
De ziel van desen Gheest by Jupijn eeuwich leeft.

the academically learned, could. His universal knowledge of nature and his ability to put that knowledge into material, visible form rendered him superhuman. Drebbel did all of this through play, showing how easy and delightful such knowledge could be. Finally, his new knowledge served a quasi-religious purpose.

This view of Drebbel was far from only a Dutch phenomenon. Drebbel was particularly popular among enthusiastic Central European theosophists such as Joachim Morsius, Abraham von Franckenburg, Heinrich Nollius, Jan Amos Comenius, and Samuel Hartlib. They believed that a new merger of natural and divine knowledge could reform the world. Both Drebbel's persona and his published writings supported this merger of natural and divine knowledge, as well as an optimistic view of man's ability to transform his world through art.

Such beliefs could be held among many in religiously and politically orthodox positions or expressed in amazingly permissive ways in widely read works. Yet, those who were branded enthusiasts for their hermetic, eirenic, and spiritualist leanings could also lose their lives and livelihood. Heinrich Nollius was expelled from the University of Giessen in 1623.⁸⁵ Joachim Morsius languished among the mentally ill for four years in the Hamburg plague-house, only to be released through the intervention of King Christian IV of Denmark in 1640.⁸⁶ The poet Quirinus Kuhlmann suffered a grislier end, burning at the stake in Moscow in 1689.⁸⁷

⁸⁵ On Nollius, see Bruce Moran, "Patronage and Institutions: Courts, Universities, and Academies in Germany; an Overview: 1550-1750," *Patronage and Institutions: Science, Technology, and Medicine at the European Court 1500-1750* (Rochester, NY: Boydell & Brewer, 1991), 122-9,

⁸⁶ Heinrich Schneider, *Joachim Morsius und Sein Kreis* (Lübeck: Otto-Quitow-Verlag, 1929), 70.

⁸⁷ For the branding of Kuhlmann as an enthusiast, see Clark, 569-70.

IV: A Public of *Liefhebbers*

As Michael Warner has discussed, the public is the anonymous body of strangers for whom a work is oriented. A work has a public, whether or not it was ever read or otherwise experienced by anyone but the author, through the mere attention to a public. Through such attention, the work is directed not toward a particular patron within a specific community, but toward a placeless, unspecific horizon of individuals.

In turn, the recipient conceives of himself as part of this broader expanse of the anonymous public, and performs his own reception within the arena formed by this idea. An enthusiastic use of print might form a public no less than Habermas' vision of enlightened readers engaging in rational discussion. Warner has argued that the public is an "informal, intertextual, and multigeneric field" not requiring the "rational discussion" of the Habermasian public sphere but rather offering a space for "uptake, citation, and recharacterization."⁸⁸

The idea of reception might imply a passive recipient rather than an active agent, and thus the term consumer might more usefully express a sense of active agency and shared participation in a broader public. This sense can encourage the consumer to invest himself and his labor into the work of the producer. The term consumer further points to the role that the market played in the development of the idea of an abstract space for exchange and investment.

The historical model of the consumer that I follow in this dissertation is the northern European ideal of the lover, *liefhebber* (Dutch) or *liebhaber* (German). This model stressed

⁸⁸ Michael Warner, *Publics and Counterpublics*, 144-5. "The public sphere never required a widespread culture of rational discussion. It required the category of a public—an essentially imaginary function that allows temporally indexed circulation among strangers to be captured as a social entity and addressed impersonally. Success in this game is not a matter of having a better argument or more complex positions. It is a matter of uptake, citation, and recharacterization. It takes place not in closely argued essays but in an informal, intertextual, and multigeneric field."

passion, not reason, and excess, not restraint. As discussed further in the first chapter, the *liefhebber* invested a great deal of labor in his consumption. This labor was recruited through a feeling of membership within a passionate, collaborative, and potentially infinite cohort – the *liefhebbers*.

As discussed in Chapter Three, the model of the *liefhebber* evolved from a social position tied to closed guild or guild-like structures such as the chamber of rhetoric to a wider sense of a consumer active in a market not bound by traditional craft and professional divides. The market's ability to set value through supply and demand also supported the centrality, agency, and investment of the *liefhebber*. The taste of the *liefhebber* determined the value and authority of cultural producers.

The term *liefhebber* most frequently appears in historiography to refer to a collector, particularly, but not exclusively, of the fine arts.⁸⁹ It is also used in a sense similar to virtuoso.⁹⁰ The seventeenth-century use of the term encompassed a much broader range of meanings. The *liefhebber* was a lover, that is, someone who related to something, someone, or a group of people in an affective way. It thus could refer to any member of a group. For example, *liefhebber* was the title of an official status within the Dutch Reformed church, as

⁸⁹ See the historiography relating to the genre of gallery paintings discussed in Chapter Three, as well as Jaap van der Veen, "Liefhebbers, handelaren en kunstenaars: Het Verzamelen van schilderijen en papierkunst," *De Wereld binnen Handbereik: Nederlandse Kunst-en Rariteitenverzamelingen, 1585-1735*, Ellinoor Bergvelt and Renée Kistemaker, eds. (Amsterdam: Amsterdams Historisch Museum, 1992), 117-134, Eric Jorink, *Het Boeck der Natuere: Nederlandse Geleerden en de Wonderen van Gods Schepping 1575-1715* (Leiden: Primavera, 2006), and Peter Forshaw, "Curious Knowledge and Wonder-working Wisdom in the Occult works of Heinrich Khunrath," *Curiosity and Wonder from the Renaissance to the Enlightenment*, R. J. W. Evans and Alexandar Marr, Eds., (Aldershot: Ashgate, 2006), 111.

⁹⁰ Harold Cook, *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age* (New Haven: Yale University Press, 2007), 72 and Brian Cowan, "An Open Elite: the Peculiarities of Connoisseurship in Early Modern England," *Modern Intellectual History* 1:2 (2004), 154.

well as the title of members of chambers of rhetoric or (non-professional) members of the Guild of St. Luke.⁹¹

The language of the *liefhebber* also spread far beyond institutional affiliations to encompass wider associations around such entities as “art,” “nature,” “theosophy,” “mathematics,” or the “fatherland.” The identity implied by the term *liefhebber*, however, is far more active and emotive than that implied by “member of a group” today, and comes closer to its modern Dutch meaning of “fan.” It implied an engagement with the labor of cultural production. As Cavendish wrote to John Pell from Antwerp in 1651 concerning “Mr. Hariot’s doctrine of triangulare numbers,” “I confess I was so farr in loue with it that I coppied it out; though I doute I vnderstand it not all.”⁹²

Since collecting was such an important part of being a cultural consumer in the seventeenth century, in practice the activities of a *liefhebber* often did include copying and accumulating. It was this investment in the copying and collection of particulars that, Johann Daniel Major felt, would build a New World. It is to such investment that we owe the *ephemerides*, commonplace books, collections of letters and “Ana” of the early modern intelligencers that allow us to re-create the lost world of work and communication behind the history of ideas.⁹³

A public of consumers is a very nebulous entity to pin down as an historical agent, since the very power of a public lay in its existence on a non-specific and indefinable plane. One can point to the many iterations of this ideal in contemporary society (the term *liefhebber*

⁹¹ On the “liefhebber” as an official position in the church, see Mia M. Mochizuki, “The Quandary of the Dutch Reformed Church Masters,” *The Low Countries as a Crossroads of Religious Beliefs*, Arie Jan Gelderblom ed. (Leiden: Brill, 2004), 150. See Chapter Three for a discussion of the *liefhebber* among rhetoricians and artists.

⁹² Noel Malcolm and Jacqueline Stedall, John Pell (1611–1685) and his correspondence with Sir Charles Cavendish: the mental world of an early modern mathematician (Oxford: Oxford University Press, 2005), 584.

⁹³ See, for example, the forthcoming chapter by Jacqueline Stedall, “Tracing mathematical networks in seventeenth-century England”, in *The Oxford handbook of the history of mathematics*, Eleanor Robson and Jacqueline Stedall (eds) (Oxford: Oxford University Press, 2009), 133–152.

appears 2,009 times in the Short Title Catalogue Netherlands, for instance) or to new genres or institutions furthering the aims of *liefhebber* sociability and consumption (gallery paintings, *alba amicorum*, and new literary, artistic, and natural philosophical societies).⁹⁴ I believe that the enthusiastic use of a single individual, Drebbel, can itself provide evidence of a public of *liefhebers*. The consumption of Drebbel also suggests the wider historical developments to which the emergence of such a public can be connected.

Studies of the role of consumption in early modern European history range from politics and warfare to the development of empiricism.⁹⁵ I would relate the development of both aesthetic criticism and empirical natural philosophy to an enthusiastic public of art lovers. Both aesthetics and empiricism were philosophies built from collections of particulars. Eventually aesthetics would serve to separate art from what we now know as science. The dividing line would become their relationship to the idea of modernity. Art, based on talent and taste, could be found perfect in its own way in each age, while science, based on the accumulation of knowledge and the improvement of technology, must progress.⁹⁶

Yet in the seventeenth century, the love of *ars* and the appreciation of inborn talent or *ingenium* applied equally to technology as to the fine arts. Both technology and the fine arts stood for the abilities of mankind vis à vis divinely created nature. Judgments concerning the

⁹⁴ No doubt a proportion of these uses of the term *liefhebber* are due to the literal meaning of a romantic lover. However, this figure also does not take into account the second term, *beminnnaer*, which covers the same linguistic territory as *liefhebber*.

⁹⁵ See for example Hugh Trevor-Roper, *The Plunder of the Arts in the Seventeenth Century* (London: Thames & Hudson, 1970), Pamela Smith and Paula Findlen, *Merchants & Marvels: Commerce, Science, and Art in Early Modern Europe* (New York: Routledge, 2002), and Linda Levy Peck, *Consuming Splendor: Society and Culture in Seventeenth-century England* (Cambridge: Cambridge University Press, 2005).

⁹⁶ Paul Oskar Kristeller, "The Modern System of the Arts: A Study in the History of Aesthetics Part I," *Journal of the History of Ideas* 12:4 (Oct., 1951), 526.

status and ability of arts could be said to entail judgments concerning the status and ability of man.

As works of art and technology were collected, judged, and historicized together, modern works of art and technology competed with the ancients. The evidence of a timeless *ingenium* supported the idea that mankind was not in decline. From there it was but a short step to the idea that it might be possible to discover methods to increase *ingenium* through *ars*, since the interventions of mankind in nature seemed to be changing nature itself over time.

Man's ability to transform nature through art raised his status, and called into question the pre-eminence of universal, timeless, and super-human reason. Shifting standards of proof can thus be related to the changing place of man in the universe. As Habermas has discussed, in the post-feudal world the term public changed from denoting an individual with a position in a cosmically ordained feudal hierarchy to an amalgam of private individuals, or as we might say, a collection of particulars.

In a period prioritizing the world's order versus man's artifacts, the axiom which proved itself without further attestation by human witnesses provided the highest standard of proof in philosophy. The statement which proved itself provided a means to escape the weaknesses of the particular human mind, and to find truth through universal reasoning. The idea of the universal can be contrasted with the idea of the public. The universal represented a category of knowledge which could be deduced by every man in isolation, not requiring communication or accreditation in an arena formed by individuals.⁹⁷ Such universal reason offered a way to leave the limited perspective of the human experience, and to survey the

⁹⁷ For the history of the axiom and the commonplace, see Wilhelm Schmidt-Biggeman, *Topica Universalis: eine Modellgeschichte Humanistischer und Barocker Wissenschaft* (Hamburg: Meiner, 1983).

timeless order of things from a divine vantage point. The axiom granted far more certainty than the commonplace, which was accredited by its frequent use and circulation and not by its inherent truth.

In order for art (experiment) to enter philosophy, it had to combat the pre-eminence of the universally rational axiom. Empirical philosophy depended not upon universal *ratio* out of time or place, but upon the collection of many particulars. The collection of particulars required an arena for the accumulation and accreditation of facts, allowing empiricism to compete with the claims of universal reason. The emerging public mitigated the weakness of a particular human witness through accreditation by a public, or an unlimited extent of private individuals.

The changing order of things implied a changing conception of man's place in space. In the feudal cosmos, the self was always situated somewhere within concentric rings of expanding authority, extending through layers of nature and social hierarchies to the heavens. This was a world which could be easily diagrammed, as it so often was. Well before widespread cartography clarified the contingent and messy borders of nation states, the smooth spheres of cosmic order clearly delineated the boundaries of a universal ontological hierarchy.⁹⁸

Unlike the clearly delineated *ordo rerum* of the Thomistic cosmos, the public is more of a Hermetic circle whose circumference is everywhere but whose center is nowhere.⁹⁹ A public sphere is precisely not a sphere, but an abstract space not bound to a particular place and implied system of authority. It cannot be diagrammed. An infinite universe allowed such

⁹⁸ Of course, cartography always existed, but the turn of the seventeenth century saw a sea change in the extent and precision of cartography, relating to a shift in the idea of place, geography, and its relationship to statehood. See J. B. Harley, *The New Nature of Maps: Essays in the History of Cartography* (Baltimore: Johns Hopkins University Press, 2001) and Richard Helgerson, "The Land Speaks: Cartography, Chorography, and Subversion in Renaissance England," *Representations* 16 (1986), 50-85.

⁹⁹ I owe this idea to conversations had with the participants of the Making Publics Project summer seminar, 2007, and especially with Meredith Evans of Concordia University.

abstract space to exist. The self could be simultaneously located in a specific, mapped locale, and in the abstract realm of the public. The abstract space of the public related to the geographical earth as an Archimedean point from whence the world could be levered into new positions.

How does all this relate to Drebbel's story? In the competition between ancients and moderns within the collections, the status of mankind itself was at stake. Thus, the collection of particulars included collecting particular personalities who served as witnesses to human *ingenium* and the power of art. Drebbel offered a triumphant model of human ability to know universal nature through his particular experience. The emerging public accredited his authority through collection, exchange, and frequent citation, transforming Drebbel into a commonplace attesting to the idea of human ability.

Drebbel also participated in the development of new ideas of place in many ways. He supported the idea of an infinite universe in his written natural philosophy and used his inventions to extend man's experience through all levels of nature, from under the water to the heavens. He also happened to be a cartographer, and thus participated in the mapping of the world through an extended net of coordinates. Although, as was typical of this inconstant *Tausendkünstler*, he only produced one map (of his hometown Alkmaar).

Drebbel directed his activities toward a public of *liefhebbers*.¹⁰⁰ In his *On the Nature of the Elements*, Drebbel conceived of his readership as strangers with varying opinions. This he said, was the due to the Fall. We were originally created completely innocent, and then through pride and negligence, we split into many factions, who now misunderstand each

¹⁰⁰ Drebbel wrote that since the perpetual motion was always a goal of mankind, yet the processes written by the ancients were all nonsense, he hoped to show the *liefhebbers* a better way. Drebbel's "Dedication," published as the *Wonder-vondt* (Alkmaar: Jaacob de Meester, 1607). See Appendix. "Daer worden wel verscheyden Processen van het Mobile by den Ouden beschreven/ maer t'zijn die grootste beuselen van de Weerelt/ wonder veel verleydt/ maer niemant yet uytgerecht: waren die Processen goet/ die Ouden soudien die ghemerckt hebben/ en ons in ghedachtenis ghelaten/ waer van wil alle Liefhebbers waerschouwen/ en haer een beter wegh wijzen."

other, since “you seem to me, and I to you, far different than we actually are, and also I do not know you nor you me.” Yet there was a way to redeem the Fall. If we “hate negligence, and practice good, will we not then be innocent-wise?”¹⁰¹ If we test ourselves, do we not see that we are all brothers, with the same God-given treasury of nature for our inheritance?

Drebbel’s account of the Fall savored more of the Tower of Babel than the Tree of Knowledge. The major effect the Fall had on the cosmos, according to his account, was to break up the sense of purpose and equality shared by all men. The pride that led to the Fall in Drebbel’s account was not the hubris of man trying to be a god, but of one man claiming to be more than another man. The way to instaurate the world, therefore, was in laying aside our differences, having concern for our brother (hating negligence), and actively practicing good.

Drebbel seemed quite confident that God would commend human attempts to know and perfect the divine handiwork. In the preface to *On the Nature of the Elements* he declared the world to be the inheritance God left to all men, and in Chapter Eleven he described man’s God-given ability to perfect nature. Such divine gifts entailed a responsibility to practice them by engaging actively in the investigation and improvement of nature. It was such active engagement that prompted the editor of the 1621 Haarlem edition of Drebbel’s works to call him a “loving investigator of nature” (“*liefhebbende onderzoeker*”).

The enthusiastic *liefhebbers* responded to Drebbel’s enthusiasm, developing and circulating his fame for their own purposes. The investment of the *liefhebbers* helps explain both why Drebbel was so famous in his day, and why he is relatively unknown today.

¹⁰¹ Drebbel, *On the Nature of the Elements* (Haarlem: Vincent Casteleyn, 1621). “soo schijnt ghy my, ende ick u, wel wat anders dan wy zijn, also oock dat ick u, noch ghy my niet en kent: als wy nu achteloosheyten hadden, ende ‘goede oeffenen: zijn wy dan niet onnoosel-wijs.”

Despite his international fame across early modern Europe and his prolific career as an engraver, alchemist, projector, and natural philosopher, Drebbel has no archive. His *Nachlass* lies in widely scattered fragments. This dispersal of Drebbel's literary remains is not due to mere happenstance, but to two related phenomena. Drebbel did not curate his own legacy by collecting his works into an archive. Many others did, seeking out Drebbeliana and inserting them into their ephemerides, recipe books, albums, and libraries. Nor did others associate Drebbel with a particular locale, collecting this Drebbeliana together in a targeted archive. Drebbeliana was widely collected, and thus lies widely dispersed around the globe today.

Individuals and institutions which, unlike Drebbel, did curate their legacy or for whom archives in specific locales were established, not only enjoyed fame during their lifetimes.¹⁰² The weight of their collected archives continues to exert a gravitational pull upon historiography today, drawing researchers to their rich sources. Drebbel, by contrast, who was known and avidly discussed by so many of his time, enjoys nowhere near the historiographic attention he deserves.

Drebbel did not need to "collect" himself in order to exert his authority, since this work was performed by the *liebhebers*. It is the very specific and historically contingent phenomenon of the *liebhaber* audience which led to Drebbel's lack of self-collection and his extensive collection by others. In turn the enthusiastic and "second-hand" nature of *liebhaber* accounts resulted in Drebbel's gradual passing from the pages of history.

¹⁰² For examples of those who curated their own legacy in art, literature, and science, see J. L. Koerner's study of Dürer, *The Moment of Self-portraiture in German Renaissance Art* (Chicago: University of Chicago Press, 1993), Marjorie Swann's study of Ben Jonson in *Curiosities and Texts: the Culture of Collecting in Early Modern England* (Philadelphia: University of Pennsylvania Press, 2001), and the collection edited by Michael Hunter, *Archives of the Scientific Revolution: the Formation and Exchange of Ideas in Seventeenth-century Europe* (Rochester, NY: Boydell Press, 1998).

This is largely due to F.M. Jaeger's 1922 monograph, which has long been the best source on Drebbel.¹⁰³ Jaeger argued against H. A. Naber's hagiography of Drebbel as a hero of the Scientific Revolution. In the seventeenth, eighteenth, and nineteenth centuries, Drebbel was a candidate for many inventions and discoveries – the thermometer, the barometer, the microscope, the telescope, oxygen – which would indeed have secured his status as a scientific hero. Jaeger deflated Naber's account by pointing out that many of Drebbel's inventions were importations or modifications of other devices, and that tales of his activities were vastly exaggerated by his contemporaries. He rejected such accounts as second-hand reports which could not answer such questions as “did Drebbel invent the thermometer.” In Jaeger's account, the overblown myths circulated by Drebbel's contemporaries obscured a clear view of the individual.¹⁰⁴

As a result, Drebbel dropped to the level of a footnote in history, and despite his past fame and his long-lived career as a philosopher, is currently described as a “shadowy figure” and an “eccentric mechanic.”¹⁰⁵ In his own time, Drebbel was far from shadowy; in

¹⁰³ J. P. Van Cappelle, *Bijdragen tot de geschiedenis der wetenschappen en letteren in Nederland* (Amsterdam: Johannes van der Hey, 1821), H. A. Naber, “Cornelis Jacobsz. Drebbel, 1572-1634,” *Oud Holland* 22 (1904) 195-237, *De ster van 1572: Cornelis Jacobsz. Drebbel (1572-1634)* (Amsterdam: Maatschappij voor goede en goedkoope lectuur, 1907) and “De Hollandsche Archimedes,” *De Hollandsche Revue*, (April 1925), 287-296, F. M. Jaeger, *Cornelis Drebbel en zijne tijdgenooten* (Groningen: Noordhoff, 1922), G. Tierie, *Cornelis Drebbel (1572-1633)* (Amsterdam: Paris, 1932), and L. E. Harris, *The Two Netherlanders: Humphrey Bradley and Cornelis Drebbel* (Leiden: Brill, 1961).

¹⁰⁴ Jaeger, 7-8. “Aldus blijft men, ook na ijverig zoeken, toch in enkele opzichten nog steeds aangewzen op min of meer waarschijnlijke gissingen omtrent de voorgevallen gebeurtenissen; en deze lacune's in verband met de zoostraks genoemde onbetrouwbaarheid der veeltijds sterk opgesmukte berichten, maken, dat eene objectieve beoordeeling van zijne praestatie's dikwijls zeer bezwaarlijk is Ondanks de ook nu nog overblijvende lacunes, meen ik toch, dat het op grond van dat alles thans zeer wel mogelijk is, om van Drebbel's persoon en werk een in hofdzak zuiver beeld te verkrijgen. Dat beeld wijkt echter, zooals blijken zal, van dat, hetwelk door den heer Naber gegeven is, in vele opzichten sterk af; maar toch meen ik, dat het tenslotte eene juistere en scherpere omlijning van Drebbel's waren geestelijken habitus biedt, dan deze op grond van Naber's voorstelling van den man, als van een in elk opzicht miskend uitvindersgenie, ooit verkregen zou kunnen worden.”

¹⁰⁵ For Drebbel as a “shadowy figure” see William Newman and Lawrence Principe, “Alchemy and the Changing Significance of Analysis,” *Wrong for the Right Reasons*, Jed Z. Buchwald, ed. (Dordrecht: Springer, 2005), 86; “rather eccentric inventor,” Lawrence Principe, *Aspiring Adept: Robert Boyle and his Alchemical Quest* (Princeton: Princeton University Press, 1998) 86; “eccentric Dutchman,” David Freedberg, *Eye of the Lynx: Galileo, His Friends, and the Beginnings of Modern Natural History* (Chicago: University of Chicago Press, 2002), 151.

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fact, his fame was itself legendary. Drebbel's exploits gained such fame that they became means of expressing the fame of others.¹⁰⁶

Although the vast dispersal of accounts concerning Drebbel poses a challenge to the historian, it should not deflect attention from a fascinating and important subject. If anything, the vast extent of sources that do exist should add weight to the subject. The effort so many individuals invested in collecting, exchanging, and dispersing Drebbeliana widens the subject of research from a single charismatic figure to a broad cross-section of early modern society. The two phenomena that have contributed to Drebbel's meager fortunes in historiography - Drebbel's lack of self-collection and the eager collection of Drebbel by others- allow for a study of the relationship of individual to society, producer to consumer, and private to public in an era of changing political, social, and economic orders.

V: Notes toward a Biography

Drebbel is long overdue for a wholesale re-interpretation not centered around the research questions of several generations past. Recent studies of alchemy, hermetism, the circulation of knowledge, the emerging public sphere, wonder, collecting, artisanal

¹⁰⁶ For instance, a poem celebrating the Augsburg optical practitioner Johann Wiesel, compared his fame to Drebbel's. Inge Keil, ed. *Von Ocularien, Perspicillen und Mikroskopen, von Hungersnöten und Friedensfreuden, Optikern, Kaufleuten und Fürsten: Materialien zur Geschichte der optischen Werkstatt von Johann Wiesel (1583-1662) und seiner Nachfolger in Augsburg* (Augsburg: Wisner, 2003), 219.

“Quod Pena Gallorum, Rhodius quod & opticus ille
Praeceptis monstrant, hoc Wisel hicce facit:
Aut acuit visum, vitreos aut inserit orbes
Humano capit, devocat astra tubis.
Quae post terga latent, Drebbel praesentia sistit
Arte sua mutat schemata, more magi.”

Was in der Optic Kunst, der Galilee gewesen,
Was von Fontana ruhm und Drebbel wird gelesen:
Wie Reita mit Divin, Rom, die klein Welt, erhoben
Wie man Septalam pflegt in Mailand hoch zu loben,
Dis kan mit warheits-grund Augspurg vom Wisel sagen,
Schad ists, das diser Mann einmal ins Grab wirdt tragen.”

philosophy, intelligencers and associations, credit and credibility, the history of the book, and the sociology of scientific knowledge all offer new ways to broach a rich subject and extensive body of sources. In turn, the subject of Drebbel and his fame has much to offer such areas of research.¹⁰⁷

While Drebbel has been of great interest in various subfields – from the origins of feedback control to the discovery of oxygen, and the shift from temperament to temperature – no analysis of the overall natural philosophy motivating Drebbel’s activities in these areas has yet been written.¹⁰⁸ The main extant source stemming from Drebbel himself remaining to be investigated is his own corpus of printed works, in particular his *On the Nature of the Elements*. Although Ian Maclean has recently pointed to the phenomenon of Drebbel’s successful vernacular publications, these have been misleadingly described as “neo-scholastic,” and as a result, ignored.¹⁰⁹ Drebbel’s natural philosophy was in fact radical, and

¹⁰⁷ He makes no appearance in Francis Yates’ *Rosicrucian Enlightenment* (Boston: Routledge and Kegan Paul, 1972) Allen Debus’ *English Paracelsians* (London: Oldbourne, 1965) or more recent works in the history of alchemy such as William Newman’s *Promethean Ambitions* (Chicago: University of Chicago Press, 2004) or Bruce Moran’s *Andreas Libavius and the Transformation of Alchemy* (Sagamore Beach, MA: Watson, 2007). In Lawrence Principe’s *The Aspiring Adept: Robert Boyle and his Alchemical Quest* (Princeton: Princeton University Press, 1998), he appears only in a footnote identifying Dr. Küffler, and in Shapin’s *Social History of Truth* (Chicago: University of Chicago Press, 1994), he appears only in a footnote listing the developers of the thermometer (258), although he, his son-in-law Johann Sibbert Küffler, and his daughter Catharina Küffler were all credited as witnesses by Boyle.

¹⁰⁸ Otto Mayr, *The Origins of Feedback Control* (Cambridge: MIT Press, 1970) and Silvio Bedini, “Role of the Automata in the History of Technology,” *Patrons, Artisans and Instruments of Science, 1600-1750* (Brookfield: Ashgate, 1999). Arianna Borrelli is currently working on Drebbel’s role in thermoscopic observations. See Borrelli, “The Weather Glass and its Observers in the Early Seventeenth Century,” *Philosophies of Technology: Francis Bacon and his Contemporaries*, Claus Zittel, Gisela Engel, Nicole C. Karafyllis and Romano Nanni, eds., *Intersections* 11 (Leiden: forthcoming, 2009). The Czech chemist and historian of alchemy Vladimir Karpenko is interested in Drebbel’s discovery of oxygen, which has also recently been discussed in Zbigniew Szydło’s *Water which does not wet hands: the Alchemy of Michael Sendivogius* (Warsaw: Polish Academy of Sciences, 1994).

¹⁰⁹ René Descartes, *A Discourse on the Method of Correctly Conducting One’s Reason*, Ian Maclean, ed. (New York: Oxford University Press, 2006), lxi. Vladimir Jankovic, *Reading the Skies: A Cultural History of English Weather, 1685-1820*, (Manchester: Manchester University Press, 2000), 180, footnote 44. “The often-reprinted meteorological tract of the Dutch experimenter and natural philosopher Cornelius Drebbel represents one of the most influential neo-scholastic renditions of classical ideas.” Despite the fact that elsewhere in his article Harold Burstyn pointed out that a theory of the motion of the winds due to pneumatic force heated by the sun continued in the work of Bacon and Halley originated with Drebbel, he still characterizes Drebbel’s theory as Aristotelian. See Burstyn, “Theories of Winds and Ocean Currents from the Discoveries to the End of the Seventeenth Century,” *Terrae Incognitae* 3 (1971), 13-14. “Cornelis Drebbel’s *Short treatise* is Aristotelian in theory and fully of deeply pious phrases. Like Aristotle, Drebbel is chiefly interested in water cycle, and he attempts to

radically popular, as it was copied, printed, read, taught, and plagiarized across Europe through the eighteenth century.

Drebbel currently appears in historiography primarily as a mathematical practitioner. This historiographic identity has supported Svetlana Alpers' theory of a peculiarly Dutch, abstracted, mechanical art of describing.¹¹⁰ However, the mathematical arts represent but a small fraction of Drebbel's activities. As is apparent from his engravings, his automata design, and his optical illusions, Drebbel was a mannerist. That is, he championed man's ability to transform (rather than describe) nature. This preference for the perfective rather than the mathematical arts can also be found in his natural philosophy and alchemy.

Despite Drebbel's importance to such figures as Johann Hartmann, Andreas Libavius, Athanasius Kircher, and Johann Joachim Becher, Drebbel needs to be resuscitated both as an alchemist and as a natural philosopher. As discussed further in Chapter Six, Drebbel was central to the "magnetic" philosophy of the seventeenth-century. The term magnetic often did not refer to an actual loadstone, but to what alchemists such as Khunrath, Sendivogius and Newton called *magnesia*, or a material substance which attracted the spirit of the world, that is, the vital agent diffused through all things.¹¹¹ This hidden universal connection linked the corporeal and the spiritual, and thus explained life, sympathy

account for the winds with a modified theory of the four elements. He uses experiments to show that heat expands and cold contracts both water and air, and he stresses the notion of Aristotle that the elements are interconvertible. Fire, says Drebbel, is air made subtle; air is water made subtle, and earth is a kind of solidified fire- ash, perhaps- so that earth can be converted into fire. Winds are caused when the heat of the sun raises large but invisible amounts of water vapor from the earth's surface to the middle region of the air. Here the water partly changes into air, partly mixes with air. The whole mass is agitated to and fro as the blowing wind, which is strongest in that part of the air where the clouds, made up of the rarefied water, are thickest. We can recognize here a reasonable account of cloud formation, but his Aristotelian notion that winds are 'meteors' has prevented Drebbel from saying anything new about the wind as a problem of motion. Drebbel's little book had astonishing vitality, appearing in German and French as well as Dutch editions until at least 1723." Drebbel did not in fact call the winds "meteors" in *On the Nature of the Elements*.

¹¹⁰ Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983), 4-5, 12-13, 23; Claudia Swan, *Art, Science, and Witchcraft in Early Modern Holland: Jacques de Gheyn II (1565-1629)* (New York, NY: Cambridge University Press, 2005), 5.

¹¹¹ See Khunrath's *Magnesia Catholica Philosophorum* (Magdeburg: Johan. Bötcher, 1599) and Betty Jo Teeter Dobbs, *The Foundations of Newton's Alchemy* (Cambridge: Cambridge University Press, 1975), 160.

and antipathy, and action at a distance. A key source in the search for the magnetic matter containing the vital agent was the Hermetic *Tabula Smaragdina* (Emerald Tablet).¹¹² The *Tabula* suggested a telescoping of the elements according to which the source of life would have the most power when the highest element was found within the lowest. This text encouraged alchemists to search for forms of fire within forms of earth.

Drebbel's theory of the elements, called "magnetic" by Athanasius Kircher, offered such a view of telescoping of the elements, with earth containing within it a salt which offered vitality (*gewächs*) to all things. Many interpreted this salty earth as nitre, particularly in light of the "quintessence of air" with which Drebbel had kept alive the sailors of his submarine. As the popularity of "aerial nitre" as the matter containing the vital substance grew, so too did the explanatory appeal of *magnesia*.¹¹³ A study of Drebbel's alchemical and philosophical reception thus sheds light on the history of the chemical understanding of heat, generation, and life.

Furthermore, Drebbel's fusion of alchemy and mechanics in the construction of what he and his contemporaries called "living instruments" preceded and exceeded Descartes' mechanical models for life, and can add much to the history of contrived experience and experimentation. Drebbel blended the mathematical and chemical arts both in his machines and natural philosophy (discussed further in Chapter Five). At the outermost level were corpuscular bodies of the elements. These moved through pneumatic force. Since Drebbel rejected the Aristotelian set proportions of the elements, these bodies could move

¹¹² Julius Ruska traced the Emerald Tablet to hermetically influenced late antique Arabic sources. See *Tabula Smaragdina. Ein Beitrag zur Geschichte der Hermetischen Literatur* (Heidelberg: Winter, 1926). A version of the tablet appeared in the Pseudo-Aristotelian *Secret of Secrets*, the letter of advice written by Aristotle for Alexander. In early modern Europe, therefore, the Emerald Tablet was not only linked to a pre-Mosaic ancient wisdom, but to the founding of classical philosophy and power. See W. F. Ryan and Charles B. Schmitt, *Pseudo-Aristotle, the Secret of Secrets: Sources and Influences* (London: Warburg Institute, 1982).

¹¹³ Cf. Anthony Turner, "Stagecraft and Mathematical Magic in Early Modern London," *Nuncius* (2007) 335-349, who argues that magnetic magic declined over the seventeenth century due to the success of mathematical magic.

powerfully and quickly through expansion and contraction between solid, liquid and gaseous states, or, to put it in period terms, earth, water, and air.

The rejection of set proportions implied a radically non-Aristotelian view of elements and temperament. The elements were not four types of simple bodies contributing to a harmonic temperament. In fact, said Drebbel, he only used the word element because it was familiar to his audience. His elements were not simple, but rather carried one within one another.

This telescoping of the elements explained why the universe cohered and cycled around in regular rhythms of weather, rain, and life. It also connected physical and spiritual bodies. The simple Aristotelian elements had set qualities immediately apparent to the senses. Drebbel's elements carried hidden contents within them, which could be forced into action through chemical processes. Thus earth, for instance, carried impurities causing the sparks and explosions engendering lighting and thunder in the macrocosm and generation, vital heat, and nutrition in living things.

Drebbel's philosophy inspired some very innovative machines, including his perpetual motion and his related self-regulating oven, now considered by engineers the first "feedback control device." Due to these two machines, Drebbel has been a candidate in the invention of the thermoscope.¹¹⁴ Rather than pursuing the question of priority in discovery of this device, I prefer to take an approach suggested by Daston and look instead for the problematization that made this object become one of interest.¹¹⁵

¹¹⁴ H.A. Naber, "Cornelis Jacobsz Drebbel" *Oud Holland*, (1904), 201, Wilhelm Schmidt, "Zur Geschichte des Thermoskops," *Zeitschrift für Mathematik und Physik* 8 (1898), 165, Jaeger (1922), 138, Tierie (1932), 4, 92, F.W. Gibbs, "The Furnaces and Thermometers of Cornelis Drebbel," *Annals of Science* (1936), 32-43, Marie Boas, "Hero's Pneumatica: A Study of Its Transmission and Influence," *Isis* 40:1 (Feb., 1949), 45, Kirstine Bjerrum Meyer, *Die Entwicklung Des Temperaturbegriffs Im Laufe Der Zeiten*, (Braunschweig: Vieweg, 1981), 28.

¹¹⁵ Lorraine Daston, ed., *Biographies of Scientific Objects* (Chicago: University of Chicago Press, 2000).

Drebbel's merger of alchemy, pneumatics, and mechanics entailed a chemical investigation of fire, which Drebbel did not see as part of a temperament that should be kept in balance. Rather, fire was an active agent in a world constantly moving through explosions and contractions of hundreds if not thousands of times. Drebbel was also aware of the many different chemical substances which could cause heat or cold, and did not think of fire as a single entity. He experimented with various sources of chemical cold (breaking saltpeter) and heat (*aurum fulminans* and burning sulfur). Thus what would be called temperature – a scale of changes at which something occurs – rather than temperament – the physical constitution of bodies out of four indivisible and proportional elements- became an object of interest to him. In his chemical pursuit of life and the structure of the macrocosm, Drebbel was also interested in understanding how these violent explosions followed continual, dependable cycles in the world, both in the macrocosmic weather and in the microcosm of living beings. He thus built highly sensitive small worlds and self-regulating systems of heat and cold, involving a cycling transformation of the elements through different states.

To understand Drebbel's fusion of mechanics and alchemy in his machines and natural philosophy, let us examine his statement that it is air which makes all things move, in the context of his oven. Air makes all things move in two ways. One is the corporeal expansion of bodies of air as masses of grosser or lighter air rise, fall, clash, and explode. Yet the air also contains a quintessence – which Drebbel famously used to sustain his submariners under water. Through the powers of its quintessential chemical content, air also sustains fire, which in turn, through its changing temperature, expands liquids, turning them into air which can then move as a corporeal body, continuing the cycle.

Both the mechanical aspects of air (size, weight, pressure) and its hidden, chemical content (the quintessence which sustains fire) played a part in Drebbel's mechanico-chemical

oven. As the fire “groweth hotter the ordinary [spirit of wine] expands itt selfe pressing upon the mercury & the mercury the Pinn I & so closeth the hole E & clampe the [fire] till It comes to a just heate. . . .” [Fig. 1].¹¹⁶ The liquid, expanded by the fire, presses down upon the air hole (hole E). In turn however, the fire requires the occult properties of the quintessence of air to burn, and as the air supply is diminished, so too is the fire, inducing a continuing cycle of expansion and diminution of fire, spirit of wine, mercury, and air, according to a fusion of chemical and mechanical properties, and along a spectrum of very fine gradations of heat (temperature).

Relating to the thermodynamic movement of his oven was Drebbel’s most famous invention of his time, his perpetual motion. It is often assumed that since this device is known as a perpetual motion, it must not have worked.¹¹⁷ This is not the case. There were many different definitions of perpetual motion in the period, as there are today. Whether or not a movement succeeded in being perpetual depended upon the definition.¹¹⁸ It was also a subject of metaphysical debate (for one such debate concerning Drebbel’s machine, see Chapter Five).

¹¹⁶ Augustus Kuffler, *A Very Good Collection of Approved Receipts of Chymical operations collected by Augustus Kuffeler and Charles Ferrers Phylchimist*, Cambridge University Library MS Ll.5.8, 169-70. “This Furnace must Bee without a grate having 2 or 3 holes running from the Place where the Δ is to the Edges which Blow the ignis as A over the fire Lyes an Iron Plate with A hole in the middle as B: thro which the Heate comes over which is placed a Double foure square Tinnen Leaden or Copper Box in which the Eggs are Laid in Towe [Tarr crossed out] & with in the Double Sides Bottome & Toppe the [Aqua] is put with which it must Bee filled thro a small Pipe coming out of the Topp of the Furnace as C & still as the [Aqua] water wasts itt must Bee filled Againe thro the same with Bottome of the water Box Between the Double of itt Lay the glass D: which is filled with [spiritus vini] to the neck & in the necke [mercury], to fill this Retorte you must first put the [mercury] in then the [spiritus vini] then Turnne itt upp side downe, holding to the mouth & mercury will come into the neck Let the [ignis] come round the square water Box & it must come out att a round small hole in the middle of the Topp of the Furnace as E upon which you must have a spoone to shut as F which spoone must have A long handle playing upon A crosse pinn at G & at H It hath a Screw by which meanes it may be fitted backward or forward, now there must be another Pinn with a Screw att the end of which is Put A little glass Pipe & fitted into the Neck of ye retorte as at I: soe that when the [ignis] groweth hotter the ordinary [spiritus vini] expands itt selfe pressing upon the mercury & the mercury the Pinn I & so closeth the hole E & clampe the [ignis] till It comes to a just heate. . . .”

¹¹⁷ See most recently, Jonathan Sawday, *Engines of the Imagination* (New York: Routledge, 2007).

¹¹⁸ Alan Gabbey, “The mechanical philosophy and its problems: Mechanical Explanations, Impenetrability, and Perpetual Motion,” *Change and Progress in Modern Science*, Joseph C. Pitt., ed. (Dordrecht: D. Reidel, 1985), 9-84.

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Fig. 1. Drebbel's oven, in Augustus Kuffler, *A Very Good Collection of Approved Receipts of Chymical operations collected by Augustus Kuffeler and Charles Ferrers Phylchymist*, Cambridge University Library MS Ll.5.8. With the permission of Cambridge University Library.

Perpetual motion was a matter of serious and widespread inquiry in the period. Rather than assuming that perpetual motion must be impossible from the outset, I will attempt to explain what contemporaries believed they were doing when they built a perpetual motion. Searching for perpetual motion, as is clear from Drebbel's writing on the subject, was the same as attempting to understand the *primum mobile* – that is, discovering the source of all motion in the universe. Drebbel's thermodynamic solution to this question was an innovative one which greatly intrigued other writers such as Francis Bacon.

I translate *perpetuum mobile* and *eeuwige beweging* directly as perpetual motion and not “perpetual motion machine” throughout this dissertation. What was important in the period was not the machine, but the motion. The machine contained the movement, made it apparent, and showed what it could be used for, but it was not the motion. If the motion was the soul, the machine was but the body. This was especially the case in a chemical rather than a mechanical motion. Rather than attempting to find an arrangement of weights and measures which would continue to move on its own, Drebbel sought a chemically elaborated spirit with an internal principle of movement which could then be employed to drive a machine. The glass holding this spirit was fragile and could break, as it often did. From Drebbel's perspective, this would not entail a failure in finding the perpetual motion, but the escape of his perpetually moving spirit from the machine.¹¹⁹

¹¹⁹ I extrapolate this view from what Drebbel says in Chapter Ten of *On the Nature of the Elements*. One should stop clarifying the elements at the level of air, and then cool into water, which is the purest form that can be useful for us. This does not mean that it is impossible to clarify the elements more (i.e. into fire, and then cool it into air), only that the spirit produced would be invisible and unable to be contained, since it would penetrate all bodies. See the Appendix. “Die Erden müssen wir Clarificieren durchs Feuer und machen sie erstlich wie Wasser welches ist wie saltz welches man Clarificiert und Distilliert zu einem Wasser wie der leib des Luffts klar wie Cristal durch scheinendt wie der Lufft und glantzend wie das feuwer daran mügen wir uns vergnügen unnd ist keine here Clarificationen nötig ursach weil wir keine unsichtbare Spiritus bewaren können sie seindan ein Corpus, sonst würden wir sie verlihren van wan es Clarificiert ist in gestalt des Wassers so wirt es durch die Distilation verandert in gestalt des Lüfts und durch die vergrossung der kolte wieder in Wasser als ein sichtbare

So what was his motion precisely? Drebbel built his perpetual motion in a variety of forms, most famously for King James in Eltham Palace outside London in 1607, and for Emperor Rudolf II during his brief sojourn in Prague in 1610-2. The Eltham version was the most extensive. This was an amalgam of several machines. The most important part, the one contemporaries often referred to as the perpetual motion itself, was a circular glass tube half-filled with a liquid (mercury, according to the Küfflers and Justin van Assche). This moved back and forth purportedly with the tides. The tube was connected to a central, hollow, gilt sphere. It was the expansion and contraction of the air in the sphere due to heat or fluctuations in barometric pressure which moved the water.¹²⁰ This was the same motion through contraction and expansion which Drebbel explored in his *On the Nature of the Elements* in his demonstration of the origin of winds (the theory of the origin of the winds which is still held today, discussed further in Chapter Five).

Above the sphere was a dial which showed the phases of the moon, and on the face of the sphere were the dials of an astronomic clock. One of the spectacular features of this clock was its ability to self-correct (just as the oven self-regulated), displaying a “magnetic” sympathy with the sun. Johann Moriaen informed both Justin van Assche and Olaus Borrichius of this aspect of the machine.

He related that he saw the perpetual motion of Drebbel operate (perhaps out of Mercury) in glass with a clock, so magnetically that if the sun is covered by clouds for two hours, at the moment the sun appears the hand of the clock would shift, for example from the 12th to the 2nd hour.¹²¹

Corpus, Aber so wir es Clarificieren, in gestalt des feuwers so vergröset es durch die kolte in gestalt des Lüffts wie würden wir es dan gebrauchen? welches auch das leiste ist der sichtbarlichen dingen und veruns unnütz. Darumb mügen wir Clarificieren in Lüft welcher sich durch die kalte vergrösset in ein Wasser und höher nicht.”

¹²⁰ Whether one believed in the period that this fluctuation had anything to do with the movements of the tide depended upon one’s theory of the tide, a hotly debated topic in the period.

¹²¹ Olaus Borrichius, *Itinerarium 1660-1665*, Vol. II (London: Brill, 1983), 166. “Perpetuum mobile Drebbelii se vidisse tradit (forsan ex Mercurio) in vitro cum horologio, ita magneticum ut acus horologii, si propter nebulas

Also associated with the machine at Eltham was a “clavicymbal” that played by itself when the sun shone.¹²²

The machines’ sensitivity to the sun greatly puzzled Drebbel’s contemporaries. Some thought that such slight fluctuations in heat, which humans barely feel, could not possibly move a machine. An even greater question was how the machine “knew” what the correct time was, and how the clavicymbal “knew” how to play precise tunes, given that it was not driven by clockwork. Isaac Beekman had a theory as to how the self-correcting clock worked. The gnomon of a sundial cast a shadow, cooling the bulb of a thermoscope located beneath a particular hour, which produced a motion which could be used to move the clock dial to that hour. He had at least managed to build his own self-correcting clock in that way.¹²³

Drebbel was also known, as mentioned above, for optical displays, camerae obscurae, the development of the compound microscope, a particularly compact telescope, the development of a chemical dye for scarlet, and the invention of the submarine, among

sol per duas horas non conspiceretur, adveniente sole momento se transferret acus ex: gr: ab horâ XII ad IIdam.”

¹²² All we know about this instrument is that it was a stringed, rather than a pneumatic instrument. Huygens said that it was called a clavicymbal since it had keys. “Fragment Eener Autobiographie van Constantijn Huygens,” (1897), 118, “Clavicymbalo nomen imposuere a fidiculis aeneis clavibus vel clavis intortis.” Contemporaries such as Libavius found it much more difficult to understand how a keyed, stringed, instrument could be played pneumatically. See Libavius, *Probabilis Investigatio Causarum Physicarum, Aliarumque Globi Archimedaei novi & instrumenti musici per se absque evidente motore mobilium* (Coburg: Bertsch, 1612), Appendix III. The fact that this instrument was specifically described as stringed heightened its mystery.

¹²³ *Journal tenu par Isaac Beekman*, Vol. III, 1627 – 1634 (The Hague: Nijhoff, 1945), 302. “Monsieur Moriaen den goeden vriendt van myn swagher Justinus van Assche, seyde my hier te Dordrecht, den 24 Aug. 1633, dat de schoonsoon van Drebbel, den Hertoch van Nieuburgh tot Dusseldorp nu onlanckx gepresenteert heeft te maken een eeuwichduerende horologium, hetwelcke een weynich des snachs ende andersins uyt syn juyste order geloopen synde, wederom op syn plaetse gaet staen, so haest als de Sonne daerop schyndt. . . . Ick gisse het fundament van syn inventie, ofte ten minste so ist van de myne, te wesen de schaduwe, die den styl, ofte wyser, van het horologie geeft, want die maeckt de plaetse, daerse op schyndt, koelder dan eenighe andere plaetse op het geheel vlack des sonnewysers, waerdoor dat de locht, die in een buysken recht onder de schaduwe besloten is, gecondenseert wort ende min plaetse beslaet dan de andere locht in eenighe van de andere uer-huyskens, welcke veranderinghe beweginghe maeckt, juyst op die plaetse. Dewelcke, bequamelick geapliceert synde van ymant, die in de voorschreven dinghen deses boeckx, ofte liever in de geheele mechanica, wel geoeffent is, kan sonder twyffel de ueren telckens rectificeren.”

other projects. Very little about Drebbel's origins indicated that he was destined for such a career.

Family, Friends and Finances

Drebbel's father, Jacob Jansz Dremmel, who passed away in 1591, was a farmer and one of the *fabrieksmeeesters* responsible for providing the city of Alkmaar with grain and beer during the siege of 1573.¹²⁴ According to his 1589 will, Jacob Jansz left a piece of land in the Bergermeer called "Dremmel's land" of twelve hundred *roeden* (i.e. about 40,000 feet) and another piece of land to the west of Alkmaar with the house the "Molentgen" of forty *roeden* (about 1,300 feet) to be divided between his three children Pieter, Cornelis, and Jan and his sister (perhaps a half-sister) Anna Augustynsd. in four equal parts. He left all his other goods to his wife Hillegont Jansd.¹²⁵

Drebbel started out life as an engraver, probably apprenticed to Hendrick Goltzius, whose sister Sophia he married in 1595. Cornelis and Sophia purchased a house in Haarlem in 1603.¹²⁶ Twenty-two known engravings by Drebbel survive, including engravings after designs by Goltzius, Karel van Mander, and the Antwerp artist Sebastian Vrancx, as well as a map of Alkmaar (1597).¹²⁷ After his father's death, Drebbel began to build machines and fountains, perhaps as a result of the inheritance he had received.¹²⁸ He could have learned

¹²⁴ He was paid ten guilders for his pains by the *vroedschap* of Alkmaar. See Alkmaar, Gemeentebestuur 92, 230.

¹²⁵ Notariaal 5, page 29.

¹²⁶ Jaeger, 13.

¹²⁷ Alfred von Wurzbach, *Niederländisches Künstler-Lexikon*, Vol. 2. (Leipzig: Halm and Goldmann, 1904-6), 825. *Dutch and Flemish etchings, engravings and woodcuts, 1450-1600*, Vol. XLIX, D. de Hoop Scheffer, ed. (Rotterdam: Sound & Vision Interactive, 1998), 55-6.

¹²⁸ He took out two patents from the States General in 1598 for a water pump and a perpetually moving clock, and in 1602 for an improved chimney. In 1600 he was paid by the city of Middleburg for building a fountain. See Jaeger, 14-5.

hydraulic engineering from Willem Jansz Benning, who married Anna Augustynsd., and who himself enjoyed an international career as an engineer.¹²⁹

Drebbel also pursued alchemy, perhaps alongside Hendrick Goltzius, also an alchemist. A certain Balthasar van Rensen, who had worked as a surgeon in Enkhuizen, claimed Drebbel as his alchemical master.¹³⁰ Drebbel was also known to the alchemist of Haarlem, Daniel van Vlierden. Van Vlierden is a good candidate for the unnamed rich alchemist of Haarlem, who, Isaac Beeckman discovered, was Drebbel's closest intimate.¹³¹

Van Vlierden's father had fled from S'Hertogenbosch as part of a large scale immigration to Haarlem.¹³² van Vlierden integrated into the local elite, spending half of his adult life at the University of Leiden. He first signed the *Album studiosorum* the same day as his friend and classmate, Theodore Schrevelius, on January 28, 1591. He signed again on June 13, 1604, at the age of thirty, and finally at the age of thirty-seven on December 21, 1611. Upon his death, he also left behind a lavish library of approximately 1,452 volumes, including four editions of Drebbel's works.¹³³

¹²⁹ Benning built sluices throughout Holland and in Oostend and Danzig (Gdańsk). On Benning, see J. G. de Roever, *Jan Adriaenszoon Leeghwater* (Amsterdam: Ahrend, 1944), 169, 213, Simon Stevin, *Principal Works*, Vol. 5 (Amsterdam: C.V. Swets & Zeitlinger, 1955), 77 and G. Köhler, *Geschichte der Festungen Danzig und Weichselmünde* (Breslau: Koebner, 1893), 300-1.

¹³⁰ Balthasar van Rensen, *Alle zyne Heerlyke Chymische Werken bestaande in 10 Tractaties*. M.D.N. Bidstrup, ed. (Amsterdam: N.A., 1743). According to the editor Bidstrup, van Rensen wrote *Van de Lapide Philosophorum* in Alkmaar on the 23 August, 1634. In addition to quoting such traditional authorities as Hermes, Aristotle, Theophrastus, Avicenna, Richard Anglicus, Lullius, and Trevisanus, van Rensen also referred to the "Boek van de Elementen" and the personal instruction of his esteemed "Leermeester," although he did not refer to Drebbel by name (van Rensen, 20). Bidstrup advertised him on the title-page as the "*Discipel van dien grooten en overheerlyken Alkmaarschen Philosopho Cornelius Drebbel*." For van Rensen in Enkhuizen, see Herma M. Van den Berg, *De Nederlandse Monumenten van Geschiedenis en Kunst*, Vol. 8, Part 2 (S-Gravenhage, Staatsdrukkerij, 1955).

¹³¹ Beeckman, *Journal*, 201.

¹³² Briels, *De Zuidnederlandse Immigratie in Amsterdam en Haarlem Omstreeks 1572-1630* (Ph.d. Utrecht, 1976), 10.

¹³³ *Catalogus Variorum & Insignium praesertim Chymicorum Librorum Viri, dum viveret, doctissimi D. Danielis à Vlierden Quorum auctio publica habetur* (Leiden: Vogel, 1646). Many of the works which we might relate to Drebbel's natural philosophy could be found in Vlierden's library, from Hero of Alexandria's *Spiritualia* to Giovanni Battista della Porta's *Pneumaticorum Libri Tres*, five works by Jean Fernel including *De Abditis Rerum Causis*, and over twenty works attributed to Paracelsus. Although Drebbel may not have read them himself, Van Vlierden was a possible conduit for these authors' theories.

Van Vlierden's many learned acquaintances are also recorded within his richly bound *album amicorum* in the Hague. These inscriptions dated from 1593 to 1613 and are for the most part the work of Leiden humanists. Yet, among these inscriptions we might note his interests gradually shifting to alchemy, as we might also ascertain from the contents of his library.

One inscription which stands out in the album is that of Cornelis Drebbel, inscribed in Alkmaar in 1604. This inscription is an extended version of Drebbel's usual verses upon his motto, "*Oeffen uw gavens recht*" (practice your gifts rightly).¹³⁴ It is the only vernacular inscription in the entire album, but it is not the only non-academic inscription. Besides for a 1613 inscription by an officer of the Strasburg mint, and a scribbled alchemical recipe on the back flyleaf, we also find the inscription of Isbrandt van Rietwyck, a friend of Drebbel, also in Alkmaar in 1604. Van Rietwyck entered his usual inscription into the book, but followed it with a line indicating his own alchemical interests, "*Rerum anatomia Janua ad philosophiam*" (the anatomy of things is the gateway to philosophy). Anatomy here referred not to the dissection of bodies, but to the spagyric untwining of the elements.¹³⁵

Van Rietwyck was another associate of Drebbel's who was a highly literate member of the local elite who had integrated alchemy into his other interests. He was also connected to van Vlierden in a number of ways. He knew Theodore Schrevelius, van Vlierden's friend, more than superficially, as he inscribed what was for him an unusually long poem in Schrevelius' album.¹³⁶ In 1616, Van Rietwyck was also recommended as *schoutampt* of several towns by Johan Coltermann, who married Daniel van Vlierden's daughter Susanna.¹³⁷

¹³⁴ Vlierden, Den Haag, KB, 74 G 21, 225.

¹³⁵ *Ibid*, 201. His regular inscription was "Cedendo, Vinco. Indociles flecti dum fulmen dejicit ornus, / Cedendo superat vilis arundo notos."

¹³⁶ Theodore Schrevelius, British Library, Add. Mss. 15.850, 22.

¹³⁷ Gemeentearchief Haarlem, Oudkarspel, Heerlijkheid, 132 no. 9.

Coltermann was a patron of Hendrik Goltzius and Karel van Mander.¹³⁸ van Rietwyck himself was a member of van Mander's literary circle.¹³⁹

Besides for exploring alchemy and engineering with his wealthy and highly literate friends, Drebbel also helped his mother look after her finances. In the Netherlands, widows had great control of their legacies. They used their control to protect the family fortune. In turn, their relatives assisted them in their financial arrangements in the expectation and hope that the widow's legacy would eventually benefit them.¹⁴⁰ Drebbel's family was no different. After the death of her husband, Hillegont cared for her entire family, extending, for example, an interest free loan in 1597 to her sister Jannitgen Jansd.¹⁴¹ In turn, her relatives worked to maintain her financial interests in the hope that she would use her discretion to benefit them in the future. For instance, on Sept. 21, 1601, Drebbel collected the interest on a loan on behalf of his mother.¹⁴²

Hillegont did indeed provide for Cornelis generously, but she did not give him complete control over her bequest. Rather, the bulk of the family goods were left to her grandchildren, Drebbel's offspring, Anna, Jacob, Lijsbeth, and any others he might have (which would include Jan and Catharina) in the care of the directors of the Alkmaar orphanage.

In Holland, the family of the deceased were required to appear before the orphanage directors within a few weeks of the demise of the widow or widower to arrange the legacy

¹³⁸ Irene and Peiter van Thiel, "Anna Steyn en de Schrijvers en Tekenaars in haar liedboek," *Bulletin van het Rijks Museum* 51:1 (2003), 37-63.

¹³⁹ Boukje Thijs, *De hoefslag van Pegasus. Een cultuurhistorisch onderzoek naar den Nederduytschen Helicon (1610)* (Hilversum: Verloren, 2004), 34.

¹⁴⁰ See Sherrin Marshall Wyntjes, "Survivors and Status: Widowhood and Family in the Early Modern Netherlands," *Journal of Family History* 7 (1982), 396-405, and Ariadne Schmidt, *Overleven na de dood: Weduwen in Leiden in de Gouden Eeuw* (Amsterdam: Bert Bakker, 2001) and "Survival Strategies of Widows and their Families in early modern Holland, c. 1580-1750," *History of the Family* 12 (2007), 268-281.

¹⁴¹ O.R. 314, 62v-63.

¹⁴² Gemeentebestuur 601 (unpaginated).

of the orphaned children. On the 27th of May, 1604, a group of family members appeared before the directors of the Alkmaar orphanage.¹⁴³ This group included Doedt Jansz Medemblick, the major of Alkmaar, and his wife Fokel Jansd. who was a relative of the children on their fathers side, as well as Jan Jansz Pap (Hillegont's brother) and Pieter Matthijsz, in the name of his wife, Jannitgen Jansd. (Hillegont's sister), and of course, the children's father, Cornelis.

They brought a very lengthy list of goods to the orphanage to be kept for the children. Drebbel himself had already taken and enjoyed his "legitimate portion" of this inheritance, to the amount of 1,888 guilders, besides for a third of the house. He would also enjoy the goods of his children as a life annuity (*lijftocht*) according to the will of his mother. The properties included, besides for two thirds of a house on the main street in Alkmaar, over twenty loan certificates and life insurance for both Cornelis and his brother Pieter (dated 19 June 1590).¹⁴⁴

After his mother's death, Drebbel decided to move to England and continue his career as an engineer and inventor there. He arrived sometime shortly before April 22, 1605, when according to a document signed in Ipswich, Drebbel appointed Jan Jansz Pap to serve as his collector. In this capacity, Jan Jansz Pap arranged a loan for Drebbel from Medemblick, putting up Drebbel's portion of the house in Alkmaar as collateral in September 1608.¹⁴⁵

Soon after the death of Cornelis' nephew, Jan Pietersz Dremmel (January 9th, 1616), an attempt was made to retrieve Hillegont's legacy from the orphanage. On 11 March 1616,

¹⁴³ On the orphanages of Holland and their use in the protection of family legacies, see Ariadne Schmidt (2001), 100-5. Several "Hillegont Jansd.s" passed away in Alkmaar near that time, the closest on January 26, 1604.

¹⁴⁴ Weeshuis 16, 360.

¹⁴⁵ O.R. 316,116v. It is this source that refers to the act signed in "Gippevico" (Ipswich). Jaeger (23) mentioned an act signed in Haarlem on 8 March, 1604 in Drebbel's presence, suggesting that he was still in the Netherlands at that date.

Pap and Pieter Matthijsz (on behalf of his wife) appeared before a notary, attesting that Hillegont Jansd. had said in her will that a blood relative should come to collect her property out of the orphanage on behalf of the children of Cornelis Drebbel. As blood relatives, they wished to do so for the greatest profit of those children, living in England, and thus requested to do so on behalf of Drebbel, who lived too far to do so himself. They signed the document in the Vergulde Hooft, the inn at Alkmaar owned by Willem Jansz Benning. Ijsbrant van Rietwijk and Jan Willemsz Benning served as witnesses.¹⁴⁶

Such attempts were rarely successful, and indeed, it was Drebbel's sons-in-law and children who arrived to collect their property immediately after Drebbel's death. First to claim Anna's share was her husband Abraham Küffler in May 1634, followed by his brother Johann Sibbert Küffler, who arrived on the 30th of August on behalf of his wife Catharina Küffler, and at last on the fourth of October, 1634, Jan and Jacob Cornelisz Drebbel.¹⁴⁷ Abraham Küffler had married Anna Drebbel in 1623, and Johann Sibbert married Catharina in 1627. Their brothers Jacob and Gilles also participated in Drebbel's projects.¹⁴⁸

After Drebbel's death, his daughter Catharina Küffler served as the representative of her father's legacy in London alongside her husband, Johann Sibbert. Monconys, Becher and Leibniz visited Catharina in London.¹⁴⁹ Catharina discussed an invention for sweetening

¹⁴⁶ Not. 51, 184. Jan Willemsz. Benning was the son of Willem Jansz Benning and Anna Augustynsd. On W. J. Benning as an innkeeper, see Roeber, 213. In 1620, Adriaen Olbrantsz Caescoper, who had worked with Benning on the sluices in Danzig, bought, along with Aelbert Jansz van Beerhem, the goods of the Drebbel children from the orphanage. See O.R. 318, 115v. Selling the goods to a third party was a standard means of refinancing the legacy. See Schmidt (2001), 100-5.

¹⁴⁷ Weeshuis 16, 361v.

¹⁴⁸ Jaeger, 47-9. See also Young, *passim*.

¹⁴⁹ Becher, for instance, visited Catharina in London. See J.J. Becher, *Centrum Mundi Concatenatum* (Nürnberg and Altdorf: Tauber, 1719), 73, "Hoc praevidens sagacissimus Cornelius Drebbel (cujus filiam jam senem etiamnum Londini vidi, maritatum olim cum Kuefflero coloris scarletinie inventore) cum navem suam construeret, quae infra aquam progredederetur." Leibniz visited her in the company of Boyle. See Leibniz' letter to Denis Papin, August 1695, *Mathematischer Naturwissenschaftlicher und Technischer Briefwechsel* (Berlin: Akademie Verlag, 2004), 480-1.

saltwater with Robert Hooke and Robert Boyle.¹⁵⁰ The later credited her and her husband as witnesses.¹⁵¹ Samuel Hartlib praised her as an “understanding Woman” who “know’s the way” of perfecting the scarlet dye, and of baking bread (presumably in her father’s portable ovens). He also mentioned the son of Catherina and Johann, as the person who is “to know all his [father’s] other secrets.”¹⁵² Indeed, Augustus Küffler’s extensive recipe book includes not only the scarlet dye, the self-regulating oven, and receipts from both “Dr.” and “Mistress Küffler,” but many receipts with an impressive provenance, such as the Duke of Buckingham’s pills for the French Disease or Robert Boyle’s method of keeping plums.¹⁵³ Such provenances, along with frequent appearances in the *Ephemerides* of Samuel Hartlib, show that the Küfflers integrated themselves into the company of the most renowned English natural philosophers.

This was hardly surprising, given their own background. The Küfflers’ father Jakob was an elder of the Reformed church in the Cologne, alongside Johan Moriaen, Jacob Pergens, and Justin van Assche (Isaac Beekman’s father-in-law). The Reformed population in Cologne had many relations among the Netherlands. The Pergens family was related to the Hoofts and friends to the Huygens, Isaac Beekman, as well as to local inhabitants of Cologne such as the van Zevels.¹⁵⁴ As members of the beleaguered Reform congregation of

¹⁵⁰ See R.E.W. Maddison, “Studies in the Life of Robert Boyle, F.R.S. Part II. Salt Water Freshened,” *Notes and Records of the Royal Society of London* 9:2 (May, 1952), 197-8.

¹⁵¹ See Robert Boyle, *Usefulness* (1663), 74, “For this relation was made me by persons of very strict veracity; the one a Doctor of Physick, who was an Eye-witness of the Cure; the other a Childe of *Cornelius Drebell*’s. . . .”

¹⁵² Hartlib, *Ephemerides*, 29/5/88B, 1656.

¹⁵³ *A Very Good Collection of Approved Receipts of Chymical operations collected by Augustus Küffeler and Charles Ferrers Phylchymist*. Cambridge University Library MS Ll.5.8. On receipt provenance as proof of membership in a community, see Elaine Leong and Sara Pennell, “Recipe Collections and the Currency of Medical Knowledge in the Early Modern ‘Medical Marketplace,’” *Medicine and the Market in England and Its Colonies, c. 1450-1850*, Mark Jenner and Patrick Wallis, eds. (New York: Palgrave Macmillan, 2007), 133-152.

¹⁵⁴ Eduard Simons, *Kölnische Konsistorial-beschlüsse presbyterial-protokolle der Heimlichen Kölnischen Gemeinde, 1572-1596* (Bonn: P. Hanstein, 1905). For the Pergens and Zewel families, see J.T. Young, *Faith, Medical Alchemy and Natural Philosophy: Johann Moriaen, Reformed Intelligencer, and the Hartlib Circle* (Brookfield, VT: Ashgate, 1998), 10. Arnout Helleman Hooft recalled visiting the Zevels at his relative Pergens’ house in Köln in *Een naekt beeldt op*

Cologne, they all would have been known to the Küfflers. Indeed, Johann Sibbert Küffler and Adam van Zewel were schoolmates at Herborn, where Küffler defended a dissertation under the aegis of Johann Heinrich Alsted.¹⁵⁵ Johann Ernst Burggrav, a disciple of the academic alchemist Johann Hartmann of Hesse-Kassel, was thus very savvy when he chose to dedicate his 1628 Latin edition of Drebbel's works to Johann Pergens, Jacob Pergens, Peter von Zewel, and Adam von Zewel.

While the bequest left to Catherina and Anna served no doubt as an incentive, the fact that the well-educated and well-connected Küfflers married into the family of an unschooled artisan attests to the respect for artisanal knowledge they imbibed both at Herborn and through their Netherlandish acquaintances. Before the Küfflers ever entered Drebbel's life, Beeckman received the rare first edition of Drebbel's natural philosophy, which according to Burggrav, Drebbel had sent only to a few friends and philosophers (discussed in the next chapter). Van Assche and Moriaen frequently informed Beeckman of Drebbel's doings, and Johann Sibbert Küffler visited him.

The Küfflers first encountered Drebbel in the early 1620's, when Drebbel and Huygens were seeing much of each other. The interest of both Huygens and his friend Robert Killigrew in optics at this time can be related to their friendship with Drebbel.¹⁵⁶

een marmore matras seer schoon: het dagboek van een 'grand tour' (1649-1651), E. M. Grabowsky and P. J. Verkruijsse, Eds., (Hilversum: UitgeverijVerloren, 2001), 59.

¹⁵⁵ Thanks to Howard Hotson for this reference. Johann Sibbert Küffler, *Disputatio physica de corporis naturalis generalibus principiis et affectionibus* (Herborn: Christoph Corvinus, 1615). See Gottfried Zedler and Hans Sommer, eds., *Die Matrikel der Hohen Schule und des Paedagogiums zu Herborn* (Wiesbaden: Bermann, 1908). Johann Sibbert entered Herborn in 1612, and Adam van Zewel entered in 1615. Küffler also received his medical degree from Padua. See Gustav C. Knod, "Rheinländische Studenten im 15. u. 16. Jahrhundert auf der Universität Padua," *Annalen des Historischen Vereins für den Niederrhein, insbesondere die Alte Erzdiözese Köln*, Vol 68, (Cologne: Boessere, 1899), 133-189.

¹⁵⁶ J. P. Vander Motten, *Sir William Killigrew (1606-1695)* (Gent: Rijksuniversiteit te Gent, 1980), 24-5.

Among the Huygens' papers can also be found many receipts of Killigrew and his wife, as well as a receipt for the tincture of coral by Drebbel sent to Huygens in the Hague.¹⁵⁷

Yet there was more than shared interests between Drebbel and Huygens. Huygens paid Drebbel for his optical instruments. The international sale of microscopes, telescopes, mirrors and camerae obscurae (which the Küfflers conducted internationally on Drebbel's behalf) as well as his scarlet dye-works (with which the Küfflers and Moriaen assisted), were no doubt major sources of income for Drebbel. So too was the payment and patronage he received throughout his life from the King and important courtiers.

Due to an anonymous picturesque seventeenth-century note, it is currently assumed that Drebbel fell into disgrace at the end of his career, scrabbling for a living as a popular showman under London Bridge. While money was always a worry for Drebbel, he never fell into such obscurity during his lifetime. The author of the note referred to a now lost portrait of Drebbel of 1628 ("Upon his picture is Ao. Aet. 56; Ao. 1628), called him "an ingenious man, as appears by his many inventions, for all those of Kufler were his" and also recounted that "he was very poore, and in his later time, kept an Ale-house below the bride. He had an invention of goeing under water which he used so advantageously, that many persons were perswaded that he was some strange Monstar, and that means drew many to him and drink of his ale."¹⁵⁸ This, combined with the fact that Drebbel had difficulty receiving the payment promised for his contribution to the disastrous campaign at the Island of Ré, led Jaeger to suppose that he fell into disgrace and out of government employ, and died in obscurity.¹⁵⁹

This was not the case. Both King James and Prince Charles had long been involved in Drebbel's projects. When he became King, Charles installed Drebbel and his fellow

¹⁵⁷ Huygens Papers, the Koninklijke Bibliotheek, the Hague, Vol. 47, 580. Reprinted in Jaeger.

¹⁵⁸ Rawlinson 158, 174-5. Cited in Jaeger, 107.

¹⁵⁹ Jaeger, 52-3.

projectors, the Heydons, in the Ordnance office at the Minories (where Haydon Square can be found to this day). Despite the setback at Ré, Drebbel and the Heydons continued to collaborate. Since the latter end of Drebbel's life has been rather obscure, I will examine in detail the participation of Charles, the Heydons, and Drebbel in plans to fish for wrack in the East Indies using his submarine, defeat the French at Ré with his underwater petards, and feed the King's army with his self-regulating portable ovens.

The collaboration between Drebbel, the Heydons, and Charles began in 1622. On the 29th of April, 1622, Sir William Heydon and Endymion Porter appeared before the court of the East India Company to deliver messages from Prince Charles and King James, respectively. Porter told of a message James had received from "the greate Mogoll to furnish him with such rarities as this Kingdome affordeth for the which he will returne him with presents of that country. His Majestie is determined to give him the best satisfacion he can, and for that end doth purpose to present him not alone with some Jewells of valew, but likewise with some Inventions and particularly with that of conveying water into their houses in such a manner as will be a greate cooling and refreshing in these extreame hotte Contries, and a benefit much desired by the Mogoll." Clearly, James considered such inventions the particular rareties which his court had to offer.

James was careful to specify that the East India Company had no right to interfere in this project. As Porter put it, "the reason why his Majestie makes this known unto the Companie is not to aske their Judgment or advice in it, for he is resolved to send . . . two of the Princes servants, whereof Sir William Heydon is one and that the reason why his Majestie is pleased to communicate this his purpose was that the Companie might make use of his servants if they so thought good." Indeed, On September 19, 1622, James did issue a commission to William Heydon and Charles Glenham to "make a voiage with 2 ships

to ye Conntries of the great Mongoll & other princes between the Cape of bona speranza & the Streighte of Jacob le Mayne To satisfy the said Mongoll wth some choice arte & rarities, & to put in use in those climate their worke & inventions.”¹⁶⁰ Although the invention of cooling is described in the commission as that of Heydon and Glenham, this too may have been devised by Drebbel. In a list of Drebbel’s inventions, Samuel Hartlib had noted a “refrigeratory instrument for the summer time and especially for hot climates such as India.”¹⁶¹ Drebbel was also known for having, at the request of the King, so cooled “the great Hall at Westminster” that the King and all the Lords had to leave the room.¹⁶²

The plan to refrigerate the court of the great Mogul was King James’ pet project. According to William Heydon, “the princes parte in the employ[en]t was by itself.” Prince Charles had a project of his own to employ Drebbel’s newly invented submarine to hunt for wrecked ships. Charles correctly anticipated what the concerns of the East India Company would be – namely that the invention would not work, or that the projectors would endanger the Company and otherwise interfere with their trade. Heydon assured them that Charles “amed only at the weying up and recovering of shipps that with ritch ladinge had bene wrackt in those partes and by such an engine as had been devised by one Cornelius Dryvet whereof he would at anie time give the Companie satisfacion by waie of a demonstracon that the Engine shall fetch upp anie waight and for the better sutch to find the places where these ritch wracks are, as also to fasten hold with the best advantag for

¹⁶⁰ Doquet Book, SP 38/12 (unpaginated). This was described in SP 14/141/362 (September 14th) as a commission “to trafficke in trade with the greate Mogull.”

¹⁶¹ “Refrigeratoria Instrumenta pro aestate et imprimis in locis calidioribus vti India etc.” See Hartlib, *Ephemerides*, 29/3/55B-56A, 1635.

¹⁶² As described in a list of Drebbel’s inventions noted by the Alkmaar chronicler Cornelis van der Woude. See *Kronijcke van Alkmaar* (Alkmaar: Breken-geest, 1645), 116. “Hy konde maken met eenige Instrumenten, en sek re plaetsen, midden inden Somer, dat het so koude was, gelyc of het midden inden winter ware geweest: ‘twelcke hy eens te werck stelde (op het versoeck van sijn *Majesteyt*) inde groote *Zale tot Westminster*, dat het in den Somer, op sekeren dach inde voornoemde Sale, soo kout wierde, dat den *Konink* met sijn Adel an veel groote Heeren genootsaecht waren deur de overgroote koude uyt de voorschreven *Zale* te wycken.”

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weying them up, there is a boate devised to go under water, where men maie live and if need be a man may go forth and walke under water 20 or 30 yardes and use his armes to any kind of labour, that it was not intended any way to preiudice the Companies trade, nor at all to deale in merchandise, and they would neither carry goodes oute nor bring anie home, if they did lett them confiscate, nor should they need to doubt anie desperate attempt upon anie the shippes or places of that Cuntry thereby to drawe the Companie into danger, for they are only to follow such Instrucons as his Majestie should give them without meddling with the trade.”

The governor of the Company answered “that this business had bene made known unto him first by the Lord Marques Buckingham as from the king and afterwarde by the Prince, and desired these gentlemen to rest assured, that not onely himself, in particular, but likewise the whole Courte of Comittees would take upp anie glad occasion wherein they might iustly expresse their dutie, and service to his Majestie and to his Highness. . . .” In fact, however, the other members of the court were far less eager to acquiesce. One said that “if it weare but a matter of presentes or the transporte of Engineers the Companie should be able to accommodate their passage in their next shippes.” Heydon and Porter responded “that they must go in shippes of their owne for that it could not stand with the conveniencie of trade, that the Companies shippes should attend their times for weying up of wrackes for which purpose shippes of some good burthen must be employed.” The idea that ships not under their control would be making an independent voyage to the East Indies alarmed the Company. They “replied that such shippes might prove dangerous to the Companie for they might perhaps attempt something to make upp their voyage in case their first hopes should faile, which might endanger the Companies stock and the lives of their ffactors.” Porter and Heydon “answered that such as were to be sent were so well knowen to the king, and both he and the prince would become answerable for them.”

At this point a series of negotiations began which would continue over the next few months, with the Company attempting simultaneously to avoid royal displeasure while insisting on their responsibility to satisfy their stockholders. The King's representative continually insisted that the Company had no power to naysay the project. A member of the court said "that if the king or the Prince would sett out anie shipping into those partes: the Companie must yield unto it. But it weare to be wisht that it might be forborne for a few yeares in which time the Companie might fetch home their stock, and then they would willinglie leave the trade to his Majesties good pleasure." Heydon and Porter repeated that "his Majestie was resolved to send fourthwith neither was their coming to enquire anie thing of the Companie & touching the conveniencie of sending, but onely to acquaint them that it is the meere Act of his Majestie and the Prince's constant resolucon to medle with nothing that concernes the Trade." Another member said that perhaps it might be deferred until some of their shippes returned home "for the Companie knoweth not in what state their stock standes But by these shippes and their servante expected in them they shalbe able to induce of the state of their business and give a more perfect answeare." Heydon and Porter brusquely replied "that if they expected anie further satisfacon, they must have it from the king, for their partes they could give no time of deliberacon."

The Governor at last intervened, explaining that "both himself and Comittees are bound to maineteyne the trade asmuch as in them lieth beeing besides their owne Interestes trusted for the generallitie. And desired the gent[lemen] to conceive that this debate is risen partly oute of presumpson of what may happen, partlie out of experience of what hath hapned by occasion of those of warwicke sending into these lands. But told them that the

Companie will be humble sutors to his Majestie and to the Prince to heare them in the business.”¹⁶³

Another possible objection to the schemes of Dutch projectors that was not voiced might be the situation that was currently developing between the Company and Hildebrandt Pruson, who would become an associate of Drebbel.¹⁶⁴ Pruson, promising to save the Company money lost by previous abuses, had become the Company’s shipping supplier. Suspicions were beginning to develop that he too was lining his pockets. On the eleventh of March 1621, Mr. Pruson was asked to set down a list of the sails, tackle, and Masts used “for shippes of severall Tonnage” that the same beeing compared with the “rigging . . . of the last three shippes that were sett forth the Companie might receive satissfaccon of his skill in those things and whether the abuses of the Companie do yet continue. . . .” Pruson replied that he “had rather be acting than proiecting and that the former abuses of the Companie appear in the Companies booke.”¹⁶⁵ Pruson’s tone grew ever more strident as the investigation into his doings proceeded, and the Pruson affair would erupt into a full-blown scandal dominating the Minutes of the Court for 1623.

At the end of its April 29, 1622 meeting, the Court appointed a group to draw up a petition to the Prince to be read allowed at the next Court.¹⁶⁶ It appears that it was the Prince’s project to send independent ships that most bothered the company, rather than the King’s plan to send two servants with gifts and inventions. On the third of May, “Mr.

¹⁶³ Minutes of the Court of Committees of the English East India Company, Volume Five, 404-7, British Library, Asia and Pacific Collection, India Office Records, B/7.

¹⁶⁴ Pruson would join with Drebbel in a scheme to drain the fens. See *The propositions of Sir Anthony Thomas, knight, and Iohn Worsop, Esquire for making of the bargaine with the country, and Henry Briggs, professor of the mathematicks in the vniuersitie of Oxford, Heldebrand Pruson, citizen and salter of London, and Cornelius Dribble, engeneere, with the rest of the undertakers for the drayning of the Levell within the sixe countyes of Norfolke, Suffolke, Cambridge, Isle of Elie, Huntington, North-hampton and Lincolne-shire, on the southside of Gleane* (London: N.A., 1629). After Drebbel’s death the secret of his ovens was sold in 1634 to Pruson and to Howard Strachey, the clerk of the Lieutenant General Sir John Heydon (discussed further below).

¹⁶⁵ *Ibid*, 363.

¹⁶⁶ *Ibid*, 407.

Governor put the Courte in minde of the proposicon made by the Princes servante for sending a shipp and pinnasse into the Indies and related what passed before the King and Prince concerning the same together with the Kinges favor unto the Companie. Also that that morning Mr. Porter had brought unto him a paper wch being read in Courte conteyned certayen reasons of the proiectors that of necessite they muste send a shipp and pinnasse of their owne for the more convenient offering of their designes.” “The Courte here upon thought it fitt to attend the Prince and to give him satisfacon if it maie be, and that a peticon be conceived to that purpose, and therein to signifie the message delivered first by his Highness servante, with the Companies resolucon to have attended the Prince for his satisfacon therein, but that they were prevented by being sent for to attend the king where they had delivered the Companies answeare and that they are desirous to do the Princes service but that if this proiect procede it will be exceeding prejudiciall to the Companie and that the Prince can have no assurance of the sucesse.” Meanwhile, another petition to the King was also read, “but nothing was resolved concerning the same.”¹⁶⁷

On the 29th of June, the Governor reported “the proceeding att the Counsell table before ye Princes Highness and divers of the lordes whome the king had appointed to take consideracon of the prince his proiect for sending a shipp and a flatt bottom boate into the Indies with Inventions for the Mogull to fish for pearls, and to weigh such wracke as have bene sunk in the Indian seas. M. Governor added further that the Companies Secretarie had digested the same procedings into Writing, and willed him to read the same, whereby as also by the reporte of Mr. Governor Mr. Deputy & thother Committees who were present at the Counsell board it appeared that notwithstanding all obiections and opposicon the Company could make to the Contrarie, yet the prince insisted upon his resolucon.” The Prince did,

¹⁶⁷ *Ibid*, 409-10.

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however, assure the Company “that the shippes shall not carry out with them anie monney or merchandise to be employed in course of trade that while they were abroad they shall not attempt anie hostile or piraticall Act nor at their returne shall bring home any merchandise whereby the Companies trade may be dampnified and if those to be employed shall transgresse in any the particulars before menconed it shalbe free for the Company and their servants in such partes where they shall come to surprise the said shippes and take them into their owne power to be answerable for the same.” Mr. Governor had replied “that himself and thothers present had no power to give consent, but if it pleased his Highness to give them leave to expound it att their next generall Courte wch would be uppon Tuesdaie next, they would attend his Highness with the Companies answeare whereto the prince gave Consent, and it was intimated that the prince needed not to have done this, yet the Kings Majesty and the princes Highness out of their love and good respect to the Companie have taken this course for their sattisfaccon.”

The Court debated “whether to propound it to the generall Courte or not, some, held it dangerous and that the generallitie would not give waiee thereto and therefore wished that this Courte would determine of an answeare, but that was not conceived fitting because many of the generallitie already tooke notice thereof and expected it should be brought to a generall Courte.” “Divers proposicons were made and this business diversly debated.” The Court decided to present the draft of the conference before the Prince which had been read to Secretary Calvert “and his opinion taken whereuppon the Courte would proceed accordingly and Mr. Governor required all men to keepe this business secret.”¹⁶⁸

¹⁶⁸ *Ibid*, 469-70.

This was done, and on July 2, the Court approved reading the draft to the generality that afternoon.¹⁶⁹

At this point, the Court Minutes conclude, but a proposition can be found in the National Archives addressing the King and concerning the Prince's project.¹⁷⁰ The document represents a canny attempt to stave off the projects for as long as possible and to offer alluring alternative projects, all the while obsequiously praising the Prince's plan. In order, they claimed, to prepare for the "great designe," they would send out one great ship, and two pinnaces, "both to be handmaydens unto this great shipp, the one speeding to returne to his Matie with such overture of possession, & first profit as shalbe made, the other to trade in the Cuntre from port to port & supplie & releive the people thereof wth such clothing & other necessities as shall not only be welcome to them and well paid for, but also preserve them unto us in all friendly prospecte until the great designe be put in executon." In order to make a "quick starte" they recommended that "such commodities be sent out, & to such valuacon as maye return a wellcome & expected profit." In other words, they wished to continue business as usual, but to present it as preparation for the royal projects.

The list of the goods which would ensure a rapid profit (which would, presumably, speed home to his Majesty within a pinnace) included precisely those sorts of old-fashioned diplomatic gifts and trading goods the King had hoped to supercede with new inventions. They included "Broadcloathes, kersyes . . . Tynn, lead, quicksilver, Allam, Ellefante tooth . . . Amber beades, & the like. But more especially, and for those princes Courte & uses

¹⁶⁹ *Ibid*, 472.

¹⁷⁰ Special thanks to Rupali Mishra for this reference. Colonial Office 77, 34 (renumbered as 60). This document has been dated to 1627 based on the fact that Drebbel was paid for water engines in 1627. The latter, however, were for the siege at the Isle of Ré and had nothing to do with the engines described in the document, which should be dated to 1622.

Introduction: The World of Tomorrow

Old & antique jewells, apparison & rings of all sorte, basons & Ewers & other great peeces of plate, both of silver, & silver & gild, And yf any sett with stones, they are there to be valued at high rates. Also fire work peeces, pistolls, knives, embroyderies, saddles, & furnitures for horses & men, Caparisons, picktures. Tappestries, vases or bottles or strong waters, sack & white wine also two or three peeces of ordinance to present either the king of Bantham, Marsalle or Empire of Mattaram. . . .”

All these would “return three for one profitt, and that in the time of two yeres or thereabout only.” This quick start, and this alone, should be undertaken for the present, since “the danger of loosing this first season is to be feared.” Also, during “this startt time is to be considered, the duple coating of the shipps & well victualeing of them, & also of skilfull & well governed Marriners & other necessarie provisions hereunto belonging, all which maye serve for two yeres time at least, by which is intended two thinge of ymport The first to court please & observe the kinge in those Indian parts, and that with such rarities & novelties as are above menconed, also with severall sourte of musickes, of motions, & other slight toyes & delightes, wch will fasten them unto us, and bring them on our shippes board, and maye serve to welcome us on shoare, & that without any suspicion whereby the safetie and lives of such persons as shalbe herein ymployed maye be the better served & freed from danger.” In other words, traditional trade only should be engaged in at first (with the addition of a few automata), in order to both send home assured profits and to pave the way to the “great designe.”

Subsequently, five designs were listed from the “taking possession of Sumatra” to the “laudable trade of Japan & venting of our English cloth there, and hereby to recover the (almost) lost honor of our nation.” The Prince’s project concluded the list, and although it

was presented as potentially the most rewarding of all the designs, skepticism made itself felt, especially in the demand for a demonstration of the engine.

5. The fishing of pearls in many parts of India, a thing of great hope and import, provided his Majesty's engines made by Cornelius Dribble prove true, and may be had, soe that of all these designs here mentioned, there are great hopes and probabilities, not only to return a present profit, but an annual and everlasting treasure to his Majesty, and his successors for ever; of all which the parties at present employed, will leave under their hands a large and ample demonstracon, as well to remain here recorded, as to inable those that shall follow in the great attempt which (God willing) is intended to be put in execution.

Although the Company remained skeptical of Dutch engineers and their projects, King James, the Duke of Buckingham, and Prince Charles employed them in large scale projects.¹⁷¹ Drebbel's career thus puts Buckingham and Charles' interest in invention and artisanal projects in a new light. Charles' project to fish for wrack in the Indies was postponed indefinitely by his trip to Spain, undertaken with the Duke of Buckingham. However, his servant Sir William Heydon was created Lieutenant General of the Ordnance Office, where he was able to put Drebbel's inventions to another use.

Drebbel entered the Ordnance Office along with the new Lieutenant General. Heydon was ordered to provide Drebbel and his colleague Arnold Rotsipen with workspace in the Ordnance Office for the "safe & private keeping of all the Artifices, Engines, Munitions and Habilements as from tyme to tyme shalbe by them consived & performed."¹⁷² As Lieutenant, Heydon was paid 1, 525 pounds for "certain forged iron cases, with fireworks, water mines, and water petards, with boats to conduct fire-engines under water,

¹⁷¹ The Royal patronage of alien innovators did not sit well with local guild members. See "The politics of Innovation" in Joseph P. Ward, *Metropolitan Communities: Trade Guild, Identity, and Change in Early Modern London* (Stanford: Stanford University Press, 1997), 124-136.

¹⁷² State Papers 16/31/14, July 4, 1626.

appointed to be made ready for his Majesty's present service."¹⁷³ In turn, Heydon paid Drebbel and Rotsipen 100 pounds for the water engines they had forged.¹⁷⁴ Those same petards were employed in the disastrous battle against the French at the Isle of Ré.

The English troops at Ré did not fare well. William Heydon was drowned in an overladen boat. Buckingham sought reinforcements, and on July 26, 1627, he wrote to John Coke to request that "Cornelis, the Dutch engineer" be sent "who will come if His Majesty encourages him. He should bring with him the fireworks he left behind, also for vessels, munition, stores, pick-axes, shovels, and other tools for work in trenches."¹⁷⁵ Buckingham, who was criticized for protecting projectors, knew Drebbel well, since "the Dutch engineer" had joined Balthasar Gerbier and John Tradescant the Younger in the Duke of Buckingham's building, gardening, and collecting project at New Hall in 1624.¹⁷⁶

William's brother John Heydon set out with Cornelius, together with some special warboats they had prepared together in great secret. As King Charles was informed, on September 8th, "in the dispatch of Mr. Heydon and Cornelius we have used such expedition that this day they purpose to set sail, and that secrecy that Mr. Burrell, who hath prepared the four barques, knoweth nothing of the design."¹⁷⁷ This was William Burrell, formerly one of the Master Shipwrights of the East India Company, and currently Commissioner to the Navy.

¹⁷³ Frederick Devon, *Issues of the Exchequer* (London: Rodwell, 1836), 350, dated 16th of July, 1626.

¹⁷⁴ State Papers 16/66/25, June 5, 1627.

¹⁷⁵ Historical Manuscripts Commission, *The Manuscripts of the Earl Cowper, Vol. I.* (London: Eyre and Spottiswoode, 1888), 310.

¹⁷⁶ For Drebbel's activities at New Hall, see P. Mcevansoneya, "A Note on Cornelius Drebbel," *Journal of Garden History* 6(1986), 1. On New Hall, see Lawrence Stone, *Crisis of the Aristocracy, 1558-1641* (Oxford: Clarendon Press, 1965), 552-3. On being criticized for protecting projectors, see Lockyer, *Buckingham, the Life and Political Career of George Villiers* (1981), 93.

¹⁷⁷ *The Manuscripts of the Earl Cowper, Vol. I*, 320. After Drebbel's death, certain works "on the project of a Dutchman" were removed from the hold of the Fourth Lyon's Whelp, one of Buckingham's small boats sent to Ré. See SP 16/262/88, March 17, 1634, when the Officers of the Navy asked to break down the works installed "on the project of a Dutchman, by his Majesty's command" and SP 16/264/1, March 29, 1634, when they were granted permission to do so.

Yet John Heydon complained to John Coke of Burrell's delays, writing from the Minories on Sept. 7th. He informed Coke on Sept. 13th of an even graver offence, writing that "I could wish His Majesty were acquainted with Mr. Burrell's inexcusable negligence and indiscretion. Every day I find more instruments employed which may make the business more public. I have not acquainted any soul with the least particular more than Mr. Cornelius."¹⁷⁸ Heydon and his confidant Drebbel eventually did reach Ré, where the petards were deployed on October 1st, not to great success according to the reports published in the *Mercure François*.¹⁷⁹

This did not, however, reduce the enthusiasm of John Heydon, who succeeded to his brother's post as Lieutenant Governor, for Drebbel's projects. King Charles seized the Fens, and granted them on June 1, 1629 to several courtiers - Robert Killigrew, John Heydon, and George Kirke - to be drained.¹⁸⁰ A committee of mathematicians, engineers and projectors, contracted to carry out the draining, including Anthony Thomas, the Oxford mathematician Henry Briggs, William Burrell, Cornelius Drebbel, and Hildebrandt Pruson. Pruson and Thomas later had a falling-out, and Heydon took Pruson's side.¹⁸¹ The fens were successfully drained only to be flooded again by rioters in 1642.¹⁸²

¹⁷⁸ *The Manuscripts of the Earl Cowper, Vol. I*, 322.

¹⁷⁹ Jaeger, 77.

¹⁸⁰ See Pishey Thompson, *The History and Antiquities of Boston* (London: Longman, 1856), 625. See the contract of "Master Burrell and his associates" in *The propositions of Sir Anthony Thomas, knight, and Iohn Worsop, Esquire for making of the bargaine with the country, and Henry Briggs, professor of the mathematicks in the vniuersitie of Oxford, Heldebrand Pruson, citizen and salter of London, and Cornelius Drible, engeneere, with the rest of the undertakers for the drayning of the Levell within the sixe counties of Norfolke, Suffolke, Cambridge, Isle of Elie, Huntington, North-hampton and Lincolne-shire, on the southside of Gleane* (London: N.A., 1629).

¹⁸¹ In SP 16/ 267/25, Anthony Thomas complains that the work of draining, which he himself had undertaken entirely to do, was almost finished, when Pruson and Sir John Heydon attempted to wrest control from him. ". . . such is Prusons impudence. . . that he doth report about the Cittie that there are 8000 acres underwater which his clamour doth disharten many Adventurers to this day. Moreover he lately procured a meeting of the Earle of Doresette where Sir John Heyden, Mr Kirke, Mr. Norton, Sir Robert Bell and many of the Gentlemn of qualitie were present pretending his desire was to set the business at right, in truth intending to perplexe it the more as the sequel proved. Ffor Sir John Heydon, one of the Kings Patentees for some land in that tract and Pruson avowed that they would take no consideration of the law of Sewers or who were made undertakers by it, but that they might appoynt Undertakers thems selves, and therefore desired of that Noble Lord that they

Pruson and Heydon also invested in Drebbel's self-regulating oven. This oven could serve as an incubator for the artificial hatching of chickens, as a portable oven for the baking of bread, or as a chemical furnace. John Heydon was himself an alchemist, and while he was busy in the Minories, his brother-in-law Christopher Gardiner kept the fires stoked at Heydon's manor in Croydon.¹⁸³ No doubt they both would have appreciated the oven which drastically reduced the labor of tempering the fire for alchemical processes which could require weeks of constant and careful heat.

Immediately after Drebbel's death, Drebbel's children sold the secret of the oven to Hildebrand Pruson and Howard Strachey, the clerk of John Heydon.¹⁸⁴ Drebbel's sons-in-law, the Küfflers, continued to improve the ovens for Heydon. As Johann Sibbert Küffler informed Samuel Hartlib in 1656, "Sir I. Heidon brought in a Calculation how by Kufflers new baking ovens 40. thousand lb. might bee saved to the k[ing's] Army."¹⁸⁵

Upon Drebbel's death, Heydon was left with many projects and models. Henry Gellibrand, Professor at Gresham, informed Hartlib in 1634 that Sir John Heydon had given him "all the Astronomical Instruments which were his fathers which are of great vawle. Hee told mee that Sir I. Heiden had a hundert Models et Rarities. Amongst others to reade an

might have a Commission to examine what was done and what was not done, that Pruson might enter upon the workes by virtue of the Patent, and to examine whether the moneyes were expended necessarylie or not albeit neyther they nor any adventuers by their meanes had disbursed a penny in the business. . . ." See also State Papers 16/339/36, for the division of rents between Kirke, Killigrew, Dawes, Long, Pruson and Heydon. According to John Heydon's son Charles in 1660/1, the Fens were to be divided between "Mr. Kirke, Sir William Killigrew, Sir Abraham Dawes, Robert Long, Hildebrand Pruson, and Sir John Heydon, all which persons save the said Heydon and Pruson passed their grants, the said Charles Heydon now praying leave to pass it, it having been chiefly prevented by the disturbance of the times." See William Shaw, *Calendar of Treasury Books, 1660/67* (London: Mackie and Co., 1904), 222. See also SP 16/251/8, Nov. 26, 1633.

¹⁸² *The Case of the heir of Sir Anthony Thomas Kt., deceased and his adventurers in the east and west fenns on the north east side of the riverr of Wütham in the county of Lincolne* (N.A.: N.A., 1661).

¹⁸³ See 16/373/37, 16/374/38 and 55, 16/397/48r-v. Gardiner also served as Heydon's alchemical reader, reading and commenting upon such authors as Hollandus and Nuysement. Interestingly, Heydon crossed out the layman's terms employed by Gardiner in his letters and replaced them with the appropriate alchemical symbols.

¹⁸⁴ See A.D. 1634, No. 75 "Stoves or Furnaces for Drying and Heating" in Bennett Woodcroft, *Appendix to Reference Index of Patents of Invention*, (London: Patent Office, 1855), 16.

¹⁸⁵ Hartlib, *Ephemerides*, 29/5/73A, 1656.

Inscription in the night halfe a mile of which hee kept very secret.”¹⁸⁶ Heydon also could turn saltwater fresh, which as we have seen, was one of Küffler’s projects.¹⁸⁷

Years later, when the question of producing life “artificially” was exercising the Royal Society, one member described the manner, “how Dr. Kuffler hatched chickens by the help of furnaces” upon which, Sir Jonas Moore, Surveyor General of the Ordnance Office “remarked that Sir Christopher Heydon [sic] together with Drebell long since in the Minories hatched several hundred eggs; but mentioned not the way.”¹⁸⁸ Kenelm Digby recalled in 1644 how he wished that it “might be continually in our power to obserue in” “some creatures” “the course of nature euery day and houre. Sir Ihon Heydon, the Lieutenant of his Maiesties ordinance (that generous and knowing Gentleman; and consummate souldier both in theory and practise) was the first that instructed me how to do this, by meanes of a furnace so made as to imitate the warmeth of a sitting henne. In which you may lay seuerall egges to hatch; and by breaking them at seuerall ages you may distinctly obserue euery hourelly mutation in them, if you please.”¹⁸⁹

It is clear that Drebbel’s secret of the self-regulating oven remained within Heydon’s possession. Indeed, according to Hartlib, “Gardiner at Croydon got all Drebbel MS. and

¹⁸⁶ Hartlib, *Ephemerides*, 29/2/31B, 1634.

¹⁸⁷ Hartlib, *Ephemerides*, 29/2/32B, 1634. “Habet egregium Experimentum Sir I. Heiden of turning salt water into fresh so that ships will bee suplied sufficiently hereafter in this kind. Gelebrand.”

¹⁸⁸ Thomas Birch, *History of the Royal Society of London*, Vol. 111, (London: Millar, 1757), 455.

¹⁸⁹ *Two treatises in the one of which the nature of bodies, in the other, the nature of mans soule is looked into in way of discovery of the immortality of reasonable soules* (Paris: Gilles Blaizot, 1644), 220. In writing to John Winthrop Jr., Digby both mentioned his relationship with the Küfflers and associated John Heydon and Drebbel. *Winthrop Papers, Collections of the Massachusetts Historical Society*. Vol. IX, Third series (Boston: Charles C. Little and James Brown, 1846), 26 Jan. 1656, “Neither do j know where the Kefflers. The doctor told me long since, that his water was to be taken inwardly for vlces, was made of [mercury]. I had from him a bottle of it for one that had the kinges evill; but it did not cure them; and it was so nauseous to the stomake, after 2 or 3 takinges (though it looked and tasted but like faire water) that patients would rather resolve to continue their vlcers then take that medicine. If ever j meete wth Keffler, j doubt not but he will teach it me if he knowes it; and j will send it you. In the meanetimme lett me tell you an easy medicine of mine owne. . . . Sir John Heydon is dead. It is pittie that Dreble dyed before he had perfected the Telescopium.”

Arcana.”¹⁹⁰ Drebbel remained installed at the Minorities and in league with Heydon until the very end. He also continued to think up new projects. At the end of his life, he was working on the improvement of the telescope, the art of flying, and according to Hartlib’s son-in-law Clodius, metalline transmutation.¹⁹¹ Upon Drebbel’s burial in 1633, he was still described as the King’s Chief Engineer. He was buried in the church of Holy Trinity just a few months after John Heydon buried his own son there.¹⁹²

The late collaboration between Drebbel and Heydon sheds light on the role of secrecy in Drebbel’s career. Although Drebbel was undeniably secretive, telling his exasperated sons-in-law that he had more than two hundred inventions and more than a thousand secrets which he would carry to the grave, the Ordnance Office context casts some light on such secrecy.¹⁹³ In a government which valued technology and craft secrets, this information was not only an arcanum of the adept, but also of the state.¹⁹⁴ It was Heydon’s responsibility to maintain the security of Drebbel’s inventions.

¹⁹⁰ Hartlib, *Ephemerides*, 29/5/102B, 1656. In 1635, Küffler also informed Hartlib of a list of Drebbelian writings and *arcana* belonging to one Hoof, a consul at Amsterdam (possibly P.J. Hoof), and suggested that this Hoof might be publishing them as his own. Hartlib, *Ephemerides*, 1635, Part 5, 29/3/55B-56A. “Nullus philosophorum scripsit ad huc Tractatus ex professo De Elemento Ignis praeter Drebbelium per MS. illi ablatum vel retentum ab Hoof quodam Consu qui brevi erit Consul Amstelrodamensis qui fortassis aliquam sub suo nomine edet Scriptionem per intervalla Drebbelium aestimavit impossibilem. Illa quae reliquit concessus vt imprimis Optica in qua habet insignia Experientia partim jam perfecta partim adhuc perficienda. Possunt apud illum videri. 1. Forma perpetui Mobilis. 2. Perspectivae omnis generis. 3. Specula omnis generis. 4. Forma Instrumenti solaris. 5. Horologi solaris quod inceptum sub Rege Iacobo sed ob defectum [sumptuum?] nondum finitum. 6. Laborat jam in Novo quodam genere pro Luna. 7. distillatoria vbi etiam [Gallinas?] excludit ex oris. 8. Magna quaedam vitra optica. 9. Fornaces ferrei pro hypocaustis, drying of Malt. 10. Refrigeratoria Instrumenta pro aestate et imprimis in locis calidioribus vti India etc. 11. Naves sub aquis natantes. 12. Conclave Opticum. 13. Vitra Tonitrium et fulgurum. etc.” More research in the Amsterdam archives for Hoof’s account of Drebbel might be fruitful.

¹⁹¹ Hartlib, *Ephemerides*, 29/5/103A, 1656. According to Clodius, Drebbel “wrote to Dr Kuffler that hee had something in translatione Metallorum which hee would impart vnto him. But before hee could come hee was dead.”

¹⁹² Edward Murray Tomlinson, *A History of the Minorities, London* (London: John Murray, 1922), 136, 400.

¹⁹³ Carpentras Ms. 1776, fol. 411r. “Il y en a plus de deux cens de choses qui n’ont iamais esté faictes, Et dict qu’en mourant il en enterrera avec luy plus de mille secretz qu’il ne veut enseigner a personne.” He taught them only a little of the perpetual motion, of the lunettes, and a few other small secrets, and sent them off to make their fortune with that (“il les a envoyez avec cela tenter fortune”).

¹⁹⁴ For the English court’s interest in technical information for the service of the state, see Eric Ash, *Power, Knowledge, and Expertise in Elizabethan England* (Baltimore: Johns Hopkins University Press, 2004).

Drebbel's projects in the Ordnance Office also point to links between royalist projecting before the Interregnum, and experimentalism among early members of the Royal Society after the Restoration. Despite his extremely busy career, John Heydon continued to experiment with the oven alongside a few invited guests such as Digby. Historians of science have seen the Ordnance Office with all of its engineers and gunners as one of the premier "laboratories" for the mathematical arts in England.¹⁹⁵ Yet, for engineers of death, the ability to shape and control life through the perfective arts and chymico-mechanical machines such as the oven was also highly interesting. Despite Christopher Hill's association of the occult arts with radical politics, there were many such as John Heydon and his friend Elias Ashmole who believed occult knowledge could defend their royalist world.¹⁹⁶ The idea of using Drebbel's inventions in colonial projects also never evaporated. The ovens reached New

¹⁹⁵ See Frances Willmoth, "Mathematical Sciences and Military Technology: the Ordnance Office in the Reign of Charles II," *Renaissance and Revolution*, J.V. Field, ed. (Cambridge: Cambridge University Press, 1993), 117-132.

¹⁹⁶ Michael Hunter made this point in *Elias Ashmole 1617-92* (Oxford: Ashmolean Museum, 1983). Note that Sir John Heydon should not be confused with the Rosicrucian writer John Heydon who was Ashmole's enemy. Ashmole was one of Drebbel's greatest English collectors. In Bodleian Library MS. Ashmole 1417, 3 Ashmole noted Cornelis Drebbel's name from Thomas Tymme's *Dialogue Philosophicall*. In Bodleian Library, Ms. Rawl D. 864, 224 Ashmole took notes from an English translation of Drebbel's letter to King James' I on the perpetual motion apparently by Tymme (whose translation of Dee's *Monas Hieroglyphica* also appears in the Ashmole papers (Ms. Ashmole 1459, 469-481). The sheet is labelled on the verso, "Notise out of Cor: Drebls perpetuall mocion," and reads "Syr. 43 32/Wisdom 7.27/Tho Tymme Cor Drebbel of Alcmarr in Holland/All things except fire lead to the Earths Center/I give to many that sweete & pleasant relish which is in ye hidden cause of thinges/I explained & examined that examples by y truly Tangina ye lydium lapidem as by ye Touchstone/ Cornelius Drebel Alcmariensis" followed by notes in Ashmole's cipher, and a drawing of the perpetual motion taken from Tymme's *Dialogue Philosophicall*. See Jennifer Drake-Brockman, "The Perpetuum Mobile," *Learning, language, and invention: essays presented to Francis Maddison*, W.D. Hackmann & A.J. Turner, eds. (Brookfield, VT: Variorum, 1994). These notes are direct translations from Drebbel's "Dedication" of the perpetual motion to King James I, "alle dinghen dalen naer midden der Aerden/ uytghesondert het vyer," "verhopende daer door veel Menschen te doen smaken die aenghename soetheyt van de verburghen oersaeck der dinghen," and "Hierom wil niet alleene bewijsen met reden en exempelen/ maer ooc die exempelen verclaren nae de waerheyt."

In Ms. Rawl D. 864, 200, we also find a notice labelled on the verso, "Authors manner of severall Facultyes." Drebbel is listed as the first author among the "libri phisici":

De libri Phisici

Drebellii [elements]

Trismegesti Pimandres

Polyphilas

Ia. Nuisement

Cosmpolita

Batavus chemicus

England at an early date, and after the Restoration, the Duke of York purchased the secret of Drebbel's ovens from the Kufflers for use in the Indies.¹⁹⁷

VI: Drebbeliana

A major source on Drebbel's life and inventions is the account Abraham and Gilles Kuffler provided Peiresc in Paris in 1624. Various details of this account seem fantastic. For instance, the Kufflers related a story concerning Drebbel's time in the service of Rudolf II that cannot be entirely true.

When he was with the Emperor, he (Drebbel) made for him (the Emperor) that globe of glass, and undertook to make for him in a square a fountain whose water he would be able to make mount a thousand feet if he wished, of which the structure was very tall, and he would put at the top his perpetual movement, which would work a clock. And in the middle of the machine he would make an artificial sun, which would shine always day and night which were three great and very rare inventions.

When the archduke Mathias surprised Vienna, and seized the Emperor his brother, he had all those who were members of the Emperor's council arrested, and among others Drebbel, whose house was pillaged, and all his instruments and furnaces broken, and given to cardinal Clesel to whom it (the house) belonged. The said Archduke condemned all the State councilors to death, and prepared the scaffold to cut off their heads in the courtyard in front of the Palace of the Emperor, who seeing this preparation from the window of his room, asked those who guarded him why that was, and having learned that it was to kill Drebbel, was greatly afflicted; and the archduke having come to visit him and finding him so sad, and begging him to say from whence proceeded this extraordinary affliction, he (Rudolf) responded that it was because they were going to kill the greatest personage of the world, who was the one who had invented that globe of glass, which he showed him, and undertook that fountain down there. . . .¹⁹⁸

¹⁹⁷ Bruce D. White, and Walter W. Woodward, "A Most Exquisite Fellow? – William White and an Atlantic World Perspective on the Seventeenth-Century Chymical Furnace," *Ambix* 54:3 (2007), 285-298, Douglas McKie, "James, Duke of York, F.R.S.," in *Notes and Records of the Royal Society of London*, 13:1 (June, 1958), 7.

¹⁹⁸ Cornelis Drebbel, *Bibl. De Carpentra*, MS. of Peiresc, 1776, Fol. 409v. "Estant avec l'Empereur, il luy fit ce globe de verre, et entreprint de luy faire en une place une fontaine qu'il fairoit monter mil pieds s'il vouloit, dont le structure seroit fort haulte, et mettroit au dessus son mouvement perpetuel, qui fairoit aller un horloge. Et au milieu de la machine il faisoit un soleil artificiel, qui auroit tousjours esclairé jour et nuit, qui estoient trois grandes et bien rares inventions. Lorsque l'archiduc Mathias surprit Vienne [sic] et se saisit de l'Empereur son frere, il fit prendre tous ceux qui estoit du conseil de l'Empereur, et entre aultres Drebbel, la maison

Not all of this can be true, either through deliberate misrepresentation on the part of the Küfflers, their own confusion, or inaccurate notation by Peiresc's amanuensis (his brother, in this case). Rudolf's capital was in Prague, not Vienna, and Drebbel was arrested immediately after Rudolf's death, so Rudolf could not possibly have lamented his arrest.

However, other very specific details of the Küfflers' account can be confirmed through archival evidence. In an effort to augment the social status of Drebbel's family, they claimed that "the land surrounding Alkmaar carried the name of Derbbel [sic] to whom it belonged" ("Les Terres qui sont au tour de la Ville d'Alcmar portent encoures le nom de Derbbel a qui elles appartennoient"). Indeed, as noted above, Drebbel's father Jacob Jans. Dremmel described in his 1589 will a piece of land lying in the Bergermeer (not far from Alkmaar), called "Dremmel's Land."¹⁹⁹

The Küfflers also recounted how Drebbel's mother invested money for Drebbel's children with the city of Alkmaar, since she thought Drebbel would spend it all ("La Mere voyant le mauvais mesnage de son filz, a retenu du prix de ce bien vint mil livres qu'elle a mis sur l'hospital de ladite Ville a trois pour cent, pour estre conservees aux enfans dudit Derbbel"). That Hillegont Jansd., Drebbel's mother, put aside money for her grandchildren other than their father's portion of the inheritance, as we have seen, can also be confirmed in the Alkmaar archives.²⁰⁰

duquel fut pillée et tous ses fourneaux et tous instruments brisez, et fust randue au cardinal Clesel à qui elle appartenait. Ledit Archiduc fit condamner tous ses conseillers d'Etat à la mort, et fit dresser l'eschaffaut pour leur trancher la teste dans une place qui est devant le Palais de l'Empereur, qui voyant ce prepartif de la fenestre de sa chambre, demanda à ceux qui le garoient pourquoy s'estoit cela: et ayant appris que c'estoit pour faire mourir Drebbel, s'en affligea grandement; et l'archiduc l'estant venu visiter et le treuvant ansy triste, l'ayant prié de luy dire d'où procédoit ceste affliction extraordinaire, luy repondit que c'estoit pour ce qu'il aloit faire mourir le plus grand personnage du monde, qui estoit celuy qui avoit fait et inventé se globe de verre, qu'il luy monstra et entrepris la fontaine cy dessus. . . . »

¹⁹⁹ Alkmaar, Notarial Archive 5, page 29.

²⁰⁰ Alkmaar, Weeshuis 16, page 360, 27th March, 1604.

Drebbel's adventures in Prague can be somewhat further elucidated to shed light on some of the details of the Küfflers' story. As recounted by Svátek and Gindely, Drebbel as well as Rudolf's keeper of the *Kunstammer*, the artist Fröschl, and other servants were arrested due to some impropriety with the *Kunstammer*.²⁰¹ Naber and Jaeger debated whether Drebbel was indeed involved with some fraud regarding the Rudolfine collections.²⁰²

Whatever the case, the *Kunstammer* incident does not appear to have been the real cause for these events, as even Gindely suggested.²⁰³ In the final years of his life, Rudolf had been ruling without the help of the important and socially elevated Imperial Privy Council.²⁰⁴ He had been turning to artists and private servants for advice and limiting the access of the socially and politically powerful. As Peter de Vischere informed Archduke Albert, immediately after Rudolf's death a cast of private servants, artists and artisans were arrested, including "a Hollander named Cornelius Tröhler, the one who discovered the perpetual motion."²⁰⁵ The story that the Küfflers tell about Khlesl's wrath makes sense within this political context, since Khlesl was one of those powerful men exiled from Prague by Rudolf II, only to return in triumph with Archduke Matthias upon Rudolf's death. The zealously Catholic Khlesl would also have looked askance at the prominence at Rudolf's court of such Protestants as Drebbel.²⁰⁶

²⁰¹ Josef Svátek, *Culturbistorische Bilder aus Böhmen* (Vienna: W. Braumüller, 1879), 251.

²⁰² Naber (1904), 219 and Jaeger, 41.

²⁰³ Antonin Gindely, *Rudolf II and seine Zeit*, Vol. 2 (Prague: Friedrich Tempsty, 1868), 313.

²⁰⁴ See Henry Frederick Schwartz, *The Imperial Privy Council in the Seventeenth Century* (Cambridge: Harvard University Press, 1943).

²⁰⁵ See Anton Chroust, ed. *Briefe und Akten Zur Geschichte des Dreissigjährigen Krieges in den Zeiten Des Vorwaltenden Einflusses der Wittelsbacher*, Vol. 10 (Munich: Gustav Himmer, 1906), 242-5. "Als bald nach I. M.t. verschiden sein ihr geheimster camerdiener Rutsky, ihr antiquarius der Fröschel, ain Luttiger Haisdal genant, bei deme man vile brief in seinen klaideren und bett vernähhet gefunden, und zween andere, deren ainer ain getaufter jude [kuhbach] daer andere ain Hollender, genant Cornelius Tröhler, so den motum perpetuum gefunden, in arrest genommen worden, deren erster beim oberhauptman dises kunigreichs, die vier andere beim oberst von Trauttmandorf in verwarung sein."

²⁰⁶ However, Khlesl cannot have stayed angry for long with those servants of Rudolf arrested at the Emperor's death. In November 1612, Khlesl stood as one of the godfathers at the birth of Melchior Fröschl, the son of

Rudolf II was once seen as a crazed tyrant. More recently, he has been shown as a mannerist Emperor involved with a wider definition of *Kunst*. Like other German princes, Rudolf participated in self-avowedly “modern” industrial and technological projects from silk-harvesting to alchemy.²⁰⁷ His attention to his artisanal servants was not only a means of avoiding powerful men, but of seeking alternate avenues to advance the Empire.

Likewise, on the other side of Europe, the involvement of Charles I and the Duke of Buckingham in large scale art collection and projecting is due for a re-interpretation. Many more projects proposed by Drebbel have come to light since Jaeger’s study. In the context of these activities, some of the projects which the Küfflers reported to Peiresc begin to appear less like fabrications of the Küfflers, and more like proposals Charles and Buckingham might have entertained.

The Küfflers told Peiresc, for instance, of a plan Drebbel had to create an artificial sun. After recounting that Drebbel believed the sun to be made of seven small globes, whose reverberation caused the sun’s heat (although with his telescope he had only been able to make out four globes at any one time), the Küfflers described the most recent and most wonderful invention – an artificial sun, or perpetual fire. The project was interrupted by the Spanish trip taken by Charles and Buckingham in 1623, which, said the Küfflers in 1624, was greatly to the detriment of the public.

When the Prince of Wales went to Spain, Drebbel proposed to him that just as one has filled London with fountains by means of a small river, which one has conducted and divided by little pipes to all the houses which wanted it, he would undertake to make a fire on a little hill near London, whence all the Londoners could obtain fire and conduct it to their houses, and with this fire they can boil

Daniel Fröschl, one of those arrested. Jaroslava Hausenblasová and Michael Šroněk, *Urbs Aurea: Praha cisare Rudolfa II* (Prague: Gema, 1997), 83.

²⁰⁷ R.J.W. Evans, *Rudolf II and his World: a Study in Intellectual History, 1576-1612* (Oxford: Clarendon Press, 1973) and Thomas DaCosta Kaufmann, *The Mastery of Nature: Aspects of Art, Science, and Humanism in the Renaissance* (Princeton, N.J.: Princeton University Press, 1993).

and roast their meats without need for wood. The voyage which this Prince undertook prevented him from furnishing what would be necessary to have this miracle made. I believe he only asked 20,000 pounds sterling. This voyage did great damage to the public.²⁰⁸

Given what we know about King James' plan to artificially cool India, it seems conceivable that Prince Charles might have entertained a project to artificially heat London.

Yet whether or not such secondhand reports can be confirmed through archival evidence, I would argue for their importance as historical sources. What troubled Jaeger about such sources was their credibility as evidence concerning Drebbel's biography. The exaggerations of enthusiastic mythmakers could not be credited as facts. However, these accounts can also be read as primary sources in and of themselves.

For example, Drebbel's submarine is one of his undeniable inventions. Yet writers on the submarine rarely mention details of the boat's design, to the great frustration of historians of submarine navigation. Instead, their maddeningly fantastic accounts appear to have little to do with any actual boat. Jean de Hautefeuille, for example, quoting from "an Author of those times," said that through Drebbel's ship

one would be able in a year or two to circumnavigate the Earth without being perceived, and being very large it [the ship] will contain one hundred men, with all the provisions which they would need during that time, and that he believed that one could make colonies of Marine Men who would stay there their entire lives, and who would voyage and communicate not only together, but also with the inhabitants of the air, that they would practice there all sorts of arts, that they would have musical concerts, experiments, and observations on Physics, and that finally if there are any learned

²⁰⁸ Carpentras Ms. 1776, fol. 412v. "La derniere et plus excelente invention que Derbbel aye trouuee, est de faire un soleil artificiel, cest a dire en feu perpetuel qui bruslera et eclairer tousiours. Lorsque le Prince de Galles alla en Espagne Derbbel luy proposa que comme l'on avoit rempli Londres de fontaines par le moyen d'une petite riviere qu'on y avoit conduit et divisee par petits tuyeaux a toutes les maisons qui en avoient foulu. Qu'il vouloit entreprendre de faire un feu sur une petite montagne aupres de Londres, dou tous ceux de Londres pourroient aller prandre du feu et le conduire a leurs maisons, Et avec ce feu faire bouiller et roytir leur viande sans avoir besoin de bois. Le voyage qu'entreprint lors ce Prince l'empescha de fournir ce qui estoit necessaire pour faire faire ce miracle. Je crois qu'il ne demandoit que vingt mil livres sterling. Ce voyage faict grand tort au public."

men who compose books there, that one would be able to print them at the bottom of the sea and carry those new books to the inhabitants of the air.²⁰⁹

As a source for facts about Drebbel's submarine, this account is worthless. Yet it is a highly valuable source if we view it as a way to see how contemporaries imagined the possibilities of invention and how such innovation might transform the future.

For this author, the boat was a Utopia. That is, he was not concerned with the actual structure of Drebbel's submarine. His subject had little to do with anything that already existed. Instead, the boat served as an imagined place of ultimate communication and exchange. This Utopian imagining gives evidence of what was important to the author - a universal voyage of pansophic investigation – and how he used Drebbel's invention to express that idea.

Those sources which did provide specific facts were often written with no less Utopian purposes in mind. For instance, the German doctor Johann Faber, secretary of the Lincean Academy in Rome, gave a rare account of the structure of Drebbel's submarine, which he himself had received from the Küfflers.²¹⁰ He did so within the context of the

²⁰⁹ Jean de Hautefeuille, *L'Art de respirer sous l'eau et le moyen d'entretenir la flamme enfermée dans un petit lieu* (Paris: 1681), 6. “. . . on pourra faire en un an ou deux, tout le tour de la Terre, sans estre apperceu, & qu'estant fort grand il contiendra cent hommes, avec toutes les provisions, dont ils auront besoin pendant tout ce temps, qu'il croit que l'on pourra faire des colonies d'Homme Marins, qui y demeureront pendant toute leur vies, & qui voyageront, & communiqueront, non seulement ensemble, mais aussi avec les habitans de l'air, qu'ils y exerceront toutes sortes d'Arts, qu'ils y feront des concerts de Musique, des experiences & des observations sur la Physique, & qu'enfin si il y à des scavans qui y composent des Livres, que l'on en pourra faire l'impression au fond de la Mer, & envoyer ces nouveaux Livres aux habitans de l'air.”

²¹⁰ Francis Hernandez, *Nova plantarum, animalium et mineralium Mexicanorum historia* (Romae: Mascardi, 1651), 574. “Et qui in Navi illa, admirabili Cornelii Trebelii Hollandi ingenio excogitata, & Londini in Anglia, ubi hodieque visitur, fabricatà sub mari navigarunt, sanctè mihi jurarunt, furentibus aequore ventis, nullam in imo maris molestiam percipi, Recipit autem haec navis viginti quator homines, quorum octo remos agunt, reliqui suis in cubiculis persistunt, qui viginti quatuor horarum spatio aere alio nullo indigent, soloque illo in navi concluso contenti vivunt, quibus exactis, superficiem maris petunt & referato navis operculo ac paulisper aperto novum aerem hauriunt, quo postea clauso operculo sub aquam denuò tam profundè merguntur, quam navis Rectori ad Orgias etiam si vellet quinquaginta, visum fuerit. Et quod mireris magis, ibi quoque magnetico indice cursum dirigunt, ubi locorum sint norunt, remisque facillimè navem agitant. Quodque fidem ferme omnem sublevat, est, quod eo loci ubi remigantes morantur, navis absque fundo est, ut aquam ipsi continuò aspiciant, ab ea verò minimè sibi timeant: cum in scamnis suis paulo altius sedentes pedibus haud quaquam ipsam contingant. Sed non libet nunc omnia persequi, quae ab ipso Artificis Genero mihi non ita dudum relata fuerunt.” On Faber,

Lincean Academy's edition of Francis Hernandez, *New History of Mexican Plants, Animals, and Minerals*, commented upon by Faber himself and other members of the Academy.

Faber slid many accounts of new inventions and other wonderful works of art into his commentary. Besides for his account of the submarine, he recounted many details of looking through the wonderful optical tube which the Küfflers had brought him, and which he named the microscope.²¹¹ That he did so within a commentary upon New World *naturalia* was no coincidence. As Faber made clear in a preface dated January, 1625, he believed a new age had dawned, signalled by the discovery of so many wonderful new inventions. The wonder excited both by the natural world and the new discoveries which helped man to explore it was, he felt, key to philosophy. It was wonder which excited man to become a lover of Knowledge and to join the hunt for knowledge as a philosopher. "For he who wonders, doubts; he who doubts, seeks; he who seeks, does not know, and he who does not know, desires to know."²¹² Transporting the reader through wonder was no less Faber's goal than that of Hautefeuille's anonymous author.

Drebbel served as the subject of painters, poets, and philosophers imagining an era of infinite possibility. His persona, inventions, and philosophy provoked fantastic sources from scores (perhaps hundreds) of writers. This makes him an exceedingly difficult subject of research for historians seeking firsthand accounts of the facts of his life. However, I

see Paula Findlen, *Possessing Nature: Museums, Collecting, and Scientific Culture in Early Modern Italy* (Berkeley: University of California Press, 1994), 71-7. On the sources concerning Drebbel's submarine, see Clark Emery, "A Further Note on Drebbel's Submarine," *Modern Language Notes* 57:6 (1942), 451-5.

²¹¹ *Ibid*, 473. "Vidimus & ad miraculum usque obstupimus ante pauculos dies domi meae per Tubum opticum mirae perspicuitatis artificiossimè elaboratum, à duobus Germanis huius artificibus fabrisque nobis allatum donatumque; quem à Telescopii imitatione, & rerum minutarum conspectu *Microscopium* nominare licuit."

²¹² *Ibid*, 462. "Qui enim admiratur dubitat, qui dubitat quaerit, qui quaerit ignorat, qui ignorat scire cupit: hinc animus cupidine flagrat, rerum causas indagat & fortè fortuna earundem quà sensibus, qua ratione utens, unam atque alteram in spissa hac Naturae miraculorum, silva venatur, atque hoc modo Sapientiae amans iure merito & Philosophus appellatur."

would argue that paying attention to secondhand sources is not an abandonment of the study of Drebbel himself.

Such sources raise two questions of equal importance: what purpose did they serve for their producers, and why was it Drebbel in particular who prompted them? A standard biography, such as Jaeger's, which ignores the fantastic reactions of Drebbel's contemporaries would not account for Drebbel's persona and how it related to the concerns of his time. While maintaining the sober aesthetics of historiography urged by Vickers, such a work would in fact not be accurate.²¹³ Drebbel was not a sober figure, but an enthusiastic one who prompted enthusiasm in his contemporaries.

Such enthusiasm was not only central to the idea of discovery in the seventeenth century, but an important part of the relationship between individual and society within an emerging public sphere. As discussed above, in a society which recognized the claims to authority of the desiring consumer (the *liebbeber*), both consumer and producer shared responsibility for a particular cultural phenomenon. In other words, Drebbel not only provoked enthusiasm in others, but the pre-existing expectations and desires of others allowed for his own enthusiasm. A study which locates its subject between Drebbel and his *liebbebers* thus not only more accurately portrays both, but shows how agency might be shared between individual and society.

Such enthusiastic sources might be compared to the period development of "Ana" literature. This genre grew out of a culture of conversation centered around particular luminaries. The collections of Ana were intended to portray a particular style or persona.²¹⁴ They were not the productions of the person they depicted, but of a collaborating group of

²¹³ Vickers (1979).

²¹⁴ Francine Wild, *Naissance du genre des Ana (1574-1712)* (Paris : Honoré Champion, 2001), 16-7.

admirers who all copied down the illustrious man's table-talk.²¹⁵ Yet, once the genre of the Ana became established, no social performer could act without the expectation that his performance might one day be recorded in the pages of his Ana. The fact that such a collaborative genre existed attests to the shared agency of auditor-editors and authors forming a culture of conversation. Although sources concerning Drebbel were never collected into a volume entitled "Drebbeliana," I refer to them as such not only as a useful shorthand, but as a way to indicate such shared agency.

In Chapter One, I track the dissemination of Drebbel *qua* persona in portraiture, dramatic roles, travel narratives, and in eye-witness accounts, or those otherwise stressing Drebbel's personality. Early modern conceptions of the relationship between desire and invention, and possibility and impossibility are the focus of the next chapter, dedicated to the *desiderata* (wish) list and related genres of lists of *deperdita* (lost things), *nova reperta* (new inventions), *possibilia* and *impossibilia*. Here we find Drebbel circulating as an example of fulfilled desire. We also find him placed in a dangerous but possibly fruitful region falling between the possible and the impossible. In Chapter Three, we look at genres tailored to *liefebber* sociability, in which we find Drebbel's perpetual motion as the ultimate object of desire. Next, we turn to Drebbel's fame as an inventor, as it appeared repeatedly in the literature of progress. In this chapter, we examine the motivations behind a mechanical repetition of Drebbel's name amid a cohort of canonized inventors. This use of Drebbel as a "commonplace" differs from the study of Drebbel *qua* persona. Such repetitions do not give a vivid or "eye-witness" report of Drebbel. They stress Drebbel's widely dispersed celebrity found in print media, rather the *publica fama* of hearsay, or the personal encounter of intimate conversation.

²¹⁵ *Ibid*, 30.

In Chapter Five, we turn from the rhetorical to the philosophical uses of Drebbel, studying Drebbel's astonishing and rapid reception in Central European academic alchemy. We continue this study through the middle and final decades of the seventeenth century in Chapter Six by comparing the relative reception of Drebbel in this period in Central Europe and England. The final chapter examines the editions of Drebbel's works, and the investment of literary agents, printers, translators, and readers in their production. Drebbel's works formed another sort of Drebbelian collection, as they snowballed over time to include more and more material submitted not by Drebbel, but by those active and invested members of a public, the *liebbebers*.

I do not offer an exhaustive collection of Drebbeliana. Indeed, if Drebbel's fame extended as far as I have argued, attempting to collect every reference to Drebbel would be nigh impossible. I have only traced Drebbel's fame as far as necessary to indicate its extent in time, space, and genre. As more of the archives and correspondence of seventeenth-century intelligencers and collectors such as Leibniz and Boulliau are published, no doubt more Drebbeliana will come to light.

Much of the reception documented here is new to the historiography, particularly concerning Drebbel's career as a natural philosopher, but I have also returned to previously noted sources where I thought more could be said.²¹⁶ Readers familiar with Drebbel might expect to hear more of Thomas Tymme's *Dialogue Philosophicall* and Constantijn Huygens' works than I have included, but these have been well analyzed.²¹⁷

²¹⁶ Jennifer Drake-Brockman noted several sources concerning Drebbel's perpetual motion, such as the descriptions of Marcel Vranckheim, Daniel Antonini, and Hiesserle von Chodau (in the German, but not the Czech version) in "The perpetuum mobile of Cornelis Drebbel." However, my interpretation of these sources differs from Drake-Brockman's.

²¹⁷ See Jessica Wolfe, *Humanism, Machinery, and Renaissance Literature* (New York: Cambridge University Press, 2004) and Rosalie Colie, 'Some thankfulness to constantine.' *A study of English Influence upon the Early Works of Constantijn Huygens* (The Hague: Martinus Nijhoff, 1956).

A portion of the public which it would be impossible to trace are those who, through an equal exercise of agency, chose not to cite Drebbel despite his extensive fame, or who constructed themselves in opposition to his example. It would be foolhardy to attempt to construct an argument around those not citing Drebbel. However, I hope that by demonstrating Drebbel's overwhelming fame through a study of those who did cite him, his omnipresent availability in the cultural and intellectual resources of the time will emerge. As a result, it will seem hardly credible that such individuals as Descartes, who did not cite Drebbel, or Francis Bacon, who when he did cite him referred only to "Dutchmen" or "certain moderns," were ignorant of Drebbel. Descartes' friends and correspondents Isaac Beeckman, Justin van Assche, Constantijn Huygens, Marin Mersenne, and Pierre Gassendi all discussed Drebbel. It is thus highly unlikely that Descartes would not have known about Drebbel's "living instruments." He himself, despite his mechanical models for life, never cited Drebbel's machines in this context, although others would.²¹⁸

²¹⁸ Kenelm Digby compared Drebbel and Descartes in their ability to compose life-like automata in *A Discourse concerning Infallibility in Religion* (Paris: Targa, 1652), 60-1. "As Archytas his doue, and Regiomontanus his like curiosities were; some of which euen imitated exactly humane voyce and wordes. As also is deliuered to vs by antiquity, of Memnon's statue, that gaue Oracles when the morning sunne first shined vpon his eyes; his priestes hauing in the night time ordered the engines within, in such sort that such soundes and wordes should breake out of his mouth att the appearing of the sunne. The like of which Monsieur des Cartes was confident he could haue produced: and I belieue that Cornelius Dreble would haue performed the like if he had bin sett about it, as well as he composed his organes that when the sunne shined vpon them played such songes as he had contriued within them." Robert Boyle argued that the mechanical disposition of parts can explain such bodily phenomena as sneezing or birdsong in "Essay on Spontaneous Generation," *Works*, Vol. 13, Michael Hunter, ed. (London: Chatto, 2000), 280. The timing of birdsong "may seeme the less to be wondred at because not to mention the statue of Memnon nor that which Cornelius Drebel made king James to sign when the sun shin'd on it we see that when the sunbeames are sudently starte upon our head they oftentimes excite and determine the spiritts in the braine & some other parts after the manner requisite to produce that motion & sound which we call sneezing." Johann Christoph Sturm argued that the new mechanical conception of animal bodies, like the machines built by Drebbel, subverted the art/nature divide in "Exercitatio Octava de Artis et naturae Sororia Cognatione" in *Philosophia Eclectica h.e. Exercitationes Academicæ, Quibus Philosophandi methodus, Selectior* (Frankfurt: Jodocus Wilhem Kohlesius, 1698), 416-7. "Denique ut in artificialibus quibusdam machines, e.g. in organis musicis pneumaticis & in hydraulis & fontibus artificiosis quibusdam, intrinsecum istud principium non operatur priùs, quàm aut ibi claves, quos vocant organi digitis tacti, aut hic pinnula quaedam, aut unculus aut obex aliquis spectatorum pedibus calcatus, ex improvis fuerint, aut solis radiùs libere affulserit, uti ferunt de quibusdam Nympharum imagunculis à Drebbelio in Anglia paratis, quae allucente sole cavernis suis exibant & in aquis ludebant; in latibula sua è vestigio se recipientes, ubi solis lumen ipsis ereptum aut obnubilatum esset: ita profectò principium illud vitæ in plantis & quibusdam animalibus hyemali tempore cessat, cum verno solis calore redit ad officium. . . ." Johann Cyprian compared Drebbel's automata to the

We can occasionally glimpse such individuals as Galileo attempting to compete with Drebbel's fame. For instance, when Peiresc mentioned that Drebbel's microscope could show a flea as large as a cricket, Galileo claimed he had a microscope which could make a flea as large as a hen, and when Peiresc later described the perpetual motions of Drebbel and the Jesuit Franciscus Linus to Galileo, Galileo claimed that "Many years ago I made a similar invention, but with the aid of a deceptive artifice. . . ." ²¹⁹ In general however, we will not be able to trace those who defined themselves against Drebbel, and such figures will not be the focus of this dissertation.

Nevertheless, we should not allow the eventually triumphant model of the philosopher such individuals formed to obscure the many possible and competing models of philosophers available at the time. Our idea of the seventeenth-century philosopher as sober, reasonable, disciplined, and socially exclusive derives from individuals who molded this persona in opposition to enthusiastic empirics such as Drebbel. The eventual canonization of the soberly disciplined and self-collecting great men of science should not occlude the historical importance of a dynamic field located between a self-assertive individual and the *liebbebers* who collected him.

paradox of Descartes' theory of brute animals. See his notes to Wolfgang Franzius, *Historia Animalium*, Johan Cyprian, ed. (Frankfurt: Lesch, [1687]1712), 476. "Altera Extrema Opino Bruta animantia sibi effingit mera Naturae idola . . . quae omni sensu vel perception & cognitione destituuntur, ac non aliter moventur aguntque, quam horologia mechanica ratione . . . aut sicut Nympharum imagunculae a Cornelio Drebbelio in Anglia fabrefactae, quas ferunt allucente Sole cavernis suis exivisse, & in aquis luisse: statim in latibula sua se recepisse, ubi Solis lumen ipsis ereptum aut obnubilatum esset. Quod paradoxum superiori saeculo primum scripsit Gometius Pereira . . . nostro repetiit & aliis persuasit Renuus des Cartes. . . ." J. M. Schammelius cited both Sturm and his professor Cyprian in *Dissertatio Physica de Arte Naturae Aemula in Celeberrima Lipsiensium Academia. . . sub Praesidio Dn. Johannis Cypriani* (Leipzig: Johann Georg, 1689), thesis XLVI. "Quibus adjicere icunculas Cornelii Drebbelii par est utique. Vid. Sturm. Phys. Eclect. Disp. 8. c. 3, p. 416.417. & Dn. Praesidis continuat. Histor. Animal. Franzii P. I. p. 49."

²¹⁹ John Joseph Fahie, *Galileo, His Life and Work* (London: John Murray, 1903), 210, and Stillman Drake, "An Unpublished Letter of Galileo to Peiresc," In *Essays on Galileo and the History and Philosophy of Science*, Vol. III. (Toronto: Univ. of Toronto Press, 1999), 52-3.

I: Do Philosophers Play in the Dirt?: Drebbel's *Personae*

II: Portraits

III: Drama

IV: Historical Chronicles

V: Eye-witness Reports

VI: Printed Itineraries

VII: Conclusion

I: Do Philosophers Play in the Dirt?

According to Lorraine Daston and Otto Sibum, scientific “personae” cannot be donned and doffed. Unlike theatrical rôles, the social roles Daston and Sibum call scientific personae – scientist, natural philosopher, engineer, etc. – are “recognizable social species” inhabited steadily by individuals and recognized consistently by society.²²⁰ This was not true for Cornelis Drebbel. The professional descriptions applied to Drebbel constantly shifted. Indeed, his very persona was often that of a shape-shifting creator of fusions.

To historicize our understanding of the philosophical persona, I trace Drebbel's persona as it appeared in a variety of genres. This range of genres conveys a methodological as well as a substantive point. The persona of the philosopher in the seventeenth century occupied a wide and shifting field. The entrance of alchemy to the academy, the rising epistemological status of artisanal knowledge, and the emergence of hybrid disciplines expanded the borders of philosophical knowledge in new and contested ways.

From a wide survey of Drebbel's persona, we see differences between the persona Drebbel displayed himself, and the varieties of personae fashioned for him by others. We also note points of convergence, when Drebbel presented himself in particular fashions recognized and noted by an appreciative audience. Both divergences and convergences point to the agency of Drebbel's contemporaries, for whom Drebbel fashioned his persona, and by whom it was noted, re-fashioned, and disseminated.

²²⁰ Lorraine Daston and H. Otto Sibum, “Introduction: Scientific Personae and Their Histories,” *Science in Context* 16(2003), 1–8.

We will trace Drebbel's persona as it appeared in portraiture, upon the stage, and in historical chronicles. All these genres had long offered avenues for the fashioning and display of a persona. However, we will also see Drebbel appearing within methodical itineraries, which were a genre new to early modern Europe. The *ars apodemica*, or the methodical art of travel, became a central part of a good Ramist education in mid-sixteenth century Europe. This genre entailed the idea of a public of attentive note-takers, who included notable personalities in a comprehensive survey of peoples and their distinguishing characteristics. The *album amicorum* or book of friends (discussed further in Chapter Three), catered to the collection of such personalities during one's academic peregrination. In such a book, one accumulated the inscriptions of famous men proffering offers of friendship. The *ars apodemica*, ideally, was conducted amid a far-flung affective network of *liebbebers*.

A Shifting Personality

In the 1621 Latin edition of his printed works published in Hamburg, Drebbel appeared on the title-page as both an alchemist and a mechanic ("Chemicus et Mechanicus Summus"). On the continent he enjoyed renown as a philosopher. For example, the Professor of Medicine and Rhetoric at Giessen Johann Tackius S.R. I., quoting Drebbel's *On the Nature of the Elements*, referred in 1673 to "the Chymical Philosopher of great renown, who is still famous due to his invention of the perpetual motion" ²²¹ While reviewing Drebbel's *On the Nature of the Elements*, the polyhistor Daniel Georg Morhof called him the "notable master of artificial and natural things, considered by many to be the possessor of

²²¹ Johann Tackius, *Triplex Phasis Sophicus* (Frankfurt: Zubrodt & Schönwetter, 1673), 7. "Unde maximi nominis Philosophus Chymicus, *Cornelius Drebbelius*, qui, ob inventionem perpetui mobilis, de quo ad Jacobum Angliae, Scotiae, Hyberniae, & Franciae Regem extat Epistola, adhuc in famâ est, & cui ratio conficiendi arcanum Philosophorum non incognita fuit, prout ex incomporabili illius *de Elementis tractatu*, notum evadit, *capite 5 de quintâ essentiâ*, planè illum modum non detestatur, quin potiùs approbat, additque: medicamentum illud, sive auri quintam essentiam, ita praeparatam, ad miraculum omnes morbos sanare, praeditamque esse quibuscunque facultatibus, quintae essentiae universali virtute correspondentibus."

the great philosophic arcana.”²²² Yet at other times, he was distinguished as a philosopher from coal-besmirched alchemists. For example, Wolfgang Helmhard von Hohberg, advised the *Hausvater* not to learn how to make the quintessence from alchemists, but “from Philosophers, among whom Cornelius Drebbel is admirably famous.”²²³ Here the malleability of the term “philosopher,” which could also signify a true chymical adept, comes to the fore.

Drebbel could be called a “mechanic” as well, but one who did not confine himself to building one sort of machine. For example, Johann Daniel Major S.R.I., calls him the “most perceptive Drebbel, that renowned Engineer (Machinator) of unusual machines of various sorts” and “Cornelis Drebbel, that admirable Polydaedalus of Britain.”²²⁴

What was unusual in Central Europe was the norm in England, where he was almost always termed a “mechanic” rather than a philosopher, and where his written works were almost never cited. Yet, even within the disciplinary arena of the mechanical arts, Drebbel was celebrated for his ability to transgress professional bounds in England as well.

Thus, in the first version of “Usefulness,” Boyle discussed the “much admir’d digesting furnace, built by that inventive Mechanitian & Chymist Cornelius Drebel, wherein a Quantity a Quicksilver was soe plac’d” that it served to regulate the temperature of the fire. “Nor,” continued Boyle, “is this the onely Mechanicall use that Chymists may make of Quicksilver. . . . And to add something upon this occasion, I can scarce doubt but that

²²² “De Elementis” in Morhof, *Polyhistor literarius, philosophicus et practicus*, fourth edition (Lübeck: Petrus Böckmannus, 1747), 337-8, „Magistri rerum naturalium & artificialium insignis, quoque multis magni Arcani Philosophici possessor fuit habitus.,,

²²³ Wolfgang Helmhard von Hohberg, *Georgica Curiosa Aucta*, Vol. 3(Nürnberg: Endter, 1715), 116.

„ . . . nicht von Kohlen-verderbenden Alchymisten/ sondern von den Philosophis oder Weltweisen zu erlernen: Under denen Cornelius Drebbel trefflich berühmt ist/. . . .”, For a study of alchemical personae, see Tara Nummedal, *Alchemy and Authority in the Holy Roman Empire* (Chicago: University of Chicago Press, 2007).

²²⁴ Johann Dainel Major, *Genius errans sive de abusu in scientiis* (Kiel: Reumann, 1677), Chapter VII and Chapter XXI, unpaginated. “Perspicacissimus verò etiam Drebbelius, ille Machinarum varii generis insolentiorum Machinator insignis” and “Cornelii Drebelii, admirandi illius Britanniae Polydaedali.”

Chymistry may be very much advanc'd if the Practisers of it were well skill'd in Mechanical contrivances. . . .²²⁵

Boyle employed the example of Drebbel to suggest not only that mechanics and chymistry should be joined, but also that professional divides even within the mechanical arts should be crossed. In a later version of *Usefulness* he remarked, "I may safely affirm that a great deal of money hath been gained by tradesmen both in England and elsewhere upon the account of the Scarlet Dye invented in our time by Cornelius Drebbel, who was not bred a dyer, nor other tradesman."²²⁶ He later repeated within the same work that Scarlet "affords me a notable instance, that Trades may be considerably improv'd by those, that do not professe them. For the most famous Cornelius Drebbel, who was the Inventor of the true Scarlet dye, was a Mechanician, and a Chymist, not a Dyer, and as an ingenious man, that marry'd his Daughter, related to me, was so far from having bin vers'd in that Profession, when some Merchants put him upon the Advancement of a certain way of dying a fine red, or rather Crimson . . . that he did not know so much as the common way of Dying the ordinary Reds, though the Merchants having once taught him that, by the help of a sagacious Conjecture . . . he soon invented the true skarlet dye, which has since bin so much esteemed."²²⁷ Boyle celebrated Drebbel's ability to leave the normal bounds of professional and disciplinary divides, and to put two and two together in the fashioning of new inventions. He also admired the fact that "the excellent Cornelius Drebbel" invented the submarine, despite the fact that "this Inventive *Drebbel* was no profess'd shipwright, nor so much as bred a Sea-man."²²⁸

²²⁵ Robert Boyle, *Works of Boyle*, Vol. 13, Michael Hunter, ed. (London: Pickering & Chatto, 2000), 298.

²²⁶ Robert Boyle, "Usefulness of Natural Philosophy, II, 2," *Works of Boyle*, Vol. 6, 1668-71, Michael Hunter, ed. (London: Pickering & Chatto, 2000), 400.

²²⁷ *Ibid*, 480.

²²⁸ *Ibid*, 481-2.

Drebbel's social, as well as disciplinary, identity could not easily be determined. This appeared most forcefully in his staged feat of personal transmutation through optical technology that prompted some to call him "Proteus."²²⁹ Yet the same Protean slipperiness could be seen in Drebbel's general social performance. Eye-witnesses professed themselves puzzled over Drebbel's social position and his behavior, while secondary reports occasionally elevated his social status, and at other times emphasized that he was a peasant.²³⁰ Even Drebbel's nationality fluctuated in contemporary reports, as he was described variously as Dutch, German, and English.²³¹

Among the shifting descriptors which contemporaries attached to Drebbel, mixture was the only constant. In a period of new hybrids, Drebbel "personified" fusion and transformation. This, according to Leibniz, was his special genius.

They say that the famous Drebbel had such a good imagination, that finding a piece of stone in the road, he would remember a hole that he had noticed in another spot that this fragment could fill precisely. That is to say that the combination of things which appear far distant often serve to produce singular effects. And that is also the reason why those who limit themselves to a single investigation often fail to make discoveries that a more expansive spirit who can join other forms of knowledge to the one with which he is occupied will discover effortlessly.²³²

²²⁹ Gottfried Hegenitius, *Itinerarium* (Leiden: Elzevir, 1630), 72. See Christoph Peller, *Politicus Sceleratus Impugnatus* (Nürnberg: Johannes Andrea Entner, 1669), 38.

²³⁰ A frequently cited source for the latter was D'Alencé's *Traité du Thermometre* (Amsterdam: Henry Wetstein, 1688), 53-4. "Cet instrument (thermometre) à été inventé par un païsan de Nord-Holland, nommé Drebbel, qui pour son industrie, & pour ses rares inventions, fût apellé en Angleterre auprès du savant Roi Jaques, où il a aussi inventé le Microscope. "

²³¹ Michael Maier, among others, described Drebbel as "Teutonic" ("Teutonicus Corn. Dreppels"). See Michael Maier, *Silentium Post Clamores* (Frankfurt: Jennis, 1617), 49. Nicholas Cabeus and Quirinus Kühlmann described him as English. Cabeus did not mention him by name, but specified that he relied on an eye-witness ("novissimis enim Rodulphi Imperatoris temporibus quidam Anglus aquam arte quadam sublimasse dicitur, quae vitro inclusa perpetuo fluctuabat, si verum est, quod ego ex oculato teste viro fide dignissimo audivi"). See Nicholas Cabeus, S.J., *Philosophia Magnetica* (Cologne, Kinckius, 1629), 36. Kühlmann wrote an epitaph for "the grave of Cornelis Drebbel, the British Archimedes" ("Grab Cornelius Drebbels/Des Britannischen Archimeds"). See Kühlmann, *Unsterbliche Sterblichkeit oder Hundert Sil-ersinnliche Wurzellige Grabe-schriften* (Jena: Samuel Adolph Müller, 1671).

²³² G. W. Leibniz, "Mémoire pour des Personnes Esclairées et de Bonne Intention," *Politische Schriften*, Vol. 4, Friedrich Beiderbec, Rosemarie Caspar, Heinz Entner et al, eds. (Berlin: Akademie Verlag, 2001), 619. "On raconte que le fameux Drebel avoit l'imagination si bonne, que trouvant un morceau de pierre dans la rüe, il se souvint d'un trou qu'il avoit remarqué dans un autre endroit que ce fragment estoit capable de remplir

The story about Drebbel matching pebbles and holes presents us with a familiar Drebbelian persona of the street philosopher. Several such stories circulate of a Drebbel who clammers about the world, fiddling in an unmethodical yet fruitful way, and testing the world with his senses. For instance, Drebbel's sons-in-law informed Peiresc that Drebbel had discovered the first foundations of the perpetual motion while playing with a knucklebone and a straw at the age of eight.²³³ Long after Drebbel's death, Samuel Hartlib recorded tales of a Drebbel who made surprising discoveries serendipitously at every turn, relating, for example, how “Drebbel found accidentally in a well some bottels with Beere which had been there about 80. years. Hee drank of it and confessed never to have drunke the like liquor.”²³⁴ According to one anonymous writer in 1686, Drebbel discovered his method for submerging his submarines while strolling by the Thames and noticing how the fishing traps attached to boats made the boats sink lower into the water.²³⁵

justement. C'est pour dire que les Combinaisons des choses, qui paroissent éloignées servent souvent à produire des effets singuliers. Et c'est encore la raison pourquoy ceux qui se bornent à une seule recherche, manquent souvent de faire des découvertes, qu'un esprit plus étendu qui peut joindre d'autres sciences à celle dont il s'agit, découvre sans peine.”

²³³ Claude Fabri de Peiresc, *Relation de ce que jay appris de la vie et inventions de Cornelius Derbbel de la Ville d'Alcmar en Hollande/ Par Abraham Kuffler son gendre et Gilles Kuffler son frere. A Paris au commencement de Sept. 1624*, Ms. Carpentra 1776, 407r. “Il dict qu'a l'âge de huict ans il commença a trouver le mouuement perpetuel, qu'il a depuis achevé parfaitement & Et que ce fut en jouant, avec un osselet et une paille faisoit une petite fontaine, et dict que ca esté la le fondement de toute son invention. . . .”

²³⁴ Hartlib, *Ephemerides*, 1657, 29/6/13A-24B.

²³⁵ *Entdeckung und Beschreibung eines Recht-und über Königlichen Instruments* (N.A.: N.A., 1686), 80. “Cornelius Drebbel/der kunstreiche Niederlander/hat unter vielen neuen Erfindungen auch diese zu Werck gerichtet/ wie man nemlich unter dem Wasser schiffen könne. Einer von seiner Befreunden hat mich glaubwürdig berichtet/ das besagter Künstler an der Teims in Engeland spatzieret/ und etliche Fischer daher fahren sehen/ mit durchlöchernten Kästen/ darinnen sie die Fische zu halten/ und ihren Kahnen anzuhenget pflegen welche/ wann sie abgeschnitten/ das Schiff höhe schwimmen machen. Daher soll er Anlass genommen haben/ durch solche Wasserkästen ein gantze Schiff unter das Wasser in einem Fluss zu sencken und mit Rudern/ oder einem Stachel fortzutreiben/ massen das Schiff/ und die Kästen kunst-richtig abgewogen werden können. Hierdurch kan man der Feinde Schiff durchbohren/ und auch vermittelst der eingesetzten Gläser sich im Wasser umsehen. Den Luftt müssen sie mit einem langen Rohr ober dem Wasser eingeholt haben/ und sind der gleichen Schiffe zwey/ unterschiedener Grösse mit Wänden und einer Decke von geschmierten Leder gemacht worden/ in welchem der jüngst-verstorbene König in Engeland auff der Teims selbst gefahren/ welcher auch eins an den Gross-Fürsten in Moscau/ als eine seltene und unglaubliche Sache/ verehret.”

Drebbel himself described his process of discovery as one of constant tinkering, overflowing with delightful and unexpected outcomes. Drebbel related how he came to discover the perpetual motion in a letter King James I. He first sought the *primum mobile* of the universe through water, fiddling with various pipes and arrangements. Although he didn't find the perpetual motion this way, he did devise some rather wonderful waterworks.

I tackled the nature of water with great diligence, wishing to make it climb upwards due to her own nature, through various vats and pipes, bent in strange manners. But it was all for nothing, since it would not raise by a hair's breadth, but according to its nature it always went downwards. Nonetheless I made various enjoyable little fountains. . . .²³⁶

Drebbel went on to describe the instrument he eventually did succeed in building as “a little twig of the perpetually moving Tree, grafted upon the true knowledge of the Elements, a goal of all the investigators of things” (dit is een twijchken van den eeuwichbewegenden Boom/ ghegriff op de ware kennis der Elementen/ een wit van alle ondersoeckers der dinghen”). He thereby expressed not only his merger of mechanics and natural philosophy, but the fruitfulness of his approach. Not everyone could putter about the world as he did and make wonderful discoveries just be chance. An underlying knowledge of nature provided fertile ground from which eventually sprouted the tree of perpetual motion. This too had many branches and possible avenues of discovery. Yet along the way to his goal, Drebbel's knowledge of nature also gave rise to many accidental, wonderful, and enjoyable fruits, such as his “little fountains.”

The very same playful persona could delight a Leibniz or a Hartlib and disgust others. To some, such a persona could represent all that was wrong with the empirics and

²³⁶ Drebbel, *Wondervont* (Alkmaar: Jaacob de Meester, 1607), N.A. “Waerom met goeden yver die Natuer des Waters aenghegrepen/ willende dat uyt zijn selfs natuer/ door vrscheyden vaten ende pijpen (op vreemde manieren geboghen) opwaerts doen climmen/ mater twas al voor niet: want ten wilde niet een hayr breedt rijsen: Maer gelijk zijn natuer/ liep altydt nae beneden/ hebbe niet te min verscheyden lustige Fonteynkens ghemaect. . . .”

their approach to invention. It was precisely in reaction to such base mechanics that Bacon developed his socially graded, methodically driven program of natural investigation.

For Leibniz, however, the tale of the street philosopher served as material for a parable. As he developed the story, Drebbel and his pebble stood for an inventive, imaginative, border-crossing, and playful approach to problem-solving. This was a persona to which Drebbel contributed, but which others extended still further not only by retelling tales of the street philosopher, but by interpreting those tales into a wholesale approach to discovery in a pansophic age.

As lines of discipline and authority were redrawn in the early modern pursuit of knowledge, hyphenated disciplines such as physico-mathematics emerged.²³⁷ Physicians, said Gabriel Clauder, felt the need to engage in “brain-breaking Philosophico-Physico-Theoretico-Anatomico-Botanico-Chymico-Practico-Pharmaceutico-Chirurgical meditations.”²³⁸ One could well feel bewildered by such pansophic requirements. Drebbel's persona offered the figure of a “ludic philosopher” who rendered such border-crossing painless (“sans peine” according to Leibniz).

Drebbel constantly emphasized how sweet, pleasant, and easy philosophy could be, which he hoped to make accessible to all by writing in the vernacular and using material demonstrations and simple language. Drebbel's friend G.P. van Schagen watered at the mouth over this sweet approach to discovery. He published Drebbel's letter to King James I

²³⁷ Peter Dear, *Discipline and Experience: the Mathematical Way in the Scientific Revolution* (Chicago: University of Chicago Press, 1995).

²³⁸ Gabriel Clauder, *Dissertatio de tinctura universalis* (Altenburg: Gottfried Richter, 1678), 167. “Arrige item Aures Philiatere; Hac enim cognita supersedere poteris [nisi sola curiositate Tibi talia pertractare arrideant] foetidis sectionibus Anatomicis, laboriosis collectionibus Botanicis, ingrate carbonum in operationibus Chymicis tractatione, taediosis lucubrationibus, diuturnis tot ac tot Annos exposcentibus Laboribus ac Cerebrum frangentibus meditationibus Philosophico-Physico-Theoretico-Anatomico-Botanico-Chymico-Practico-Pharmaceutico-Chirurgis; Sic poteris una fidelia parietes dealbare omnes, remediô unicô morbos sanare omnes & quidem non tam citu, tuto, jucunde, quod semper desiderarunt Medici quilibet; quam penitus citissime, tutissimè, jucundissimè.”

so that everyone would be able to “smaeck-mond” (“taste-mouth”) it - a wonderful, untranslatable verb which drips with enjoyment. As Schagen said, “After the fore-mentioned Drebbel gave me a copy of the Dedication of the perpetual motion to King James to read, that reading was very tasty and pleasing to me, and made me think it a wonder above wonders, and I was immediately inclined to make it known to all Netherlandish art lovers, since the sweetness of this was so tasty to me that it made me pity that the entire world might not taste (*smaeck-monden*) of it.”²³⁹

Schagen emphasized the universal accessibility, ease, and sensual enjoyment that Drebbel's machine-based philosophy offered. He contrasted this ease and enjoyment to the difficulty of philosophies based on verbose reasonings.

If this knowledge was common among astronomers, one would not require so many theorems in calculating the planets and other stars, but astronomy would be easy and Copernicus would prosper, since he demonstrated with reason that the Earth goes around every 24 hours, but this Alkmaarian philosopher can demonstrate the same not only with reason but also with living instruments.²⁴⁰

The lure of philosophizing by “playing with machines” proved irresistible to the new discipline of academic alchemy in Central Europe (discussed further in Chapter Five). Samuel Hartlib also suggested that new mechanical toys might be employed in natural philosophical instructions. He recommended that Descartes' new “device to make a Statua or Babie to wake up and down to eat to concoct to disgorge itself,” was “admirable also for didactiks to shew the manner of concoction,” as was “Drebbels feate to shew the didactik of

²³⁹ G. P. Schagen, forward to Cornelis Drebbel, *Wonder-vondt*. See Appendix. “Naedien de voorsz. Drebbel de Copy van de Dedicatie oft toeeygheninghe van de eeuwigh bewegingh aen Coningh Jacob my te handen bestelt heeft om te lesen: die selve lesende was my seer vermakelyck en aenghenaem en docht my wonder boven wonder te zyn, was terstont genegen om hier van alle Nederlantsche Konst-beminders to verwittigen: want de soeticheyte van desen was my soo smaeckelyck dattet my jammert dat niet de gantsch Weerelt daer van soude smaeck-monden.”

²⁴⁰ *Ibid.* “Soo dese wetenschap onder de Sterkondigers ghemeen was soo en soudemen niet behoeven soo veel stellingen en rekenigh der Planeten en ander Sterren maer de Ster-konst soude licht zyn en Copernicus soude bloeyen: want die bewyyst (met reden) dat het Aerdtryck alle 24. uren ront om gaet: Maer desen Alekmaersche Filosooph cant selfde niet alleen met reden maer oock met levendige Instrumenten bewyisen.”

thundering and lightning.”²⁴¹ Drebbel himself, Hartlib reported, opposed the discipline required by traditional academic instruction fiercely: “The binding ones-selfe to any Rule whatsoever dose hinder mightily a Mans free-Invention. Therefore Drebbel would not suffer his children to bee taught in schooles. Ergo non synthetice procedendum.”²⁴² Yet through play and constant tinkering, free invention could grow like the tree of perpetual motion.

As Paula Findlen has argued, the ludic approach to knowledge forestalled definition and maintained a plurality of interpretation. Findlen claimed that such multi-valency gradually disappearing from science in its construction as a sober, rational discipline over the course of the seventeenth-century by the likes of Descartes and Boyle. As a result, narratives of the Scientific Revolution have favored not only such sober personalities, but their clearly defined theories and moments of discovery, despite the fact that for much of the history of the study of nature multiple interpretations were kept in play.²⁴³

Drebbel certainly did have his own idiosyncratic natural philosophy, and although a ludic border-crosser, he did claim authority to moments of discovery. Given his social status, however, his claim to universal knowledge through the work of his own hands itself represented an overthrow of order, on a par with Aristotle being ridden by Phyllis.²⁴⁴ Furthermore, his contemporaries also played with both the content of his thought and the image of his persona, constantly transforming them to suit their own needs.

²⁴¹ Hartlib, *Ephemerides*, 1635, 29/3/62A.

²⁴² Hartlib, *Ephemerides*, 1639, 30/4/35A.

²⁴³ Paula Findlen, “Between Carnival and Lent: The Scientific Revolution at the Margins of Culture,” *Configurations* 6:2 (1998), 246-47. See also Findlen, “Jokes of Nature and Jokes of Knowledge: The Playfulness of Scientific Discourse in Early Modern Europe,” *Renaissance Quarterly* 43:2 (1990), 292-331, Jan Huizinga, *Homo Ludens: a study of the play element in culture* (New York: Roy, 1950), and Mikhail Bakhtin, *Rabelais and His World*, Helene Iswolsky, trans. (Cambridge: MIT Press, 1968), and Rosalie Colie, *Paradoxia Epidemica: the Renaissance Tradition of Paradox* (Hamden, Ct.: Archon, 1976).

²⁴⁴ Natalie Zemon Davis, “Women on Top: Symbolic Sexual Inversion and Political Disorder in Early Modern Europe,” *The Reversible World: Symbolic Inversion in Art and Society*, Barbara A. Babcock, ed. (Ithaca, N. Y.: Cornell University Press, 1978), 147-190.

Drebbel served as a common coin in shared circulation among those who were otherwise theologically and philosophically opposed. Both Johann Hartmann and his bitter rival Andreas Libavius admired Drebbel's natural philosophy and held academic debates on his perpetual motion machine (discussed further in Chapter Five), while both the Counter-Remonstrant Jakob Revius and Hugo Grotius composed epigrams on the machine. According to the English divine Thomas Tymme this device offered support for the geocentric universe, while Drebbel's friend G.P. Schagen argued that it demonstrated the truth of Copernicanism. By citing only Drebbel's activities as a mechanic, Boyle employed Drebbel as evidence for the mechanical philosophy, while Christian Adolph Balduin saw him as support for vitalism.

At the end of the day, it is the persona of the enthusiastic, artful, and unbounded Drebbel that was recognized by all. Drebbel's contemporaries may have defined themselves against Drebbel, although the examples of Leibniz and Boyle cited above suggest that the triumph of reason over play may have been exaggerated. Nevertheless, the fact that a subject this talkative and exoteric circulated so extensively and imaginatively sheds important light on the nature of early modern discovery.

Examining the gestures and manners of Drebbel and his admirers reveals an important relationship between work, public investment, and desire in changing mores of who knew what and how they knew it. Florence Hsia has argued that the ability of individual *bricoleurs* to form creative combinations was limited by the institutionalization of science.²⁴⁵ Yet this institutionalization took different forms and proceeded at different rates in different genres and disciplines. The new ideal of border-crossing, collaboration, and association

²⁴⁵ Florence Hsia, "Mathematical Martyrs, Mandarin Missionaries, and Apostolic Academicians: Telling Institutional Lives," *Institutional Culture in Early Modern Society*, Anne Goldgar and Robert I. Frost, eds. (Boston: Brill, 2004), 13.

personified by *bricoleurs* itself contributed to the rise of scientific societies and the eventual institutionalization and professionalization of the discipline.

Playfulness had long distinguished the courtly performance of the virtuoso. Castiglione prescribed for his *Courtier* the light-hearted ease of *sprezzatura*. *Sprezzatura* clarified the boundaries between those who carelessly dashed off objects of *virtù*, and those who worked for financial gain. This playfulness was socially exclusive, eschewed labor, and disdained the needs and desires of the marketplace.

Boyle reformed the Italianate ideal of the virtuoso in order to build a population with the habits of collaboration, dedication, and respect for the mechanical arts required for the pursuit of empirical natural philosophy. As Shapin and Schaffer have shown, Boyle's new ideal was a socially exclusive one, and one that proved very influential to the model of the modern scientist. Yet Boyle's *virtuosi* were not the same as the *virtuosi* of the past. In his *Christian Virtuoso*, Boyle described the careful, solicitous, and modest characteristics of "our *Virtuosi*" that gave them the "peculiar Right to the distinguishing Title that is often given them, of *Experimental Philosophers*."²⁴⁶ These *virtuosi* must also be well-informed about a broad array of disciplines; "a true Naturalist" "brings with him, besides a more than common Curiosity and Attention, a competent knowledge of Anatomy, Optics, Cosmography, Mechanicks and Chymistry."²⁴⁷

The attention of the *virtuoso* did not skip lightly with ease, grace, and *sprezzatura*, but was directed with constancy and investment.²⁴⁸ In addition to observing the world about him through an eye-witness examination, the *virtuoso* also attended to the experiences reported by a wide network of observers cast around the world. Much has been made of Boyle's

²⁴⁶ Robert Boyle, *Christian Virtuoso* (London: John Taylor and John Wyat, 1690), 6.

²⁴⁷ *Ibid*, 16.

²⁴⁸ Lorraine Daston and Peter Gallison, *Objectivity* (New York: Zone, 2007).

distinction between empirics and gentlemanly natural philosophers, yet Boyle equally distinguished between his philosophers and older models of *virtuosi*.

when, in this Discourse, I speak of an Experimental Philosopher, or Virtuoso; I do not mean, either, on this hand, a Libertine, tho' Ingenious; or a Sensualist, though Curious; or on that hand, a mere Empirick, or some vulgar Chymist, that looks upon nothing as Experimental, wherein Chymistry, Mechanicks, &c are not employ'd; and who too often makes Experiments, without making Reflection on them, as having it more in his aim to Produce Effects, than to Discover Truths. But the Person I here mean, is such a one, as by attentively looking about him, gathers Experience, not from his Tryals alone, but from divers others *matters of fact*, which he heedfully observes, though he had no share in the effecting them . .

..²⁴⁹

Boyle did not develop his new model of the virtuoso de novo. Universal autopsy, communication, and association were signal features of the northern European model of the *liefhebber*, which began to appear untranslated in English as a synonym for the *virtuoso* in the early seventeenth century.²⁵⁰ As discussed further in Chapter Three, the model of the *liefhebber* itself evolved in this period, becoming increasingly communicative and associative, entailing the appearance of new tools for sociability and new institutions of fraternization.

The tastiness and “ease” of Drebbel’s machine-based natural philosophy was not *sprezzatura*. Drebbel’s knowledge was “easy” because it was accessible to all. However, playing with machines still required work, and very manual work at that. In building his various little fountains, Drebbel approached the question of water’s nature with an aggressive industry (*goeden yver*) which could be described as a form of humanist zeal (*studium*) were it not so material (“met goeden yver die Natuer des Waters aenghegrepen”). The

²⁴⁹ Boyle, *Christian Virtuoso*, 52.

²⁵⁰ The OED gives 1654 as the earliest appearance for “liefhebber.” Edward Norgate used it in his *Miniatura*, circa 1627. See Norgate, *Miniatura, or, the Art of Limning*, Jeffrey M. Muller and Jim Murrell, eds. (New Haven: Yale University Press, 1997), 83, “A Gentleman of Antwerpe being a great *Liefhebber* [marginal note: Virtuoso or Lover of Art] returning from a long Journey, he had made about the Countrey of *Liege*, and *Forrest of Ardenna*, comes to visit his old friend, an ingenious Painter of that Citie, whose House and Company he useually frequented.”

model of the *liefebber* brought humanist ideals such as *studium* and *amicitia* together with a profound respect for the arts and artisanal knowledge.

Heinrich Schuler (who in his *Methodus and Principia of all the Water-arts Which have been Discovered since the Beginning of the World and Which can still be Discovered* described having seen Drebbel's perpetual motion in Prague) described the need to bring together *studium* and art in order to promote new inventions. He argued in the preface that literati so disdained waterworks that they did not invest real zeal and seriousness in writing about them. Meanwhile the simple people discussed them either too simply or insufficiently diligently ("simpel oder aber unfleissig"), making new inventions and improvements impossible.²⁵¹ He, however, would transfer the zeal of the learned to the study of hydraulics.

People of high social status engaged in mechanical arts throughout the fifteenth and sixteenth centuries.²⁵² Yet displaying one's direction and control by turning ivory on a lathe is not the same as a constant, border-crossing perambulation through the world in the pursuit of a universal knowledge of nature. The *liefebber's* pansophic interests, investment of sustained attention, and collaborative approach to the advancement of knowledge can be traced in many arenas, such as the Hartlib circle, before Boyle developed his new ideal of the virtuoso. The *liefebber's* persona informed Boyle's virtuoso, and distanced it from older models of the virtuoso.

²⁵¹ Heinrich Schuler, *Methodus und Principia Aller Wasserkünste die von der Welt anfang erfunden seyn/ und noch erfunden werden können* (Geraw an der Slier: N.A., 1622), 4-5. ". . . diese Künste viel zu gering unnd schlecht zu seyn geachtet/ unnd noch von keinem Literato oder Gelehrten/ wofern ich anderss so viel von mire schreiben darff/ mit rechtem Lust und behanlichen Ernst vorgenommen worden/ sondern allerzeit das operae pretium welches ich gleichfalls hierunder beacht/ durch höhere Kunst und Faculteten/ die dort auch auff grosse Herrn Glade bestehen/ unnd mir kein Gelt eyntragen wollen/ angesehen wirdt. Der thewren Dienst und hohen Ehren/ damit mir ab ermahl nicht ausgeholffen ist/ geschwiegen.

Dannenhero die Kunstbeschreiber dieser kunst entweder simpel/ oder aber unfleissig gewesen/ und wann man denselbigen so simpliciter nach künsteln wollen/ macher in verblicken Schaden geführet/ und die alter Künst/ die sie nie recht erfahren/ noch versucht haben/ mit den newen Invention und Besserungen zum öftern verworffen und verachtet worden."

²⁵² Joseph Connors, "Ars Tornandi: Baroque Architecture and the Lathe," *Journal of the Warburg and Courtauld Institutes*, 53 (1990), 217-236.

Furthermore, while the older model of the *virtuoso* expressly separated himself from systems of economic exchange, Boyle oriented his new *virtuosi* toward the market. He developed in his *Usefulness of Natural Philosophy* the ways individuals operating outside the guild system of traditional professions can benefit trade, pointing out how Drebbel's discoveries carried with them the potential for "a great deal of money."

As one attending to the broader desires of the market, Drebbel cast his activities towards a wide audience, who themselves in turn felt an investment and emphasized their own labor on his behalf. In the traditional system of literary patronage rooted in Greek and Roman forms of support for literature, the dedication of a work to a patron ensured the work's value both for its author and in the eyes of a wider readership. There are no surviving dedications in any editions of Drebbel's written work from Drebbel to a patron - only his preface to the reader - although there are many dedications by the literary agents who reprinted his works. The only dedication we have is not the dedication of a written work, but the dedication of Drebbel's machine to King James I. Schagen published this dedication not as a paratext, but as the text.

Yet even in this "dedication," Drebbel claimed that he undertook his work ("arbeydt") to benefit a much broader audience – the lovers (*Liefhebbers*).

There were many processes of the *Mobile* written by the ancients, but they are the greatest nonsense of the world, misleading many, but procured by none. If the processes of the ancients were good, the ancients would have known it, and left us it in remembrance. Wherefore I wish to warn all the lovers (*liefhebbers*), and show them a better way. . . .²⁵³

²⁵³ Drebbel, *Wonder-vondt*. "Daer worden wel verscheyden Processen van het Mobile by den Ouden beschreven/ maer t'zijn die grootste beuselen van de Weerelt/ wonder veel verleydt/ maer niemant yet uytgerecht: waren die Processen goet/ die Ouden soudien die ghemerckt hebben/ en ons in ghedachtenis ghelaten/ waer van wil alle Liefhebbers waerschouwen/ en haer een beter wegh wijzen:"

Drebbel continued to argue that the royal patronage of the arts entailed the good of all. A king who enjoyed the sweetness of the arts would not engage in war, thus preserving the life and goods of his subjects. In turn his subjects would be able to taste the sweetness of the arts in a Utopian future. Drebbel declared that even in his dedication of his machine to a royal patron, he had a wider social agenda, asking James I to exercise compassion rather than war, and thus to spread enjoyment to all. He cast the discovery of his perpetual motion as marking a new future for mankind.

Begging the beneficent God to enlighten all kings and regents with his merciful wisdom, so that all men (O King, just as we, your subjects) should taste of the true pleasure of divine peace. . . . justice does not wish the punishment to outweigh the crime, but rather that the punishment should be lightened through moving compassion, so that all men may taste the pleasing fruit of the wise regents, and in place of cruel war, shall enjoy the sweetness of the arts. As a start for this I have begun this work of mine.²⁵⁴

Schagen did indeed dedicate the “dedication” to a particular patron, yet he too gestured in his dedication towards a much wider audience of “Netherlandish *liefebbers*” (cited above). He selected as patron Adriaen Anthoniszoon, the engineer of the Prince of Orange, who knew Drebbel well. Schagen pointed to Anthoniszoon’s sighting of the new star in Cassiopea as the herald of a new era.

O wonderful time in which everything that was hidden begins to come to light. Who has ever heard that there were ever any new

²⁵⁴ *Ibid.* “Biddende den ghenadigen Godt/ alle Coninghen ende REgenten te verlichten/ met zijn godertieren wijsheyt/ op dat alle Menschen (o Coningh/ gelijk wy uwe Ondersaten) souden smaken die waere wellust van de Godlijcke vrede/ waerom door uwe M. genietende/ de grootste weldaet die van den wijsten Regent te wenschen/ so wete niet wat danckbaerheyt sal bewijzen: overdenckende/ hoe meest alle Coningen haer laten verleyden van de blinde begheerte/ soeckende door’t bloedighe Oorlogh vermeerderinghe des Rijcx/ niet ghedenckende/ hoe dat onmoghelijck te vercrijghen/ sonder grooter verlies ende elendigh verder van haer ghetrouwe Ondersaten/ die lijf/ goedt/ bloedt/ daer voor moetenavontueren: wat cloeck verstandt wil zijn leven alleen vergheelijcken by eenigh verganckelijck goedt? Waer uyt moghen bekennen die vrucht van het bloedighe Oorlogh/ ende die wijseyt an de vreedsamighe Coningen/ welcke door goede Wetten soecken te verhoeden die misdaet/ en het quaet door Justitia rechtveerdelijck te straffen: ghedenckende/ dat rechtveerdicheyt niet wil/ dat straf de misdaet sal overwegen/ maer liever dat straf door beweghelijcke barmherticheyt soude verlicht worden/ op dat alle Menschen souden smaken die aenghename vrucht van de wijse Regenten/ en in plaets van’t wreede vittere Oorlogh/ haer vermaken met de soeticheyt van de Consten/ waerom tot een inleydingh dese mijne arbeydt begonnen:”

stars except now in our time? except around the first coming of the Messiah in salvation of the entire world. Did not the first appear in Cassiopea in the year 1572? Which Your Honor observed with understanding eyes (both its end and beginning). Was it not in the same time that this Drebbel was first born? How little did Your Honor think that the latter would have gone [*ghedrebbelt*] so far. Is not now the fifth year since the new Star in the Swan lasted in a similar magnitude? And still presently it continues unchanged in breadth and length over which all astronomers may well wonder. Has not the new star that appeared in the year 1604 or 1605 in the Caput Serpentis disappeared in the sign of Orion (*schutter*)? May God grant that also all the equipment and weaponry of the militias (*schutters*) not only in the Netherlands but over the entire world (just as now has already begun in England and France) may disappear so that Zion may flourish and all the Kings and Potentates may enjoy themselves in the sweetness of the arts.²⁵⁵

Even as both Drebbel and Schagen wrote for particular patrons, they claimed the desires and enjoyment (the taste-mouthing, “*smaeck-monden*”) of a much wider and non-specific audience – the *liefhebbers*- as what gave their work value.

This audience extended far beyond individual patrons and professional disciplines. Daniel Mögling, for example, in his *Perpetuum Mobile* (where he discussed Drebbel's machine at length) suggested that his perpetual motion could be played with by children in school. He also suggested that it would prove both useful and enjoyable (“*nützlich unnd delectierlich*”) to “a mathematician and an astronomer, or a lover of those arts” since it would allow anyone to contemplate at any time the face of the heavens with pleasure (“*mit Lust*”), and thereby

²⁵⁵*Ibid.* “O wonderlycke tydt in welcke al wat verburghen was begint aen den dagh te comen. Wie heeft oyt gehoort datter eenighe nieuwe Sterren ayn gheweest dan nu in onsen tydt? behalven een tegens de eerste toecomst van Messias en Heylandt aller Weerelt. Is niet de alder eerste verschenen in Cassiopea? int jaer 1572. Die U.E. met verstandighe oogen (soo wel zyn eynde als begin) aenschout hebt: wast niet in de selfde tydt dat desen Drebbel eerst gheboren was? hoe weynich dacht U.E. doe dat desen soo vordt ghedrebbelt soude hebben. Ist nu niet het vijf ofte seste jaer dat de nieuwe Ster in de Swan heeft in eender grootte gheduert? en noch teghenwoordich onverandert in breedte en lenghte staet waer over alle Stercondighers haer wel mogen verwonderen. Is niet de nieuwe Sterre die int Jaer 1604 en 1605 in den Slangen-dragher openbaerde int teycken van den Schutter verdwenen? Godt gheve dat oock alle Schutters gereetschap en oorlogh-tuych niet alleen in Nederlandt maer ooc over de gantsche Weerelt (gelijck nu alree in Engelandt en Vranckryck begonnen is) mach verdwynen op dat Syon mach bloeyen en alle Coninghenen en Machtigen haer mogen vermaken in de soeticheyte van de konsten.”

eliminate the need for difficult calculations.²⁵⁶ In fact, its ease would level distinctions between the professional astronomer and the *liebhaber*, since it would allow access to the same knowledge without professional expertise.

The *liebhaber* or *liebhaber* attached himself to particular scientific personae. Now, through a delightful machine-based natural philosophy, the *liebhaber* could claim access to the authority enjoyed by the accredited mathematician. From the periphery, the *liebhaber* could move to the center. He could define his interests not by professional personae – artist, mathematician, astronomer – but by broader entities – arts, nature, etc. – or by universalist personae offered the *liebhaber*s by Drebbel and his like.

Enthusiasm, sensual enjoyment, investment, and border-crossing are signal characteristics of the *liebhaber*. In the remainder of this chapter, I trace the dynamic of Drebbel's *personae* between Drebbel and the *liebhaber*s, who collected, interpreted, and transformed their ludic philosopher. As Paula Findlen discussed, in the seventeenth-century, one could choose between different *personae* in philosophy – the laughing Democritus or the crying Heraclitus. Those promoting reason chose Heraclitus, since reason, they argued, was opposed to laughter.²⁵⁷ Yet the laughing philosopher remained an option, offering in place of reason the ease and enjoyment of a philosophy based on the senses.

I explore Drebbel's appearance on the social stage *qua* personality, in four genres – portraits, drama, historical chronicles, and eye-witness travel reports. Our ability to trace these appearances depends, like all Drebbeliana, on their “collection” by others. In tracing

²⁵⁶ Daniel Mögling, *Perpetuum Mobile* (Frankfurt: Lucas Jennis, 1625), 54-5. „Bistdu ein Mathematicus unnd Astronomus, oder doch deren Künsten ein Liebhaber/ so bedencke/ ob sie dir nützlich unnd delectierlich seyn möchte . . . Dann sie durch dieses Mittel allezeit ein Faciem coeli vor Augen haben/ Die Situs und Aspectus stellarum mit Lust contempliren, die Zeiten/ Jahr/Monat/ Tag/ Stundte/ und Minuten fertig unterscheiden/ und fast alles da/ was einem Astronomo zusteht/ ohn einige Rechnung oder Delineation/ verrichten können.”

²⁵⁷ Findlen, 249. “When the Jesuit Antonio Viera participated in a 1674 Roman debate about the preferability of Heraclitus's tears to Democritus's laughter, he summed up the philosophical underpinnings of this new approach with a simple statement: ‘Laughter is improper to reason.’”

Drebbel's performance within such collections, I hope to show the purposes a particularly ludic, malleable, hybrid persona served in early modern Europe.

II: Portraits

Johan Adriaan Vollgraff has claimed that a portrait of Drebbel and his wife Sophia (née Goltzius) could be found in Hendrick Goltzius' massive allegory of 1611 [Fig. 1]. The interpretation of this painting has long been inconclusive; I will offer my own interpretation in the next chapter. The work shows a king faced with mostly male figures, except for one tempting female figure lying a little further off, whom Otto Hirschmann has identified as Alchemy.²⁵⁸ Lying lasciviously bare-fleshed, holding a retort, and displaying the gold and riches she has to offer, Alchemy is accompanied by a fool. A brawny male figure lies in the position of a river god on the ground next to her. These are the two figures Vollgraff claimed represented Sophia and Cornelis Drebbel, contrasted with the serious people ("gens sérieux") close to the king.²⁵⁹

This was far from how Drebbel was seen in the seventeenth century.

Contemporaries observed both his low social status and the fact that he was close to Kings. His enthusiasm – or claim to authority far above his socially accepted status – was frequently noted. Contemporaries added to this claim by refashioning Drebbel's portrait into a persona they considered authoritative. Tracking this changing persona thus entails an exploration of shifting sources of authority.

A realistic portrait of an individual author was one of several options available at the start of an early modern printed work. Other options were an image of a dedication of the

²⁵⁸ Otto Hirschmann, *Hendrick Goltzius als Maler, 1600-1617* (Haag, M. Nijhoff, 1916), 58.

²⁵⁹ J.A. Vollgraff, "Cornelis Drebbel (1572-1633): Premier Inventeur des Vaisseaux Soumarines," *Archives Internationales d'histoire des Sciences* (1947), 234.



Fig. 1. Hendrick Goltzius, *Allegorie auf die Eitelkeit (Alchimie)*, 1611. Kunstmuseum, Basel, Martin Bühler.

work to a patron, or an abstract “picture of an author” in general.²⁶⁰ The author’s portrait could also join a group of figures representing his predecessors in a discipline or tradition.²⁶¹ The portrait was placed in the most “public” section of the book - the first few pages including title-page, frontispiece, and dedicatory letter where the authority and desirability of

²⁶⁰ Roger Chartier, *Forms and Meanings: Texts, Performances, and Audiences from Codex to Computer* (Philadelphia: University of Pennsylvania Press, 1995), 31.

²⁶¹ Volker R. Remmert studied such portraits in “Docet parva pictura, quod multae scripturae non dicunt.” Frontispieces, their Functions, and their Audiences in Seventeenth-Century Mathematical Sciences,” *Transmitting knowledge: words, images, and instruments in early modern Europe*, Sachiko Kusukawa and Ian Maclean eds (New York: Oxford University Press, 2006), 239-270.’

the book could be established for the potential reader and purchaser.²⁶² The bookseller normally made the choice of what image to use. The decision of what type of author's portrait to employ thus represented an important business decision, which fluctuated over time as readers invested more authority in the persona of a singular author rather than a patron or generic authority.

Drebbel, as a charismatic and renowned personality, clearly sold books. This is apparent not only from the numbers of his own editions, but from other works which advertised Drebbel on their title-page, such as G. P. Harsdörffer's *Deliciae Physico-Mathematicae*.²⁶³ M.D.N. Bidstrup published an alchemical work by Balthasar van Rensen, whom he claimed to have been the alchemical disciple of Cornelis Drebbel. Drebbel's name appears on the title-page in almost the same size font as the author's. Even in a manuscript work, Franz Daniel Pastorius' commonplace book *Bee-Hive*, which was never intended for sale but was intended to be read widely within the community, we find Drebbel advertised on the title-page.²⁶⁴ While Drebbel thus proved an asset in the marketing of a work in many times and places, we find, in the various portraits of the Drebbel editions, changing claims to authority in the depicted personae, from a genial, ludic character to a stern philosopher, theosophic adept, and university educated inventor.

²⁶² Kevin Dunn, *Pretexts of Authority: The Rhetoric of Authorship in the Renaissance Preface* (Stanford: Stanford University Press, 1994).

²⁶³ G. P. Harsdörffer, *Deliciae Mathematicae et Physicae. . . auss Athanasio Kirchero, Petro Bettino, Marino Mer-sennio, Renato des Cartes, Orontio Fineo, Marino Gethaldo, Cornelio Drebbelio, Alexandro Tassoni. . .* (Nürnberg: Dümler, 1651).

²⁶⁴ Franz Daniel Pastorius, *Bee-Hive*, Ms.Codex 726, Special Collections, Van Pelt Library, University of Pennsylvania. Pastorius consulted the edition of Drebbel's *Tractatus Duo* from the library of Isaac Norris, one of the important early American collections (currently in the Dickinson College Library; special thanks to Dickinson librarian Jim Gerencser).

All portraits of Drebbel are based on a woodcut dated 1604 by Christoffel van Sichem [Fig. 2].²⁶⁵ van Sichem was familiar with Drebbel and his world in many ways. Like Drebbel, van Sichem engraved after Goltzius and his circle. He lived in Amsterdam under the sign of the “Seylende Windt-waghen” (Simon Stevin’s famous invention), and was also a business partner with Hendrick van Haestens (who published Drebbel’s *On the Nature of the Elements* in German in 1608), in a venture selling curiosities and paintings in Leiden.²⁶⁶ Van Sichem had issued a print of the sailing wind-wagon in Dutch, French, and German versions in 1605.²⁶⁷ He was thus located ideally at the commercial junctures of art, technology and inventive personalities aimed at an international audience.²⁶⁸

The 1604 portrait was most likely commissioned by Drebbel himself to accompany a small run of his major work of natural philosophy, *On the Nature of the Elements* in the original Dutch. In 1903, Fritz Burckardt reported receiving a 1604 Dutch edition from Dr. Th. Van Doesburgh of Rotterdam, which included a woodblock entitled “Cornelius Drebbel, Alcmariensis, 1604.”²⁶⁹ The 1604 edition may be the Dutch edition which Johann Ernst Burggrav mentioned in his own 1628 edition of Drebbel’s *On the Nature of the Elements*. According to Burggrav, Drebbel had a few copies of his natural philosophy printed. He shared these copies only with “good friends and philosophers.” Burggrav said that “about

²⁶⁵ See Dieuwke de Hoop Scheffer and George S. Keys, *C. V. Sichem I* (Hollsteins’ Dutch and Flemish Etchings, Engravings and Woodcuts, Vol. xxvii) K.G. Boon, Ed. (van Gendt & Co: Amsterdam, 1983), 33; H.F. Wijnman, “De Van Sichem-puzzle,” *Oud-Holland* 46 (1929), 233.

²⁶⁶ Wijnman, 236.

²⁶⁷ De Hoop Scheffer, 10.

²⁶⁸ The printers of Holland were famed for their international production, which however, also relied on their lively home market. See C. Berkvens-Stevelinck, H. Bots, P.G. Hoffijzer and O.S. Lankhorst, eds, *Le Magasin de l’Univers: The Dutch Republic as the Centre of the European Book Trade: Papers Presented at the International Colloquium Held at Wassenaar, 5-7 July 1990* (Leiden, 1992), and especially P. G. Hoftijzer, “The Leiden Bookseller Pieter van der Aa (1659-1733) and the International Booktrade,” 169-184.

²⁶⁹ Fritz Burckardt, „Zur Geschichte des Thermometers,” *Verhandlungen der Naturforschenden Gesellschaft in Basel*, Vol. 16 (Basel: Georg & Co., 1903), 3. This edition, which can no longer be traced, was printed in Haarlem by Gillis Rooman (op de Marckt, in de vergulde Parsse). Rooman was associated with Jaacob de Meester, the Alkmaar printer who printed Drebbel’s letter to King James I in 1607. On Jaacob de Meester as an employee of Gillis Rooman, see Boukje Thijs, *De hoefslag van Pegasus. Een cultuurhistorisch onderzoek naar den Nederduytschen Helicon (1610)* (Hilversum: Verloren, 2004), 28.



Fig. 2. Christoffel van Sichem I's portrait of Cornelius Drebbel of 1604.

twenty years ago” (i.e. about 1608) he had received the tract from a “trusted friend.” He then translated it into German and had it published. The 1608 edition was translated into German for the “nature lovers” (“allen der Naturliebhaberen zu nutz ins Hochdeutsch getreulich uber gesetzt”). Burggrav said that his first edition of Drebbel’s works became a hit with “understanding philosophers.” Many people asked him for a copy of the book, and to satisfy them, he decided to reprint it in Latin and German.²⁷⁰

The 1608 German edition was published by Hendrick van Haestens, who also published Burggrav’s first work, *The Lamp of Life and Death* in 1610.²⁷¹ The case seems strong

²⁷⁰ Johann Ernst Burggrav, preface to Cornelius Drebbel, *Ein kurtzer Tractat von der Natur der Elementen* (Frankfurt: Rötelij, 1628). “Ist auch bey veilen verständigen Philosophis, so es zu lesen b.kommen/ ein angenehmes Büchlein gewesen. Weiln diss Buchlein von der Natur der Elementen seithero von unterschiedlichen bey mir gesucht und begert worden/ Als hab ich solches/ damit ich multorum desiderio ein genugen thete/ in Lateinischer unnd Teutscher Sprach auffs new zu drucken und auffzulegen/ anordnung gethan.”

²⁷¹ *Ibid.* “Bin ich damaln durch einen vertrauweten Freundt dieses Tractats, von der Natur der Elementen/ welchen Cornelius Drebbel damaln in Niderteutscher Sprach verfertigt/ und etlich wenig Exemplaria fur sich drucken lassen/ und allein guten Freunden unnd Philosophis mitgetheilet/ theilhaftig worden/ welches Büchlein ich haernacher in die hochteutsche Sprach ubersetzt/ und in Druck damals

for believing Burggrav's version of events: Drebbel was responsible for the original 1604 edition, and therefore also the included portrait, yet he published this only in a few copies sent to specific individuals. This must have been the edition which prompted Isaac Beeckman to experiment with wind pressure in 1619. Beeckman noted that he made his experiment on the tenth of November, 1619 at Middelburg, according to what was written in chapter six of Drebbel's book, which was printed in Haerlem, *On the Nature of the Elements*. The earliest extant Haarlem edition dates to 1621, so Beeckman must have read one of the

befördert?" *Lampas vitae et mortis* was published as an octavo by Haestens in Leiden in 1610. Burggrav enlarged the work and had it printed in Franeker in 1611 under the title of *Biolychnium. The Lamp of Life and Death* resembled Drebbel's own work in that it was a slim work on an invention combining mechanics, chymistry, medicine, and vital philosophy. Burggrav's lamp used the blood of an individual as fuel, and could thus, claimed Burggrav, indicate the health of that individual at a distance, since the blood continually attracts the life-giving forces of the stars which direct the course of an individual's health. The philosophical bases supporting this were the same Burggrav employed in his interpretation of Drebbel's perpetual motion, which he claimed carried within it an innate heat drawn from the heavens, as discussed further in Chapter Five. The idea that the heart was a form of perpetual motion driven by a vital flame or *biolychnium* was repeated by supporters of Harvey. See Walter Charleton, *Oeconomia animalis novis in medicina hypothesibus superstructa, & mechanicè explicata* (London: Daniel and Redman, 1659), 9-10, "Quippe *Flamma* (prout ab ipsa ratione definitur) est luminosa quaedam, perpetuo mobilis, & calefaciens substantia, quae in perpetuo *Fieri*, i. e. indesinenti pabuli sui particularum accensione, consistit, quam citissime generata, nec minus cito periens. Ut ignis fit ignis, rursumque ignis esse cessat, vel brevissimo temporis momento; & simul ac omnes materiae, in qua se generat, particulae inflammabiles fuerint exhaustae, mox extinguitur. . . . Similiter (ut rem instituto accomodemus) cum pro confesso habeatur, *Biolychnium*, seu *Lampadem vitae in Animalibus*, in continua quadam spirituum vitalium, è sanguine, dum cor pertransit, oriundorum, accensione consistere. . . ." Burggrav's high esteem for empiricism led him to counter widely-held views, such as the efficacy of blood-letting. I cite from the duodecimo 1678 reprint of the 1610 edition (Leiden: A. Doude, 1678), 9-10. Documentis ab *Experientiâ rerum omnium praeceptrice solertissimâ depromptis*, luculenter constat, *VITAM in sanguine*, ceu propriâ ei sede à *Natura omnium parente destinatâ*, contineri. Etenim si vel homini vel caeterarum animantium cuiquam *Vulnus* inflictum sit, *Sanguis* autem non sistatur." Burggrav also displayed a similar preference for short works based in practice rather than reason, telling his readers not to look for further disquisitions on this subject. Such things could be affirmed through experiments and not the "logodaedalic" statements of ambiguous reasonings. *Ibid*, 72. "Pluribus in harum rerum disquisitionem & assertionem ire, quaesitis hinc inde multivariis, quid attinet? *Experimentiis* haec & talia constant, non logodaedalis ambiguarum *Rationum* enunciationibus." Boyle neglected to put this to the test of experiment, but he suggested that others do so, in *Some considerations touching the usefulness of experimental naturall philosophy* (Oxford: Davis, 1663), 328: "I ignore not that there are extant in *Burgravius*, *Beguinus*, and divers other Chymical Authors, very pompous and promising Processes of the Essence of Mens Blood, to which they ascribe such stupendous Faculties as I should not onely wonder to finde true, but admire that they can hope the Reader should believe them so. But of these Preparations, some being, as that of *Burgravius* in his *Biolychnium*, very mystical and unlikely; and others, like *Beguinus* his *Q. E. Sanguinis humani*, exceedingly laborious and not so clear, I have never put my self to the trouble of making them, but shall be very forward to acknowledge their excellency, if any Man shall vouchsafe me an Experimental Conviction of it."

few impressions of the first 1604 edition.²⁷² Burggrav also acquired one of these copies, which he then translated and published in 1608 with the printer who would become his own publisher.

Christoffel van Sichem II copied his father's woodcut of Drebbel for the 1621 Haarlem edition of *On the Nature of the Elements* (the original woodblock still remains in the Museum Enschedé in Haarlem).²⁷³ Van Sichem's portrait is also related to a drawing of Drebbel found on the page of his 1623 inscription in Daniel Stolcius v. Stoltzenberg's *album amicorum*, which has been published as a self-portrait.²⁷⁴ It is not clear whether this drawing was indeed executed by Drebbel; if so, he had a strangely unchanging self-portrait between 1604 and 1623. Since Drebbel never included images in any of his other album inscriptions, it is more likely that Stoltzenberg had the drawing executed by a professional album illustrator after Drebbel's engraved portrait.

In the 1604 portrait Drebbel's smiles broadly, swathed in a large fur coat whose edges spill playfully over the border of the rondel, as does his own hair. Martin Warnke has argued that this portrait shows that a learned man could be shown laughing in the period, in contrast to the far more numerous stern representations of the erudit.²⁷⁵ Yet, one cannot assume that this portrait would have been seen as representing a "learned man" in the period. Others who described Drebbel's appearance at the time did not do so in such terms.

²⁷² Isaac Beeckman, *Journal tenu par Isaac Beeckman de 1604 à 1634*, (Hague: M. Nijhoff, 1939), I, 346, "Den 10 November te Middelb., occasionem praebente *cap. 6 libri Drebbelij Alcmariensis*, gedrukt te Haerlem, *Van den natuyre der Elementen*, int Duytsch."

²⁷³ De Hoop, 33

²⁷⁴ Marco Beretta, *A history of non-printed science: a select catalogue of the Waller Collection* (Almqvist & Wiksell International: Uppsala, Sweden, 1993).

²⁷⁵ Martin Warnke, "Das Bild des Gelehrten im 17. Jahrhundert," *Res publica litteraria: die Institutionen der Gelehrsamkeit in der frühen Neuzeit*, Sebastian Neumeister and Conrad Wiedemann, eds. (Wiesbaden: Harrasowitz, 1987), 10.

Constantijn Huygens famously described Drebbel as having a face like Dutch farmer, but speech like the ancient philosophers of Samos and Sicily.²⁷⁶ Drebbel's fur coat also appeared both idiosyncratic and coarse. Rubens, who prided himself on his own elegant attire and employed it in claims to social status, ran in to the most famous philosopher Drebbel (il famosissimo filosofo Drebbel) in the street in 1629, as he wrote to Claude Fabri de Peiresc. He suggested that Drebbel was like those things Machiavelli described which appeared greater from afar due to the opinion of men than they did up close ("come dice il Maschiavello che di lontano nella opinione degli huomini paiono maggiori che d'apresso"). Others had assured him that Drebbel hadn't really been able to achieve anything – the perpetual motion was a mere bagatelle, and Drebbel's war machines at La Rochelle failed utterly.

Because Rubens was not prepared to believe the *fama publica* to the prejudice of such an illustrious man, he hoped to visit him at home and engage him in more intimate conversation ("Pur io non voglio credere all a fama publica à pregiudicio di un uomo tanta illustre ma vederlo in casa sua y praticarlo se sara possibile familliarmente"). As for his first impression of Drebbel's appearance, Rubens was struck by the eccentric fusion of great stature and mean attire. He did not "remember having seen a physiognomy more extravagant than his." Switching mid-sentence to a classicizing Latin to express the singularity of this ragged philosopher, he claimed there was "a certain wonderful *je ne sais quoi* which shines within the ragged man, and not even the coarse coat which he always wears makes him ridiculous" ("Io non mi ricordo d'haver visto una physionomia più stravagante

²⁷⁶ He calls Drebbel "magne Senex" who "fronte Batavum Agrigolam, sermone Sophum Samiumque referret et Siculum." See his "Vita Propria," *De Gedichten van Constantijn Huygens* (Groningen: B. Wolters, 1898), 203-4. Perhaps Huygens refers to Pythagorus, Aristarchus, or Euripides of Samos and Archimedes of Sicily.

della sua; et nescio quod admirandum in homine pannoso elucet, neque enim crassa lacerna, ut solet in re tenui, deridiculum facit).”²⁷⁷

Drebbel was very aware of the social norms of dress and how such norms could be manipulated. His engravings of the seven liberal arts after Goltzius offered an idealized view of the *personae* of astronomers, mathematicians, musicians, etc. He also engraved a ten part series on the clothing of various nations and estates from English youth to Netherlandish merchants, *Variarum Gentium Ornatus*, after the Antwerp merchant, rhetoriquer, and artist Sebastian Vrancx.²⁷⁸ In his optical display, Drebbel transformed the color, fabric, and ornamentation of his clothing to represent social transformation. “Now I present myself as a king, decorated with diamonds and all sorts of stones, and in a moment I change into the form of a beggar, with all my clothing torn and full of holes” (“. . . nu als een coningh mijnselven presenteerende, met diamanten en allerley aert van steenen verciert, en in een oogenblick mij veranderende in de gedaente van een bedelaer alle mijne cleederen met lappen beset ende verscheurt zijnde. . . .”).²⁷⁹ Had Drebbel wished to claim social pretensions through his clothing, he was very well aware of how to do so. In this light, his signature fur cloak appears as a purposeful statement of his disregard for social status and convention.

²⁷⁷ Rubens, *Correspondence de Rubens*, Vo. 5, Max Rooses, ed (Antwerp: Buschmann, 1907), 153. See also Jaeger, *Cornelis Drebbel en zijne tijdgenooten* (Groningen: Noordhoff, 1922), 30 and 52. Note that Jaeger reads “famossissimo” as an ironic statement, and does not mention that the statement that the perpetual motion was a mere bagatelle was not Rubens’ own opinion, but a rumor he was not prepared to accept without further investigation.

²⁷⁸ Sebastian Vrancx inve. C.D. scalp. Rob. Baudous excud. The series included “Romanorum viri et feminae habitus, Mediolanensis, Apud Florentinos, Habitus Lusitanorum peculiaris, Hispani et Hispanae, Gallica in Vestitu varietas, Adolescentes Angli, Germanicus habitus, Nobilium in Belgio utriusque, Mercatoris Belgae ejusque conjugis vestitus.” Alfred von Wurzbach, *Niederländisches Künstler-Lexikon*, Vol. 2 (Leipzig: Halm and Goldmann, 1904-6), 825.

²⁷⁹ Drebbel, Letter to Ijsbrandt van Rietwijck. “Nu ben ick geleet al in een swart fluwel, en in een oogenblick, jae soo haest als ijemand dat dencken can, ben ick al in groen fluweel, in root fluwel, ende in alle coleuren van de werelt mijnzelfen veranderende. Ende niet allene dit, maer vaerandere mijn cleedinge in alle manieren van gewaet, soo ick selver begeere, als nu in sattijn, val alle verwen, dan in armozijn van alle verwen, dan in laken van alle verwen, dan in silveren, dan in gouden laken, nu als een coningh mijnselven presenteerende, met diamanten en allerley aert van steenen verciert, en in een oogenblick mij veranderende in de gedaente van een bedelaer alle mijne cleederen met lappen beset ende verscheurt zijnde, sonder dat nochtans maer een cleet aenhebbe, twelck noyt van mij doe.”

The ludic interpretation of van Sichem's portrait becomes the more convincing when compared with the version of the portrait printed in the Leiden edition of 1608 [Fig. 3].

Although Drebbel retains his fur coat, lace collar, and curly hair, his smile has disappeared, and his hair no longer waves wildly past the borders of the rondel. Drebbel no longer appears as a ludic and extravagant border-crosser. This sterner portrait was followed and extended by Johann Ernst Burggrav in his 1628 German and Latin editions of Drebbel's works [Fig 4]. In this version Drebbel appears sober and restrained, yet the coarseness of his signature cloak has been if anything increased with visible and broad seams.

By 1628, Burggrav had made Drebbel famous within the new discipline of academic alchemy in Hesse-Kassel, where Drebbel served as an authoritative source in dissertations and textbooks in the circle of Burggrav's teacher Johann Hartmann (see Chapter Five). Burggrav did not attempt to hide Drebbel's status as an artisan; in fact he emphasized it for an audience who delighted in Drebbel's machine-based philosophy. Yet Drebbel's fusion of alchemy, mechanics, and universal natural philosophy was no laughing matter. Drebbel's status as an artisanal philosopher appears in this grave portrait of someone who could be called a "learned man," if an oddly clothed one.

The rival of Hartmann and Burggrav, Andreas Libavius, however, preserved the persona of the ludic Drebbel. Himself writing in a satiric vein in his dissertation on Drebbel's perpetual motion, Andreas Libavius compared Drebbel's laughter to that of Democritus, the laughing philosopher. Recounting Johann Ernst Burggrav's description of Drebbel's perpetual motion (published by Johann Hartmann), Libavius called it as ridiculous as a dream of a fable, which would make Democritus laugh, "and perhaps Drebbel too is

laughing.” Libavius portrayed Drebbel as amused by the transformation others (ie Burggrav and Hartmann) worked upon his inventions.²⁸⁰

Burggrav's version of van Sichem's portrait was in turn copied by Jan Luyken. Luyken extended the portrait for Jacob Claus' 1688 Amsterdam edition into a sensitive allegory of Drebbel's natural philosophy (Fig. 5).²⁸¹ Drebbel now appears as a magus, with his fur coat turned a long, flowing gown. Four figures representing the elements surround him, with air symbolized by the figure of fame flying above and displaying the title of the work. On the table before Drebbel a folio volume lies open, and next to the table, a distillatory furnace is at work.

Drebbel does not look at either the book or the furnace, but at the microcosm he holds in his hand. This contains the various elements encircling each other in concentric layers within a glass sphere, just like a glass microcosm Drebbel boasted he could build in his letter to King James I on the perpetual motion.²⁸² Drebbel's attention to the microcosm suggests his ability to build living instruments that offer a concentrated and comprehensive view of the universe. Drebbel can contemplate within the microcosm all the actions of the elements at work in the macrocosm, and gain universal knowledge instantly, rather than gleaning it piecemeal from the heavy scholarly tome or the retort.

Luyken's engraving was in turn copied for Adriaan van Dijk's 1702 Rotterdam edition and by Pieter Gerardus Geysbeek and Laurens Groenewoud in their 1785 edition. Geysbeek and Groenewoud also granted Drebbel several posthumous degrees, advertising in

²⁸⁰ Andreas Libavius, *Probabilis Investigatio Caussarum Physicarum, Aliarumque Globi Archimedaei novi & instrumenti musici per se absque evidente motore mobilium* (Coburg: Bertsch, 1612), proposition 21. “Modus dicitur insensibilis & astralis: artificium modi, chymicum: Forma & actus, attractio magnetica, infusio, conclusio, motus, rotatio, continuatio, quod cum vero pronuncietur consentaneum, est fabulae somnium, quod Democritus fusissime rideret, & forse ridet ipse Drebelius, inventum esse hominem, qui magiam istam instrumentalem tam miseris revera, ad speciem phantastice pulchellis coloribus possit pingere.”

²⁸¹Nel Klaversma and Kiki Hannema, *Jan en Casper Luyken te boek gesteld: catalogus. van de boekencollectie Van Eeghen in het Amsterdams Historisch Museum* (Hilversum: Verloren, 1999), 170.

²⁸² It also resembles the microcosm in Luyken's titlepage for Kenelm Digby's *Theatrum Sympatheticum*.

their title that Drebbel was during his life “A.L. M. Philos. Math. & Phys. Doct. te Alckmaar, en Uitvinder der Zamengestelde Microscoopen” (“Master of Liberal Arts in Mathematics and a Doctor of Philosophy at Alkmaar, and inventor of the compound microscope”).

Andreas Luppilus' edition of Drebbel's works represents the end of a series of border-crossings. Drebbel's works were translated from Dutch to German, and thence back to Dutch (in the 1632 edition) and to Latin (by both Peter Lauremberg before 1621 and by Johann Ernst Burggrav in 1628), and from Latin back to Dutch by Luppilus in 1702. Luppilus was a printer of theosophical works and of portraits of such individuals as Jakob Böhme, Abraham van Franckenberg, and Valentin Weigel.²⁸³

Drebbel's portrait in Luppilus' edition recalls the 1608 portrait, although it has been encircled with laurels, suggesting Drebbel's coronation (Fig. 6).²⁸⁴ Beneath the portrait lie the traditional accoutrements of learned men – books, instruments, and a globe. Yet within the one book which lies open, we do not find any writing, but a fiery triangle and a shining triangle. This theosophical Drebbel does not consult his books, but is rather elevated above verbal instruction.

By comparison, the version of Drebbel's portrait published by Friedrich Roth-Scholtz was far more conservative (Fig. 7). The alchemical publisher Roth-Scholtz, who had many portraits of alchemists engraved, was certainly a collector of Drebbeliana. He owned

²⁸³ See Peter Jürgen Mennenöh, *Duisberg in der Geschichte des Niederrheinischen Buchdrucks und Buchhandels bis zum Ende der alten Universität* (Duisberg: Walter Braun, 1970), 160.

²⁸⁴ J. B. Trapp, “The Owl's Ivy and the Poet Bays. An Enquiry into Poetic Garlands,” *Journal of the Warburg and Courtauld Institutes* 21:3/4 (1958), 227-255.



Fig. 3. The portrait from the 1608 Leiden edition. Staatsbibliothek, Berlin.



Fig. 4. The portrait published by Burggrav in his 1628 German and Latin editions. Staatsbibliothek, Berlin.



Fig. 5. Luyken's composition (awkwardly) re-engraved for the 1785 edition of Drebbel's works.



Fig. 6. Luppius' edition.



CORNELIUS DREBBELIVS,
Alcmariensis,
Celebris Mathematicus, motus perpetui,
à temporibus Archimedis incogniti alior.,
unque instrumentorum Mathematicorum in,
ventor felicissimus claruit circa A1628.
Ex collectione Fridr. Roth-Scholtzji Norimb.

Fig. 7. The portrait published by Friedrich Roth-Scholtz.

four editions of Drebbel's works (Leiden, 1608; Burggrav's German edition of Frankfurt, 1628; Geneva, 1628, and Leipzig, 1723).²⁸⁵ According to Georg Andreas Will, Roth-Scholtz

²⁸⁵Roth-scholtz, *Bibliotheca chemica* (Nürnberg: Johann Daniel Tauber, 1727), 58-59. Roth-scholtz gave his library to the University of Altorf, which is now incorporated in the library of Erlangen-Nürnberg. The collection of Erlangen-Nürnberg also included a German manuscript copy of Drebbel's letter to King James published in Dutch in 1607, „Wunderliche Erfindung von der Ewigen Bewegung, welche Cornelius Drebbel, ein Philosophus in Holland . . . zu wegebracht,” which however has been missing from the library since 1963 (e-mail correspondence from Erlangen-Nürnberg librarian, Sigrid Kohlmann, 1/8/2008).

published a Latin and German octavo edition in 1722 with an explanatory preface (“Corn. Drebbelii lat. Und deutsche Schrifften, samt einer Vorrede aus Licht gestellet durch F. R. 1722 8.”).²⁸⁶ Roth-Scholtz labelled his engraving, “Cornelius Drebbelius Alcmariensis Celebris Mathematicus, motus perpetui à temporibus Archimedis incogniti aliorumque instrumentorum Mathematicorum inventor felicissimus claruit circa A. 1628/ Ex collectione Fridr. Roth-Scholtzii Norimb.”²⁸⁷ Roth-Scholtz repeated Burggrav’s stern version of Drebbel, labeling him a mathematician and an inventor.

III: Drama

In the ever changing portraits of Drebbel, we find his persona manipulated in order to increase its authority for varied audiences. We find a similarly creative use of Drebbel’s persona appearing in the masques of Ben Jonson. Jonson did not invest Drebbel’s persona with authority; rather he dramatized Drebbel’s bid for authority as unjustified. By policing the borders of authority, Jonson concealed his own transgressive claim to status.

Jonson, like Drebbel, claimed authority far beyond his social station, yet he employed directly opposite tactics to do so. The son of a brick-maker, Jonson exerted his authority through an innovative use of print. He “collected” himself by bringing together the scripts for performances (which might equally be considered the property of the producers of the performances) into large folio volumes (and later quartos) identified as his *Works*. Both the claim to having a *corpus*, and the extensive Latin marginalia with which Jonson glossed his own works granted him a much higher status than that generally accorded playwrights.

²⁸⁶ See “Roth-Scholtz” in Will’s *Nürnbergisches Gelehrten-Lexicon*, Vol. 3. (Nürnberg: Schüpffel, 1757), 407.

²⁸⁷ Peter Mortzfeld, *Porträtsammlung der Herzog August Bibliothek Wolfenbüttel* (New York: K.G. Saur, 1986), A 5158.

Jonson employed the learned languages in his glosses so that “none but the Learned” could have full access to his text. The gloss thus did not make the text more accessible, but limited readership.²⁸⁸ By this means, Jonson also distanced himself from the rabble and associated himself with an exclusive group.²⁸⁹ By contrast, Drebbel claimed that the writing of “fat books” was a sign of vanity, and emphasized the slimness of his own volume – usually published as a slim octavo or even duodecimo – calling it a “little book” or pamphlet.

In life, Jonson fostered the same exclusivity he cultivated in print. Jonson’s sociability was restricted to a select group in the Devil and St. Dunstan Tavern, where the rules of sociability, the *Leges Convivales*, were composed by Jonson himself in Latin and inscribed in marble on the wall of the Apollo room of the tavern. These included the admittance only of erudite, urbane, lively, and honorable men (“eruditi, urbani, hilares, honesti, adsciscuntor”). Michelle O’Callaghan distinguished such conviviality from “earlier, more fluid societies through its stronger sense of hierarchy and ritualized paternalism centered on Jonson.”²⁹⁰

Jonson himself certainly derided other locales which served as centers for border-crossing rather than civility and exclusion. It is in the context of such derision that the persona of Drebbel appeared as an enthusiastic, confused, border-crosser of mean status. In the *Staple of News* and *News from a New World discovered in the Moone*, Jonson mocked the persona of the intelligencer who industriously collected pieces of news and communicated them without respect for borders. The Factor of news described how “I doe write my thousand Letters a weeke ordinary, sometim twelve hundred. . . I have friends of all ranks,

²⁸⁸ Evelyn Tribble, *Margins and Marginality: the Printed Page in Early Modern England* (Charlottesville: University Press of Virginia, 1993), 151.

²⁸⁹ Marjorie Swann, “The Author as Collector,” *Curiosities and Texts: The Culture of Collecting in Early Modern England* (Philadelphia: University of Pennsylvania Press, 2001).

²⁹⁰ Michelle O’Callaghan, *The ‘shepherds nation’: Jacobean Spenserians and early Stuart political culture, 1612-1625* (New York: Oxford University Press, 2000), 38.

and of all Religions, for which I keepe an answering Catalogue of dispatch.”²⁹¹ Drebbel's various border-crossing inventions were seized upon by such intelligencers as heralding a new era of painless communication. We have already seen how Drebbel's submarine was seen by some as a Utopian means of communication between earth, air, and water (Introduction). Drebbel's optical devices further offered a means of communication to the heavens themselves. Drebbel's inventions were not only devices for communication, but the subject of communication among those seeking to unburden themselves of growing amounts of correspondence. Communicative devices were big news among communicators.

Drebbel himself eagerly kept abreast of the latest optical developments. We have his letter on his own optical performance due to his attempt to learn from his friend Ijsbrandt van Rietwijck about the latest optical news. Rietwijck had told him about the telescope (“t verre sien”) discovered by the son of Adriaen Anthonisz., Adriaen Metius. Drebbel asked Rietwijck keep him informed about Metius' doings, claiming in return that he too has discovered many excellent things with the telescope, and going on to describe his optical display.²⁹²

Drebbel used optics to transcend borders in that display, just as he did in his declaration, recorded by Gassendi in his life of Peiresc, that the moon was inhabited just like the earth. It is through just this piece of news that Jonson ridiculed Drebbel before their mutual patron in his *Newes from the New World Discover'd in the Moone. A Masque; As it was Presented at Court before King James. 1620*. Jonson contrasted a trustworthy way of learning about the moon – from poets- over such incredible means as the telescope. Two heralds

²⁹¹ Jonson, 40.

²⁹² Drebbel, Letter to Ijsbrandt van Rietwijck. “Gunstige vrundt Mr. Ysbrandt rietwijck, UE heeft mij voor desen deswegen ‘t verre sien gevonden bij den zoon van Mr. Adriaen Thonissen. Ick bidde laet mij weten wat daerin gedaen heeft. Ick hebbe oock vele excellente dingen daerin gevonden, soo ongelooflijke schijnen sende als tooverij geestimeert werden, waervan UE hier een weinich wil gedencken.”

declared to a printer, chronicler, and factor of news that the moon had just been discovered to be “an earth inhabited.” Their audience wondered how that news had been gained. The printer immediately thought it must be due to a new technology, “I know it, a thing no bigger than a Flute-case; a neighbour of mine, a spectacle-maker, has drawn the Moone through it at the boare of a whistle, and made it as great as a Drum-head twentie times, and brought it within the length of this Roome to me, I know not how often.”

In a competition over who had access to the most current and credible forms of long-distance communication, the Chronicler tut-tutted the Printer's opinion, “Tut, that's no newes; your perplexive Glasses are common.” The Chronicler believed it must have been due to an older magical technique of reading in the moon. Not one willing to concede the palm in book learning, the Printer claimed he was already familiar with this from Cornelius Agrippa, and cited the very chapter “*in disco lunae*.” No, said the heralds, our news came neither of these ways, “neither by the way of Cornelius Agrippa, nor Cornelius Drible no forc'd way, but by the neat and cleane power of Poetrie. . . .”²⁹³

Jonson parodied Drebbel as a collectible and communicable piece of news once again in the *Staple of Newes*, in which the invention of the submarine by “Cornelis-son” was compared as a news item to Galileo's invention of a terrible burning glass and the discovery of the perpetual motion by the Alewife of the Three Dancing Bears in St. Katherine's.²⁹⁴ This tavern served Jonson in several masques as a meeting-place of rude, foreign, confused, enthusiastic inventors and charlatans – precisely the sort of people who would not be admitted to the Apollo room at the Devil. In fact, in his *The Masque of the Augurs* of 1622, an

²⁹³ Jonson, *Workes* (London: Andrew Crooke, 1640), 41.

²⁹⁴ For a recent discussion of Jonson's allusion to Drebbel in the *Staple of Newes*, see Roger Chartier, *Inscription and Erasure: Literature and Written Culture from the Eleventh to the Eighteenth century* (Philadelphia: University of Pennsylvania Press, 2007), 55-6. Jonson referred to Drebbel by name only once in the *News from the New World*. He referred to the perpetual motion machine at Eltham in *Epicoeue*. This particular satirical use of the perpetual motion as a comparison to a talkative woman was widespread.

anti-masque was performed before the court by the Bear-keeper John Urson (Ursus= bear) and his bears, in which Urson of the Three Dancing Bears challenged Jonson's own tavern.

For any Alehouse,
We care not a louse,
Nor Tavern in all the Town-a;
Nor the Vintry Cranes,
Nor the St. Clement Danes,
Nor the Devill can put us down-a.

Urson indicated the pretensions the drinkers of the Three Bears had to social mixing, although their actual inhabitants were all drawn from the very lowest levels of society.

From Court we invite,
Lord, Lady, and Knight,
Squire, Gentleman, Yeoman, and Groom;
And all our stiffe drinkers,
Smith, Porters, and Tinkers,
And the Beggars shall give ye room.²⁹⁵

This ballad was reprinted in John Mennes' *Recreations* (1650) with a woodcut of the ludic, rude bear-keeper of The Three Bears [Fig. 8].²⁹⁶ John Urson, as the "post of the sign" and his three bears performed as the sign of the tavern come to life, personifying the brash, competitive, and commercialized claims of the marketplace. Despite the assurances by the alewife and her associates that these bears were "well bred" and of "quality and fashion," such crass advertisement clearly did not belong at court.

John Urson was but one of a rude troupe of Dutchmen barging into court and bringing their uncivil ways and bold claims with them. These included "Notch a Brewers Clarke, Slug a Lighterman, Van-goose a rare Artist," and the "Lady Alewife" of the Three Dancing Bears in St. Katherine's. In the figure of Van Goose, we can recognize Drebbel,

²⁹⁵ Jonson, 84-5.

²⁹⁶ John Mennes, *Recreations for Ingenious Head-Peeeces* (London: John Hancock, 1650).

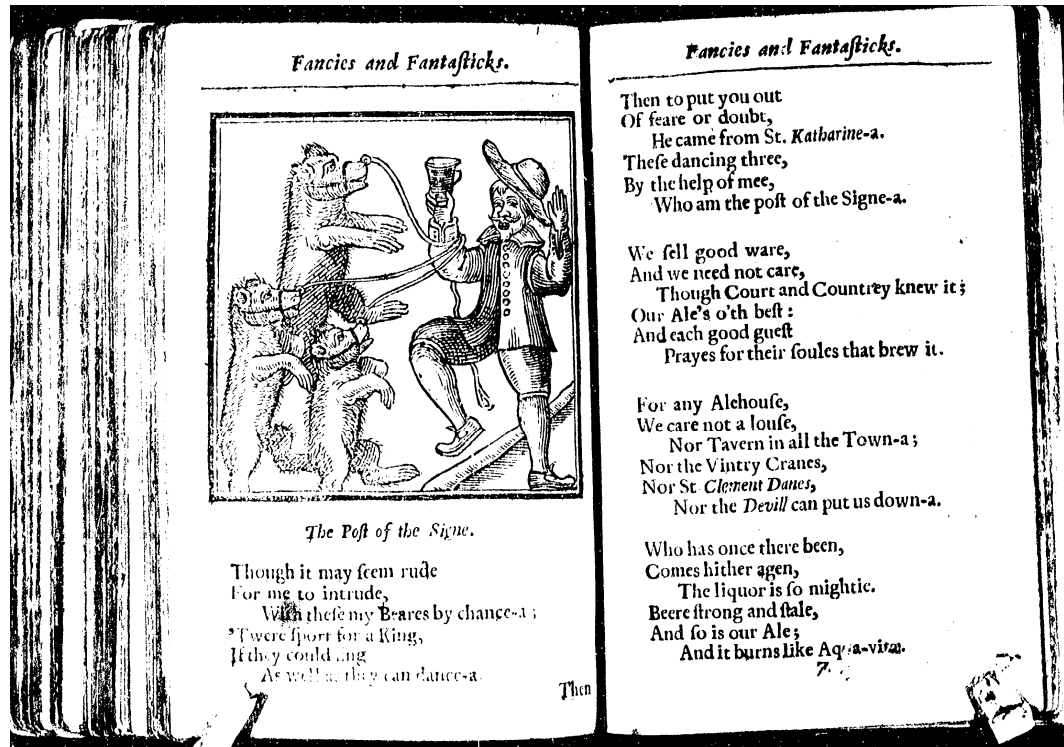


Fig. 8.

speaking a wonderful Dutch/Latin/English polyglot. This group could not distinguish between commercial and social credit. Notch and his friends attempted to reach the court literally through the back-door in an effort to parlay commercial credit into social admittance. Slug had “credit” at the back-door of the butter as “one that hat had the honour sometimes to lay in the king’s beer there.”

The Groome of the Revels halted the company.

What’s this? A hogshhead of beere broake out of the Kings buttery,
or some Dutch Hulke! Whither are you bound? The wind is against
you, you must back; do you know where we are?

Clearly the Dutch horde had invaded a space far above their social standing, and the groom attempted to send them back to where they belonged. Notch claimed social standing as a

brewer's clerk, a "head-clerk" no less, and the Groom apologized, "A man of accompt, sir! I cry you mercy."

Notch explained that he had heard that "neither the King's poet nor his architect [Ben Jonson and Inigo Jones] had wherewithal left to entertain so much as a baboon of quality." He, out of his "allegiance to wit, drew in some other friends that have as it presumed out of their own naturals to fill up the vacuum with some pretty presentation." A natural abhorrence of the vacuum had sucked these rude fellows together and up into the court, preternaturally above their regular level in society. Yet Notch also pointed to their own agency in their enthusiastic entry into the buttery; he alluded to an entity above and beyond the social order – wit- to which he owed allegiance, and which justified association, presumption, and border-crossing.

At this point Van-Goose entered, speaking a Dutch polyglot which appears as a Dutch typeface in Jonson's 1641 collected *Works*. Van-Goose agreed with Notch that the inventors at the court were all "barren." He, a projector of masques, went on to advertise what he himself would devise in terms highly reminiscent of Drebbel's *On the Nature of the Elements*. Drebbel's mix of artisanal philosophy, Latinate terms, and his claims to uniquely independent knowledge all appear in Van-Goose's first remarks.

VAN. Dat is all true, exceeding true, de inventors be barren, less, less, ore, four mile, I know that from my seiven; dey have no ting, no ting van deir owne, but dat dey take from de eard, or de sea, or de heaben, or de hell, or de rest van de veir Elementen, de place a, dat be so common as de bench in de Burdello, show me would bring in some dainty new ting, dat never was, no; never fall be in de rebus natura; dat has neder van de materia, no; de forma, no; de haffen, no; de boote, but a mera devisa of de bzaine—

GROOM. Hey-da! what *Hans Flutterkin* is this? what *Dutchman* doe's build or frame Castles in the Aire?

Fig. 9.

Dat is all true, exceeding true, de inventors be barren, lost, two dre, your mile, I knew that from my selven; dey have no ting, no ting van deir owne, but dat dey take from de eard, or de zea, or de heaven, or de hell, or de rest van de veir Elementen, de place a, dad de so common as de vench in de Burdello. Now me would bring in some dainty new ting, dat never was, nor never sall be in de rebus natura; dat has neder van de materia, nor de forma, nor de hoffer nor de voote, but a mera devisa of de braine-²⁹⁷

The Groom was far from impressed by this Dutchman building “castles in the air.” Notch, the brewer’s clerk, quickly denied that Van-goose was Dutch, claiming instead that he was “a Britain born” who “hath learn’d to misuse his own tongue in travel, and now speaks all languages in ill English.” Notch also assured the Groom that the Lady Alewife and her “two women that draw drink under her” were “gentlewomen born all three.” Notch’s assurances of Lady Alewife and her barmaids’ social status was as doubtful as his protestations of the bears’ high breeding or Van-Goose’s Englishness.

Notch further explained that as a rare artist and projector of masques, it was Van-goose’s project that they should all come over from the Three Dancing Bears in St. Katherine’s. Drebbel himself had been involved in 1620 in a project to erect a theatre for machine-plays in London.²⁹⁸ Had this project been fulfilled, Drebbel would have helped to introduce courtly spectacles to the city, just as in the *Masque of the Augurs*, van Goose tried to bring city entertainments to the court.

The Groom said he must see a demonstration to ensure that it would be fit for the ladies of the court, and John Urson’s dance with the three bears ensued. Van-Goose was inordinately eager for approval, and at the same time claimed that the three dancing bears were nothing compared to what he could show. Through catoptricks, he would make the Turks, Tartars, Persians, and Mogulls all appear and “fight in the ayr, and be all killen, and

²⁹⁷ Jonson, 83.

²⁹⁸ Anthony Turner, “Stagecraft and Mathematical Magic in Early Modern London,” *Nuncius* (2007), 346.

aliven and no such ting. And all dis met de *ars* van de Catoptricks, by de reflexie van de glassen.”

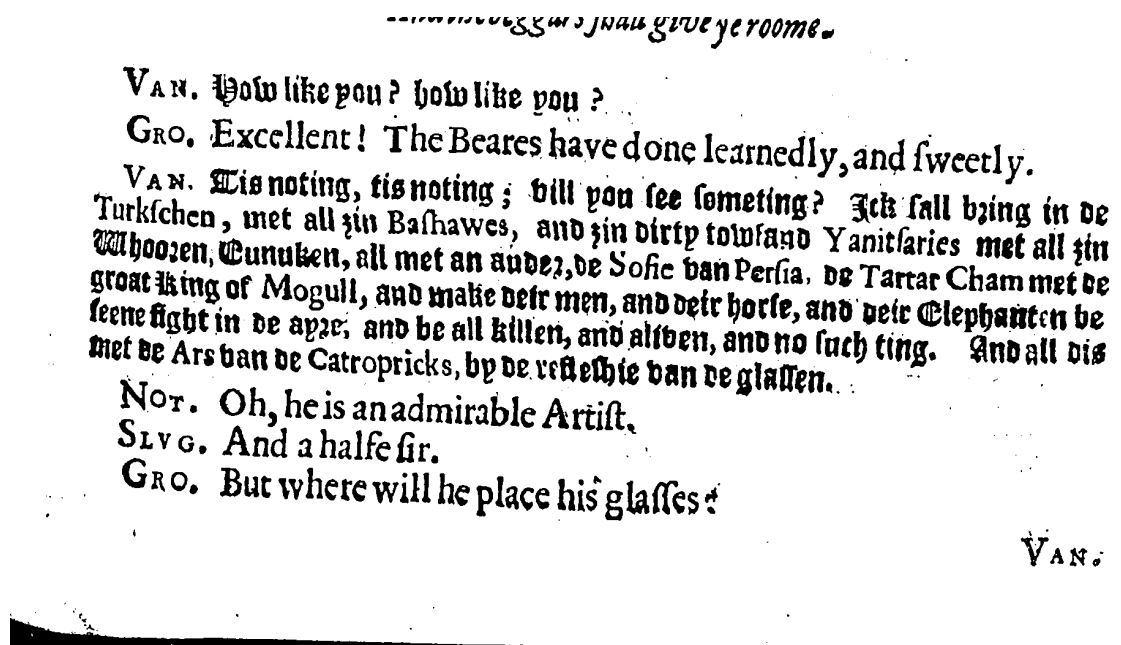


Fig.10.

When the Groom protested over the technical arrangements of the show, Van-Goose shrugged him off with talk of his other optical secrets. Physical space offered no constraints to the new optical technology. Just as the Printer had told of his neighbor bringing the Moon through the bore of a whistle and into his room, Drebbel exclaimed, “Fow, dat is all ean, as it be two, dree, vier, vife towsand mile off; ick sall multiplien de visioun, met an ander secret dat ick heb: spreck, vat vill you haben?²⁹⁹”

The Groom appeared suitably impressed with Van-Goose’s ability to achieve the impossible. Notch objected to the Mogul, Turk or Tartar since “their names are somewhat

²⁹⁹ Drebbel’s son-in-law described to Peiresc Drebbel’s plan to make a telescope for seeing at night by grinding a lens with multiple convexes which would collect the last remaining light in the air, and allow the viewer to see more clearly than during the day. “Que ceste lunette pour voir la nuit est faicte en sorte qu’elle reunit et ramasse tout ce qui reste de clairté du iour en la nuit, a un seul endroit qu’il nous le faict voir plus clair et plus distinct que la iour, a cause qu’il ny a point de rayons qui esblouissent. . . .”

too big for the room,” and suggested instead “country-players” “or some Welsh pilgrims.”

Van-Goose quickly picked up on Notch's idea, claiming it as his own.

Pilgrim! Now yow talk of de pilgrim, it come in my head. Ick vill show yow all de whole brave pilgrim o'de world: de pilgrim dat go now, now at de instant, two, dre towsand mile to de great Mahomet, at de Mecha, or here, dere, every where, make de fine labyrints, and shew all de brave error in de vorld.

Van-Goose refused to let go of the outlandish and outsized. His pilgrims would travel three thousand miles in all directions in one instant, as an allegory of the error of the world, making in a precious display “fine labyrints.” When Slug the lighterman innocently asked “shall we see it here,” Van-Goose was quick to anger. Recalling Drebbel's claim that others suspect him of sorcery (*tooverij*) in his optical displays, van Goose assumed that he stood accused of achieving the impossible by having recourse to the devil, despite the fact that nobody in the room had brought up the devil except him.³⁰⁰

Yaw, here, here, here in dis room, tis very room: vel vat is dat to you, if ick do de ting? Vat an devil, vera boten devil?

Notch excused him since “all excellent men cannot govern their passions” and begged that the Groom grant him a chance. The Groom of the Revels would like to “try him” but objected that it has nothing to do with “our mask.”

Van-Goose nimbly turned this objection to philosophical advantage with a confused argument over the relationship of art and nature, a frequently debated question of the period. Van-Goose pointed to two distinct realms of art and nature, and argued that the further he left the nature of things behind the better. He confused “Antick-mask” and “anti-mask,” suggesting mannerist grotesque “anticks” which displayed the master of art over nature by contorting the natural form.

³⁰⁰ Drebbel wrote to Van Rietwijck that his optical displays seemed so incredible that they were considered sorcery (soo ongelooflijke schijnen sijnde als tooverij geestimeert werden”).

O sir, all de better vor an antick-mask, de more absurd it be, and vrom de purpose, it be ever all de better. If it go from de nature of de ting, it is de more art: for dere is art, and dere is nature, yow sall see. *Hocos Pocos! Paucos palabros!*

Despite the fact that van Goose denied using sorcery, he employed the showmanship of the sorcerer's spells. The anti-masque followed with a "perplexed Dance of straying and deformed Pilgrims" till they were all "frighted away" by Apollo "and the main Masque" began.

Nowhere do we better see Jonson contrasting himself as the classically trained writer with the figure of the "projector of masques." Van-Goose spoke confusedly and enthusiastically in a Dutch font. With unrestrained passion, he claimed everything. He had immense self-confidence and a vocabulary of outlandish hocus-pocus, yet no solid authority nor gentility to back up his claims. All his boasts resulted only in "straying and deformed" figures. Jonson purged the court of the claims of Dutch artists with a classically sound harmonious Apollo, whose speech not only appeared in elegant italics, but was laden with notes in Latin and Greek.

Jonson represents Drebbel to the court as promoting a dangerous form of enthusiasm. Drebbel offered the impossible, the foreign, the oversized, the unlearned, and the illusive. He employed light and mirrors in his shows as a "projector of masques." Jonson, by contrast, buttressed his own masque with the solidity of book-learning. The playwright contrasted his own glossed masques, "grounded upon antiquities" with the "airy nothings preferred by the ignorant."³⁰¹ It was this authority, the Apollonian gift of augury, which would direct the future, and not the impossible claims of Van Goose and his ilk.

³⁰¹ Tribble, 142.

VAN. *Frow, dat is all ean, as it betwo, dret, betre, hire tounfand Spile off: Ick fall multipliren de vizioun, met an ander secret dat Ick heb: Spzick, bat vil you haben?*

GRO. Good fir put him toot, bid him doe something that is impossible, he will undertake it I warrant you.

NOT. I doe not like the *Mogul*, nor the great *Turke*, nor the *Tartar*, their names are somewhat to big for the Roome; marry if he could shew us some Countrey Plaiers, strolling about in severall Shires, without licence from the Office, that would please I know whom, or some Welsh Pilgrims.

VAN. *Pilgrim? now you talke of de Pilgrim, it come in my head, Ick bill shew you all de whole brabe pilgrim o' de World: de Pilgrim dat goe now, now at de instant, two, dret tounfand Spile to de great Mahomet, at de Mecha, oz here, dere, every where, make de fine Raptivits, and shew all de brabe erroz in de world.*

SLVG. And shall we see it here?

NAN. *Pau, here, here, here in dis Roome, tis very Roome: bel bat is dat to you if Ick doe de ting? bat an debill, vera boten debill?*

GRO. Nay, good fir be not angry.

NOT. 'Tis a disease that followes all excellent men, they cannot governe their passions; but let him alone, try him one'bout.

GRO. I would try him, but what has all this to doe with our Maske:

VAN. *O Sir, all de better voz an Antick-maske, de moze absurd it be, and from de purpose, it be ever all de better. If it goe from de nature of de ting, it is de moze Art: for deare is Art, and deare is Nature, you fall see. Hochos pochos, Paucos, Palabros.*

The Second Antimaske.

Which was a perplex'd Dance of straying and deform'd Pilgrims taking severall pathes, till with the opening of the light above, and breaking forth of Apollo, they were all frighted away, and the Mainie Masque begun.

(^a) APOLLO descending, Sung.

I*t is no dreame, you all doe wake, and see;
Behold, who comes! (^b) far-shooting Phœbus he
That can both hurt and (^c) heale, and with his (^d) voyce
Reare Townes, and make societies rejoyce;
That taught the Muses all their harmonic,
(^e) And men the tunefull Art of Augurie.
Apollo stoopes, and when a God descends,
May Mortalls thinke he hath no vulgar ends.*

(^a) Artes eximias quatuor Apollini acceptas tulit antiquitas (^b) Sagittandi peretiam, unde apud Homerum, frequens illud Epitheton *κρησελος*, longe jaculans. (^c) Medicinam, unde Medici nomen adeptus. (^d) Musicam, unde *μουσική* appellatus. (^e) Et Divinationem (in qua etiam Augurium) unde Augur Apollo dicitur, Virg. *Æneid.* lib. 4. & Horat. *Car.* lib. 1. Ode. 2. *Nube cadentes humeros amissas Augur Apollo.* Et *Car.* sæcul. ult. ubi doctissimus Poeta has artes totidem verbis complectitur. *Augur ex fulgente decorus arcu Phœbus, acceptum que neminem camentis, Qui salutaris levat arte fessos corpora artum.*

IV: Historical Chronicles

As news invaded memorials and histories in the period, Drebbel found his way into the historical chronicle. The works of the Antwerp merchant resident in London, Emanuel van Meteren, and Willem Baudartius are large folio volumes, replete with high politics. While the form of van Meteren's *Histories* (covering 1555-1598 in the first approved edition of 1599) identifies it as a historical chronicle, Meteren frequently updated the work until his death in 1612. Despite the antagonism Jonson depicted in *Newes from the New World* between the Chronicler and the Factor of News, van Meteren's *Histories*, as a chronicle of very recent events, also bordered upon the "news" circulating in more ephemeral genres.³⁰²

Emmanuel van Meteren was a cosmopolitan character. As described by Deborah Harkness, van Meteren participated intensively in the collaborative projects of "big science" in Elizabethan London.³⁰³ He met travelers such as Otto Heinrich von Herberstain, signing their *alba amicorum*, and kept his own album.³⁰⁴ In his *Netherlandish Histories*, van Meteren celebrated the amount of travelling Netherlanders did, which he linked closely to their abilities as artists. Netherlanders both learned new arts abroad, and found employment abroad due to their skills as artists.

Under the rubric "Netherlanders are great Artists" ("Nederlanders groote Constenaers") van Meteren described how several hundred thousand Netherlanders had emigrated from their country due to political and religious unrest, fleeing with wife, children, and servants to Germany, France, England, and eastward, from whence they sent their sons ("as if they had no Fatherland") even further to Italy, Spain, Hungary, Turkey, etc., "to see

³⁰² R. Fruin, "De Historiën van Emanuel van Meteren," in *Verspreide geschriften*, VII (The Hague, 1903), 383-410.

³⁰³ See Harkness, *Jewel House*, 25, for Meteren's residency and network in England.

³⁰⁴ Egerton 1239, 67, "Emmanuel Van Meteren Antwerpianus, Londini in Anglia 8/18 Septembris 1610." Van Meteren signed Herberstain's album the same year as Drebbel, although far further back in the book (See Chapter Three). Yet van Meteren did not ask Drebbel to sign his own album. See Bodleian Library Oxford, MS. Douce 68, Album Amicorum Emanuelis de Meteren.

and learn all forms of knowledge” (“om allerhande wetenschappen te sien ende te leeren”).

Since they more than other nations were honest, hardworking, curious, and gifted in the arts, they found it easy to leave their Fatherland. Van Meteren's single example of a person who exemplified Netherlandish skill and travel was Drebbel.

“and they have brought about so many artful crafts that it is quite amazing, such as all sorts of new draperies, figured damasks, velvets, silk. . . there is also one Cornelis Dribbel from Alkmaar, who can make a perpetual motion, and who is currently working on a clavicymbal that can play by itself through the power of the sun's rays, and even if it is in a cellar without sunlight, he knows how to lead its power (to the clavicymbal), but it would take too long to describe its form here. Drebbel is in the service of the King of Great Britain, and he is now sought out by many princes due to his art (*conste*). In short, there is almost no land without a Netherlandish diaspora. . . and they have also not been found to seek after their own profit, but they have gladly shared their own arts, sciences, and industry with other nations.³⁰⁵

Van Meteren developed an ancient historical theme of the particular genius of a nation. The genius of a nation ought to remain constant through time, as the defining characteristics of a people. Yet, the genius he singled out in the persona of Drebbel as particularly Netherlandish was a transformative one. It was the Netherlander's ability to transform his surroundings, and to carry that transformation to all nations which identified him as a member of his people.

³⁰⁵ Emanuel van Meteren, *Nederlantsche historien ofte geschiedenissen* (Dordrecht?: N.A., 1612), 349 (under the year 1609). This passage can be found in the German edition, *Niederländische Historien* (Antwerp: N.A. 1609-11), 135 (Anno 1610). “. . . ende hebben so veel constighe handt-wercken voortgebracht dat te verwonderen is/ als alderhande nieuwe Draperien/ alderhande ghefigureerde Dammasten/ Fluweelen/ syde werecken/ selve Ammelaeckens werck ende servetten met alderhande figueren/ van Beesten/ Landschappen/ Huysen/ Boomen/ Menschen/ al ofte het geschildert ware/ datmen nu als int Nederlandt maeckt/ met menischerhande ontallike consten/ selve isser een Cornelis Dribbel van Alkmaer/ die perpetuum mobilie can maecken/ heeft onderhanden een Clavesimble die van selfs sal spelen/ door cracht van strale van de Sonne/ als waert in eenen kelder wt de Sonne/ diens cracht hy weet te leyden/ de forme te langhe hier te verhalen/ zynde in dienste vanden Coninck van groot Britaengien/ ende nu van meer Princen ende Vorsten versocht om zijn conste. Somme alsoo datter niet en is/ bytans in gheen Landen/ door dese Nederlandsche verstroeyinghe/ fote ten is by haer afghellert ende ghedaen/ sy en zyn oock soo eyghen baetsoeckende niet ghevonden/ maer hebben haer eyghen consten/ wetenschappen ende industrie/ ander natien gheerne medegedeelt ende ghewesen. . . .”

Yet it was paradoxically also this genius which aided the dispersal of that people. Van Meteren was hard pressed to define the sons of Netherlandish emigrés who never returned “home” (“as though they had no Fatherland”) as still Netherlandish. He claimed that second-generation emigrés are “people of the land, and true Dutchmen, since they are Dutch in their origins” (“zijnde een volck van aerde/ waere Duytschen/ als Duytschen van afcomste”).³⁰⁶ Yet it is hard to imagine this identity as “people of the land” surviving many more generations of inveterate travelling and communication.

Furthermore, the particular skill that Netherlanders possessed and communicated so liberally was the transformative one of *const.* Since the mid-sixteenth century, historians such as Louis Le Roy and Jean Bodin had noted man’s ability to alter his world through new inventions, and connected this consciousness of change to new ways of judging evidence and composing history. Related to this view of contingent change over time was the emergence of the methodical art of travel, which served as a way to collect evidence through universal autopsy.³⁰⁷ Van Meteren held up Drebbel as an exemplar of travel and artful invention that typified his people. It was, however, precisely such qualities which cast doubt on the unchanging characteristics of a nation and a historiography based on such constants. The tension between the persona of the artful traveler and its use as a stable marker of national identity appeared in the eruption of Drebbel’s persona into the pageantry of the historical chronicle.

Van Meteren’s fellow Antwerper Francis Sweerts also celebrated Drebbel as an exemplar in his massive *Athenae Belgicae Sive Nomenclator infer. Germaniae Scriptorum qui*

³⁰⁶ *Ibid.*

³⁰⁷ See Anthony Grafton, *What was History? The Art of History in Early Modern Europe*, (New York: Cambridge University Press, 2007), 174-8 and “Renaissance Histories of Art and Nature,” *The Artificial and the Natural: An Evolving Polarity*, Bernadette Bensaude-Vincent and William R. Newman, eds. (Cambridge: MIT Press, 2007), 185-210.

disciplinas philologicas, philosophicas, theologicas, iuridicas, medicas et Musicas illustrarunt. Like van Meteren, Sweerts located national pride in the internationality of his compatriots. Certainly one of the most impressive collections of Netherlandish personalities of the period, Sweerts' fascinating (and under-studied) work also included what has been called the "first classified bibliography of bibliographies."³⁰⁸ Sweerts identified Drebbel as an

incomparable mathematician, once the intimate of the famous Goltzius, whose sister he married and took with him to England, where he has for some time been maintained liberally by the munificence of King James. It is he who invented the Perpetual Motion, unknown since the time of the great Archimedes. This praise too is owed to Netherlanders. Emperor Rudolf wanted him for his own, and honored him with high wages. At the latter's death, he returned to England, where he lives now, currently fifty-five years old, and every day he devises something truly wonderful.³⁰⁹

By displayed his inventive skill on an international stage, rivaling the ancients, and attracting imperial attention, Drebbel won praise for his fellow Netherlanders.

The historian Willem Baudartius provided a perfect example of the "Netherlandish diaspora." His parents were forced to flee the Netherlands to England. There their two oldest daughters supported the family by teaching the daughters of gentlefolk such arts as embroidery and playing the clavier. Baudartius himself learned languages – Dutch and French at home, and English by playing with the children in the street.³¹⁰ He went on to

³⁰⁸Archer Taylor, *A History of Bibliographies of Bibliographies* (New Brunswick, N.J.: Scarecrow Press, 1955), 18.

³⁰⁹(Antwerp: Willem a Tongheren, 1628), 184. "Cornelius Drebbelius Alcmariensis Batavus, Arithmeticus incomparabilis, celebris illius Goltzii aliquando domesticus, cuius sororem in uxorem duxit, cum qua Angliam adiit, ubi regis Jacobi munificentia liberaliter aliquamdiu est habitus. Hic ille est, qui MOTUM PERPETUUUM a temporibus magni Archimedis incognitum adinvenit. Haec laus Belgis quoque debetur. Rodolphus Imp. eum virum suum esse voluit, ac magnis stipendiis auxit. Illo mortuo unde venerat in Angliam rediit in qua etiamnum vivit, ac quotidie verè admiranda comminiscitur annum agens LV. "

³¹⁰P.C. Molhuijsen, "Leven van Willem Baudaert door hem zelve beschreven," *Kronijk van bet Historisch Gezelschap te Utrecht*, Vol. 5 (Utrecht: Kemink and Son, 1849), 231.

learn Latin, Greek, and Hebrew while visiting several universities. These included Leiden, where he signed the album of Daniel van Vlierden in 1593.³¹¹

Baudartius urged a similar course of travel and language-learning upon his son: “My wish is that you should travel through the most famous kingdoms of Christendom. I say travel through, not stay a long time, and I intend the lands and cities in which the true reformed religion is practiced, such as Germany, England, Scotland, and France, so that you too might learn to speak the more perfectly the languages of these lands.”³¹² The fruit of Baudartius’ travels were his publications, the list of which Baudartius, (who published other works as “W.B., a lover of histories,” “Lief-hebber der historien”), concluded with “mijn groote historije, in twee tomes, geintituleert, *Memorijen ofte corte verhael vande gedenckweerdichste geschiedeniessen.*”³¹³

In his hefty *Memoryen*, Baudartius, like Sweerts, stressed Drebbel’s ability to rival the ancients. He reported that the admirably learned Guido Pancirolli had written two books in Italian, translated into Latin and commented upon by Henricus Salmuth, entitled “Two books of memorable things once lost, and on the other side, such things which have been newly and ingeniously invented.” Yet, said Baudartius, “there are still many more liberal arts and sciences coming to light, and more of them are discovered every day” (“noch veel fraeye consten ende wetenschappen aen den dach gecomen/ ende dar wordender noch daeghelixx eenighe ghevonden”).³¹⁴ He mentioned a new Dutch translation which appeared in 1619 of

³¹¹ Den Haag, Koninklijke Bibliotheek, Ms. 74 G 21, 141. “Sic nobis fidus, Vlierdeni, semper amicus,/ Ipse tibi fidus semper amicus ero. ”

³¹² “Leven van Willem van Baudaert,” 244. “Mijnen wensch is, dat ghy mochtet doorwandelen de voornaemste coninckrijcken van christenrijck. Ick segge door wandelen, niet langhe blieden wonen, endi ick spreek van die landen en stede inde wlecke de waere gereformeerde religie geoeffent wort, als Hooge Duijtschlant, Engelant, Schotland ende Vranckrijck, opdat ghij te gelijcke de spraeke dier landen des te perfecter mooght leeren spreekken. . . .”

³¹³ *Ibid.*, 249.

³¹⁴ Willem Baudartius, *Memoryen, ofte Cort Verhael der gedenckweerdichste so kerklicke als werltlicke geschiedenissen . . . van den jaere 1603 tot in het haer 1624* (Arnhem: J. Jansz, 1624), Book II, 145 (anno 1619).

Frans Kessler's (originally German) *Const-Boeckxen*, in which could be found four secrets until now unknown, which could all be achieved through "natural arts and instruments without any sorcery or black arts ("Alles door natuurlike consten en instrumen sonder eeinge Toverye ofte swaerte consten").³¹⁵

Baudartius' second example was the "enlightened, gifted researcher of nature, Master Cornelis Jacobsz. Drebbel of Alkmaar" who "after a long time has found the Primum Mobile, which he has given to James the King of Great Britain. This is the more wonderful since Master Cornelis Drebbel is the first to find this wonder, as he says in his dedication to the might King of Great Britain." Baudartius cited at length from Drebbel's letter to King James, published in a 1607 Dutch translation in Alkmaar. After which Baudartius concluded that Drebbel had also made ships which travel under water, and other wonderful instruments, such as lenses through which one can see very far, and also lenses with which one can see at night, etc. ("Noch heeft de selfe Cornelis Drebbel gemaect Schepen die onder het water varen ende noch ander wonderbaerlicken Instrument/ als Brillen daermen heel verde mede sien can Item Brillen daermen snachts door sien can &c.").³¹⁶

Although Jonson contrasted the preferences of the Chronicler and the Printer for old and new technologies, chroniclers such as van Meteren and Baudartius shared a lively sense of the world transforming around them. They disrupted the measured pace of historical narrative with their enthusiastic accounts of a persona who exemplifies change and daily invention. In this, they momentarily diverted attention from the seemingly endless round of royal births, deaths, entries, battles, and treaties of high politics. In the next section, we turn to the methodical art of travel, the *ars apodemica*, which encouraged the traveler to

³¹⁵ Frans Kessler, *Const-boeckxen. Daer in ghevonden wordeke, vier onderscheydelicke secreten* (Arnhem: J. Jansz., 1619).

³¹⁶ Baudartius, 146.

train attention upon all walks of life, both in order to study the structure of other societies and to reform their own.

V: Eye-witness Reports

Despite the new technologies for visual witnessing invented in the period, eye-witness reports were not necessarily preferred in all genres over authoritative citations. For example, as discussed further in Chapter Four, the Silesian John Jonston travelled to England, met Drebbel, and looked through microscopes with him in London. Yet he chose not to cast his account of Drebbel as an eye-witness report within his rhetorical *Constancy of Nature*, preferring to cite the frequently reprinted commonplaces concerning Drebbel already in circulation. In another genre which was devoted to the visual observation of the world - his vividly and realistically illustrated natural histories - Jonson did mention his personal acquaintance with Drebbel, recalling how he observed peacock-colored flies through the microscope with “the celebrated mechanic Drebbel.”³¹⁷

The ultimate genre devoted to visual observation of the world was a relatively new one in early modern Europe – the *ars apodemica*. As Justin Stagl has argued in the *History of Curiosity*, the *ars apodemica* represented a major development in the methodical survey of the world. Beginning in the mid-sixteenth century, travelers followed a Ramist programs of survey and collection, not only travelling to meet powerful men, see wonders, and sow wild oats, but methodically noting the customs, estates, administration, arts, and crafts of the cultures they encountered. As Stagl emphasized, although the art of travel was practiced

³¹⁷ See *Historiae Naturalis de Insectis Libri III* (Frankfurt: Merian, 1653), 67, “Variis depingi cancellatim quasi coloribus, pavonis instar, per microscopium apud celebrem illum mechanicum Drebellium Londini observavimus.” On John Jonston, see Miguel de Asua & Roger French, “The ‘Who’s Who’ of Seventeenth-Century Natural History: John Jonston and his Encyclopaedia on Animals,” *A New World of Animals: Early Modern Europeans on the Creatures of Iberian America* (Burlington: Ashgate, 2005), 203-9.

mainly by Central Europeans, the genre enjoyed a pan-European provenance, combining “German didacticism, Italian realism, and French methodology.”³¹⁸

Such traveler's reports accentuated personal encounters with the world, whether through conversation or observation. These reports foregrounded lived experience, to an extent which required the verisimilitude of eye-witness reports even when the composer of the report was but an armchair traveler. Martin Zeiller, for instance, never travelled to England, though he composed a travel itinerary, the *Itinerarium Magnae Britanniae*, based on such printed sources as Camden and van Meteren.³¹⁹ Travelogues thus, like portraits and drama, offered important and vivid depictions of various personae whether or not those depictions corresponded to lived reality.

Travelers designed these reports to enhance their own reputation upon their return home. A traveler's report displayed one as informed and educated about the world and able to bring that experience to bear in an active career in one's native land.³²⁰ Thus who and what was observed, and how much was invested in recording those observations serve to indicate what information was valued. The Ramist methodizers who developed the *ars apodemica* viewed government as a work of art which could be improved through informed expertise. Travel was a way of accumulating and concentrating information, which could then be turned again towards the reform of every aspect of society. As Theodore Zwinger, the authority on *ars apodemica* wrote, “as precious goods are transported from the whole world to the most famous emporia and are exported from the same competitively, so

³¹⁸ Justin Stagl, *A History of Curiosity: The Theory of Travel, 150-1800* (Chur, Switzerland: Harwood Academic Publishers, 1995), 70. See also Jill Bepler, *Ferdinand Albrecht, Duke of Braunschweig-Lüneburg (1636-1687): a Traveller and his Travelogue* (Wiesbaden: Harrassowitz, 1988).

³¹⁹ Bepler (1988), 33.

³²⁰ *Reisen und Reiseliteratur im Mittelalter und in der Frühen Neuzeit*, Xenja von Ertzdorff and Dieter Neukirch, eds. (Atlanta, Ga.: Rodopi, 1992). Lotte Kurras and Werner Taegert, *Axel Oxenstiernas Album Amicorum und seine eigenen Stammbucheinträge: Reproduktion mit Transkription, Übersetzung und Kommentar* (Stockholm: Almqvist & Wiksell, 2004).

treasures of wisdom and virtue of all types, which are diffused over the whole earth, can be brought together into a Republic (such as Plato wanted to be created in his book of that name) or into an Academy, or even into one church by the zeal of the travelers, and they can be recaptured from there, just as from a Trojan horse, so that by this type of reasoning clearly, travels may be to known to have considerable importance for every type of life.”³²¹

Zeal, “*studium*,” could be transferred from the culture of laborious reading to travel, where the same skills of notation and collection exercised by humanists in literary work could be trained upon the world, in an eye-witness survey of all things. The fruits of travel can be collected together as in a market, from whence the best goods can be exported again, improving “wisdom and virtue of all types.” Hard work, border-crossing, and collection in pursuit of future improvement were the hallmarks of the methodical traveler, just as they were signal characteristics of the invested, observant, and collecting *liebbeber*.

Travel also had its critics. The mercantilist political theorist Christoph Besold (discussed further in the next chapter), conceded that the argument could be made both for and against permitting the citizens of a well-constituted republic to travel.³²² In any case, casual travel was not advisable. In order for travel to be beneficial, the traveler ought to diligently observe the laws, mores, and ways of living of various peoples.³²³ He should

³²¹ Zwinger, 1577 *Praefatio*, translated by Stagl, 122. “Ut ergo è toto terrarum orbe preciosae merces in celeberrima convehuntur emporia & ex iisdem certatim evehuntur; ita omnigenae sapientiae & virtutis thesauri per totum universum disseminati vel in unam Remp. (quod Plato in sua fieri volebat), vel in unam Academiam, vel etiam in unam Ecclesiam, peregrinantium studio, convectae, inde rursus tamquam ex equo Troiano peti possunt, ut hac sane ratione peregrinationes ad omne genus vitae non exiguum habere momentum intelligantur.” Stagl suggests that the comparison to the Trojan horse suggests from the start a weakness at the heart of the genre. This reading does not hold, however, as the Trojan horse was a wide-spread and time-honored metaphor for a very compact container of wonderful things, and in this use did not suggest deception or tragedy.

³²² Christoph Besold, “Discursus Politici Singulares, De Informatione et Coactione Subditorum,” in *Operis Politici Editio Nova* (Strassburg: Zetzner, 1626), 30. “STUDIIS literarum, succedat inspectio studii *Peregrinandi*: ubi primo omnium dispiciendum erit: an in benè constitutâ republicâ, civibus, ut peregrinationes suscipiant, permittendum sit? quâ de re in utramque partem variè disputari potest. . . .”

³²³ *Ibid*, 31. “Verum necessarium est, Statum unius cuiusque rei publicae officia, modum vivendi, leges, mores, naturasque populorum, quàm diligentissimè perspexisse.”

prepare for his travel by reading about the methodical art of travel in authors such as Zwinger, Rantzau and Loysius, and by bringing along accurate descriptions and itineraries of the various regions he planned to explore.³²⁴ Indeed, according to Loysius only such serious, methodical travel could be termed “peregrination.”³²⁵ Peregrination was the study of foreign lands taken up for the purpose of acquiring those arts which could benefit the *res publica*. Only diligent observers who undertook their travel with utility in mind could properly be termed travelers.

The economic theorist Jakob Bornitz exemplified the experienced advisor formed by his travels. As Bornitz described his career, “when I had bid farewell to the life of study and methodical travel (*Academicae & Apodemicae vitae*), I was called to the Saxon court in Thuringia; Lusatia & Silesia called me back again, until the Emperor Rudolph unexpectedly placed me in charge of the legal protection of the imperial exchequer and honored me with the title of Counselor, in which office I showed such faith and industry, that the great Emperor Mathias generously confirmed me in that same position. . . .”

³²⁴ *Ibid.*, 32. “Ac de peregrinatione ritè instituendà, vide Zvvingeri, Rantzovii, & Georg. Loysii, methodos apodemicas, Iulii item Belii Hermetem Politicum. Hilar. Pirckmaier. *Commentariol. de arte apodemica.* et Hieron. Turlerum. Iuvat habere descriptiones exactas, et itineraria earum regionum, in quas destinavimus peregrinationem. Inprimis praestat Bellonus, Villamont, (qui Palaestinam et Orientales regiones) Pighius, Shottus, Heinrich Schickhardt. Henr. A Pflaunen. (qui Italiam) Zinzerlin. (qui sub nomine Iodoci Sinceri Galliam) Henznerus & Neumayer, à Ramsla/ qui totam ferè Europam descripserunt.” Heinrich Rantzau (1526-1598) was the councillor of the Danish King in Schleswig-Holstein. According to Justin Stagl, his work was more the product of the mathematician, astrologer, and alchemist Albert Meier (1528-1603). See Justin Stagl, *Apodemiken: Eine räsonnierte Bilbiographie der Reisetheoretischen Literature des 16., 17., und 18. Jabrhunderts* (Paderborn: Ferdinand Schöningh, 1983), 72. Stagl calls the work of Theodore Zwinger (1533-1588), professor of Medicine at Basle, the most important early theory of travel. Zwinger, he says, was recognized as the founder of the field until the eighteenth century, and based his work on the method of his friend and teacher Petrus Ramus. See Stagl, 106.

³²⁵ Georg Loysius, *Pervigilium Mercurii* [in the edition published with the *Itineraria* of Hegenitius and Ortelius] (Leiden: Verbiest, 1667), 220. Est autem peregrinatio nihil aliud quam *studium perlustrandi terras exoticas, & insulas, ab homine idoneo suscipiendum, ad artem vel ea acquirenda, quae usui & emolumento patriae vel Rei esse publicae possunt.* Talem peregrinarum regionum perlustratorem & diligentem earum rerum observatorem, qui suam peregrinationem non temeritate, sed utilitate motus instituit, Peregrinantem appellare licebit.

Bornitz considered the methodical art of travel to be central to the well-conducted *res publica* itself.³²⁶ As he wrote in 1602, politics was an art which could not be deduced from antique laws, but had to be learned empirically. This was because modern man was not merely a degenerate form of ancient man; rather just as nature constantly produced novelties, human *ingenium* too was on the rise. How far the moderns have outstripped the ancients could be proven through the comparison of ancient and modern inventions collected by Pancirolli (the author Baudartius also mentioned).³²⁷

The political artisan (“*Artifex Politicus*”) must therefore turn not to general laws, but to the particulars gained from experience. He must depend upon the four sources we have of particular experience – the examples to be gained from history, from the reports of diplomats, from peregrination, and through the practice of the political art itself.³²⁸ Bornitz continued to discuss these four sources at length, offering his own very lengthy list of observations that diplomats should include in their reports. Bornitz recommended that travelers follow the *Methodus Apodemica* of Zwinger and Rantzau in their political

³²⁶ Bornitz offered his own *vita* in the dedicatory letter of his *De Instrumentis* (Dresden: Seiffert, 1625). “*Me Torgae natum, cūm Academicæ & Apodemicae vitae valedixissem, aula Sax. in Thuringiam avocabat; Lusatia & Silesia revocabat, donec D. Imp. Rudolphus praeter spem & expectationem, Patrocinio Fisci regii praeficeret & Consilarii titulo ornaret, in quo officii genere, fidem & industriam pro virili praestiti, ut D. Imp. Mathias augustissimus, idem munus mihi clementissimè confirmaret. . . .*”

³²⁷ *Discursus Politicus de Prudentia Politica Comparanda* (Erfurt: Birnstilius, 1602), unpaginated [37]. “*Haud tamen opinio alicujus et autoritas adeo valitura sit, ut rationem vincat et experientiam, neque credendum, a tot saeculis humanum ingenium fuisse effoetum, quin etiam quaedam adinvenerit, aut veterum monumenta in melius redegerit. Etenim, cum natura deproperet edere novas formas, ubi experientiâ compertum est, quis est, qui non videat maximum defectum in antiquioribus authoribus reperiri; ut eorum doctrina neque disciplinae civili. neque militari hodie satis sit. Est enim naturae et humani ingenij aeternum incrementum, quod ex collatione inventorum pristini et hujus aevi, de quibus Pancirolus eleganter, liquido constat, ut nostra longe anteferri veteribus videantur.*”

³²⁸ *Ibid.*, [63]. *Cum enim generalia praecepta, prudentiam, quae in singularibus versatur, vix pariant, certum est eandem ex ijs fontibus, qui singulares exemplorum rivulos suppeditant, hauriendam esse, quales sunt: Historia et experientia. Vt enim Historia omnium exemplorum et Rerumpublicarum imagines proponit, ita Experientia ipsa exempla et Resp. in Peregrinatione et Praxi sensibus ipsis subijcit. Historijs aequiparantur Relationes. Vnde quasi quatuor modi, Historia, Relationes, Peregrinatio et Praxis existunt, in quibus usus artis civilis ad prudentiam comparandam continetur, de quibus nunc ordine, quantum instituti ratio exigit, dispiciemus.*

observations, as well as noting “naturalia, medica, mechanica, etc.”³²⁹ The facts (*facta*), speeches, and counsels observed by the political artisan should be collected within a well organized commonplace book, which would readily offer up examples to be put into practice.³³⁰

In England, Francis Bacon gave similar advice as the Ramist methodizers of travel in his essay, “Of Travaile.” Travelers should be diligent note-takers. “It is a strange Thing,” remarked Bacon, “that in Sea voyages, where there is nothing to be seene, but Sky and Sea, men should make Diaries; But in *Land-Travile*, wherein so much is to be observed, for the most part, they omit it; as if Chance were fitter to be registred, then Observation.”³³¹ Not only should diaries be kept, but the items to be observed – such as courts, stock exchanges, and cabinets of curiosities – should be determined in advance.³³² Bacon even proposed that the traveler should carry with him one of the “cards” that Ramist methodizers devised,

³²⁹ *Ibid*, [112]. “In quibus observationibus politicis, ut quis ordine progrediatur, consultum est. Methodum politicam in conspectu habere, quae singulis capitibus indicat, quid in quaque Republ. inquirendum & notandum, ut supervacuum videatur, singularem rationem apodemiam, qualem Ranzovius, & Zuingerus delinearunt, adsciscere, nisi ejus ductu, & in alia praeter politica, puta naturalia, medica, mechanica, &c. inquirere, quis velit.”

³³⁰ *Ibid*, [132]. “Cum enim in tanta rerum copia omnium memoriam tenere non mortalitatis, sed divinitatis sit, necesse erit politicae prudentiae cupidum, apparatus locorum communium in promptu habere, quos secundum seriem artis civilis, cujus capita quaedam supra attigimus, disponet, eorumque ductu quaevis digna observatu, sive facta, dicta, sive consilia & instituta, &c. suis domiciliis congeret, ut quando opus fuerit, in usum communem, veluti ex Promptuario copiam exemplorum politicorum depromere queat.”

³³¹ Francis Bacon, *The Essayes or Counsels, Ciuill and Morall, of Francis Lo. Verulam, Viscount St. Alban* (London: John Haviland, 1625), 100-4.

³³² *Ibid*, 101-2. “Let Diaries, therefore, be brought in use. The Things to be seene and observed are: The Courts of Princes, specially when they give Audience to Ambassadors; the Courts of Justice, while they sit and heare Causes; And so of Consistories Ecclesiastick: the Churches and Monasteries, with the Monuments which are therein extant: the Walls and Fortifications of Cities and Townes, and so the Havens and Harbours; Antiquities, and Ruins; Libraries; Colleges, Disputations, and Lectures, where any are; Shipping and Navies; Houses and Gardens of State, and pleasure, near great Cities: Armories: Arsenals: magazens: Exchanges: Burses: Warehouses: Exercises of Horseman-ship; Fencing; Trayning of Souldiers; and the like: Comedies; such whereunto the better Sort of persons do resort; Treasuries of Jewels, and Robes; Cabinets, and Rarities: And, to conclude, whatsoever is memorable in the Places; where they go.”

which collected under different *loci* or headings the various items to be observed in travel, or a printed itinerary.³³³

These diligent observers themselves wrote accounts, which, whether manuscript or printed, were intended for a wide audience. The content of these accounts was thus chosen to reflect both upon the reputation of the observer and the wants and needs of his audience.³³⁴ For instance, the minor Bohemian nobleman Jindřich Michael Hýzřle z Chodů or Heinrich Michael Hiesslerle von Chodau (1575 – 1665), recorded his travels (including his many visits to fine collections and *Kunstkammern*) in both Czech and German.³³⁵ Z Chodů devoted over three pages, including a beautiful illustration, to his eye-witness account of Drebbel's presentation of his perpetual motion to King James I.

Z Chodů described Drebbel as “a very rude fellow in appearance” (“na hledění velmi sprostnej člověk,” “gahr schlechter Mann anzusehen”), yet both he and the King were suitably impressed by what he had to offer. Drebbel appeared before the King while James was lunching, fell upon his knees, and, addressed the King. He promised the King the discovery of the perpetual motion. King James questioned Drebbel closely, and Drebbel pulled his little perpetual motion out from underneath the cloak of his servant. He suggested that it be kept secluded for as long as one wanted to see if its motion did indeed continue on its own. The King ordered Prince Henry to keep it in his cabinet, where after

³³³ *Ibid*, 102. “Let him carry with him also some Card or Booke describing the Country, where he travelleth; which will be a good Key to his Enquiry.”

³³⁴ Jill Bepler, “Travelling and Posterity: The Archive, the Library, and the Cabinet,” *Grand Tour: Adeliges Reisen und Europäische Kultur vom 14. bis zum 18. Jahrhundert* (Ostfildern: Jan Thorbecke Verlag, 2005), 191-204.

³³⁵ *Život, v němž se obsahují některé jízdy a tažení, které sem já, Jindřich Hýzřle, svobodnej pán z Chodů, činil. Též způsob všebo života mého, co sem sobě od dětinství svého pro pamět rodu svýmu, dědicům a budoucím mejm poznamenával a do těchto kněh svou vlastní rukou vepsal a figurami ozdobil dal. Léta Páně 1614.* See Czech National Archives (Národní archiv 1, M. Horákové 133, Prague 6), Ms. A 215. Published, with a Czech translation of the German version, as *Příběhy Jindřicha Hýzřla z Chodů*, Věra Petráčková and Jan Vogeltanz, eds. (Prague: Odeon, 1979). The German version, *Raif-Buch und Leben, darinnen begriffen, was ich Heinrich Hiesslerle von Chodau, seider vom aifftten Jar meines Alters, als de Anno 1586 angefangen und gefüret, somit Figuren hiebeineben gezieret, unndt jetzť new abgeschrieben worden im 1612*, (National Museum, VI A 12), which does not identify Drebbel by name, has been noted by previous Drebbel scholars. See Jennifer Drake-Brockman, “The Perpetuum Mobile of Cornelis Drebbel.”

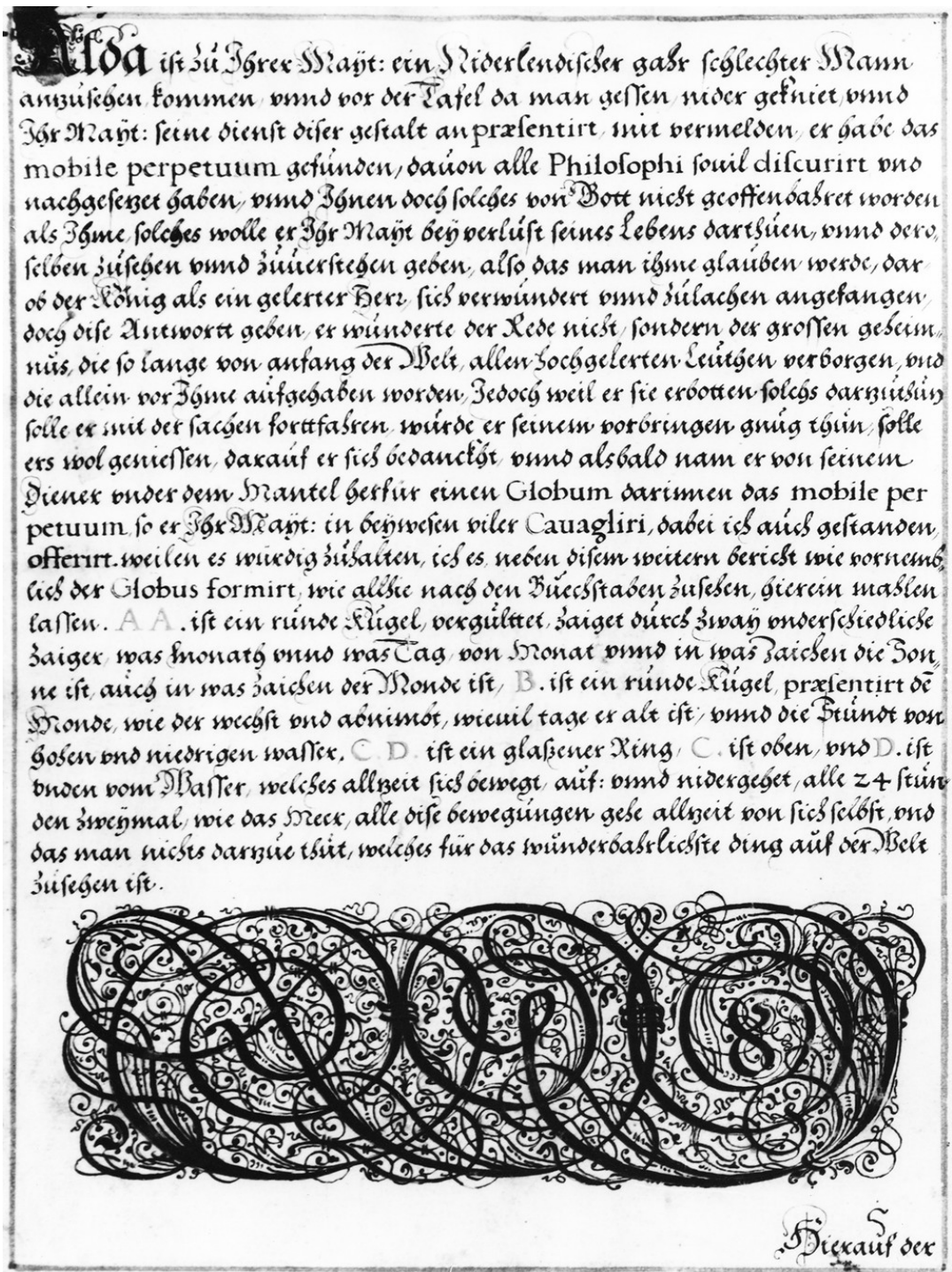


Fig. 12a. Czech National Museum in Prague (Knihovna Národního muzea v Praze), VI A 12, 48v.

Hierauf Jone der König fragte, was für ein Wasser in dem Crystall were
 antwortet er es were ein gemeines Wasser, wol gesalzen, damit es nicht verder-
 den solle, der König fragte weiter, was dem Wasser vnd Himlischen gestirn, macht den
 Fortgang haben, da antwortet er, das dasselbige were, das mobile perpetuum, &
 welches darinnen in offendarer Kunst verbergen ligt, vnd vorhanden ist, so des alles
 mouirn macht, vnd Ihr Mächt: sollen alle Philosophi kommen lassen, die sollen
 hierüber studiren vnd speculiren, vnd zusagen, wohero die macht kombt, vnd
 was das mobile perpetuum were, wolte auch dasselbe so bald nicht offenbaren,
 allein Ihr Mächt: sollen das verpetchiren, vnd einschliessen so lang sie wollen, da-
 mit kein Mensch dartzu könte würden, Sy sehen, das es einen stetigen Fortgang ha-
 ben soll, da fragt ihn der König weiter auf wie lang, gab er die Antwort, so lang
 die Welt stehet, oder so lang mans nicht zübricht, Der König fragt noch weiter durch
 was macht das mobile perpetuum sein macht gett, gab er kurze Antwort vnd
 sagt die Lüfft welches das vornehmste Element ist, vnd alle Sachen beweglichen
 macht, Hierauf fraget abermals der König, ob das mobile zu was anders nütz:
 vnd dienstlich were, Darauf er auch Antwort gab, es seye nütz vnd dienstlich
 zu allen Sachen, vnd er wolle das zu einem Monstro dem Zungen Dringen ein
 Instrument machen, welches so lange wehret weil die Welt stehet, soll allein in
 der Nacht von dem Mond musicirt werden, vnd das ander öch Tage von der Son-
 nen, dasselbige solle so lang schlagen als mans gehen leset, Item einen Pflug wol-
 le er auß Feldt stellen, der soll sich von dem ackern nicht zürwegen, auch eine Müg-
 le ohne verley, weil die Welt stehet, Hernach wird er auch gefragt, ob er das Was-
 ser ohne Instrumenta einführen könte, wo er wolte, sagt er Ja, ein fließendes Was-
 ser wolte er über den höchsten Berg, ohne einiges Instrument fügen, vnd wolle Ihr
 Mächt: man sie wollen offenbaren, doch mit seinem profita, vnd werden Ihr Mächt:
 sehen, das kein betrug darinnen, seye allein natürlich wesen, vnd die Jone allein
 von Gott gegebene gnad. Hierüber sich der König hoch verwündert, derowegen das
 mobile perpetuum auf Lounden in sein palatium führen lassen, vnd dem
 Zungen Dringen beuoglen, solchs selbst mit seiner eignen Hamd in seine Camer
 züverpetchiren, vnd einschliessen, welches auch geschah. **N**ach 2. Mo-
 naten da der Progres aus war, kam der König auf das mobile zusehen, ob es fort-
 geget oder stehet, hat er gefunden, das es vnuerlegt seinen Fortgang mit dem Was-
 ser in dem Crystall, wie die Marina die zu London fürfließt, ab vnd zünimbt, eben-
 messig auch das Gestirn, die Sonne, der Mond, Stern vnd alle Planeten in dem
 Globo gleicher gestalt als am Himmel, darüber sich der König hoch vnd sehr ver-
 wündert vnd nicht nachgelassen von dem Mann, solches wo es herkomme zu
 erforschen

Fig. 12b. Czech National Museum, VI A 12, 49r.

^S Zuerforschen, derogalben er alsbaldt vmb Igne geschicket, vmb von demselben
 genugsamer bericht dem König gegeben worden, deme dan der König geglaubet
 vnd vermeldet, das er dis in einem solchen Menschen nie gesüchet, es würde auch
 am ganzen Hofe erschollen, das dis mobile perpetuū dem König in effectu ge-
 zaiget worden, Mein meinung ist, das derselbe dem Könige geoffenbaret doch
 mit Condition, das solches verschwigen behalten werden möchte. — Also vil
 was ich in presente von dem mobile perpetuo gehört vmb gesehen habe.

Weill Ich aber an dem Hofe Vier ganzer Monath zugebracht, vmb von Ih
 Majt: mir alle Ehr vmb gnad auch von dem ganzen Hofe widerfahren, habe
 Ihr Majt: ich das Kleid bis gen Hamdencurt geben, vmb alda von Ihr Majt:
 vrlaub genommen, vmb mit disen Worten in Italianischer Sprach gegen Ihr
 Majt: aller empfangnen Ehr halber bedanckt. *Vn*edigster
 König vmb Herr, Ich habe nicht vnderlassen können vor meinem abraisen Eür
 Majt: züvor einen Demütigen Fußfall züthun, vmb aller empfangener gnade
 so ich von Eür Majt: vmb deroselben Hofe, vnüerdienter weise empfangen habe
 mich gehorsamblich zübedanken, welches mich hoch verobliget, wils Gott wider
 an Eür Majt: Hof züthun, vmb solche empfangene gnad weiter züüerdienen,
 thue mich also in Eür Majt: gnad ganz gehorsamblich vmb Demütig empfehlen.
 Viele darauff Ihr Majt: zü den Füßen, da alsbaldt mich der König, z. mal in sei-
 ne Arm umbfieng, zöbe seinen Hüet ab, vnd sagt in der französischen Sprach dan-
 er in welcher Sprach nit wol genöt, Wir sein eüch nit aller gnad wol gewogen, vnd
 thun vmbß bedancken ewres dienstis, vmb wann Ihr andero gelanget, sollet Ihr
 allheit willkommen sein, darauff Ich meinen Abschied auch von allen Cauaglien
 Hornemblich von dem Landgraf Friderich von Hessen, welchen Ich zü meiner an-
 küfft alda am Hofe gefünden, von demselben Ich ein Recommendation an sei-
 nen Herrn Brüder Landgraf Ludwigen Regirunden Herrn genommen, vnd mei-
 ne Reis nach Seelandt vff dem Meer nach Flissingen genommen vmb angestelt.
 Dabin raitz man von London zumeil 100. Dieselben bin ich in 24. stunden
 geschicket, aber grossen Sturm erlitten, das vns zü saluren wenig hoffnung gewesen.
 Der Patron de la Naue franckh vmb selbst in schwacher hoffnung gestanden, gab-
 en müssen die Segel vmb den Segelbaum abschneiden, den Timon anbinden vnd
 das Schiff also die Wellen treiben lassen, vmb vns Dort beuögleu, welcher vmbß
 dennoch in den Porto zü Flissingen eingetrieben, also das sich meniglichen darob
 verwündert, das sich das Schiff noch erhalten vnd dauon kommen, wie hernach
 volgt.

Daum Ich

Fig. 12c. Czech National Museum, VI A 12, 49v.

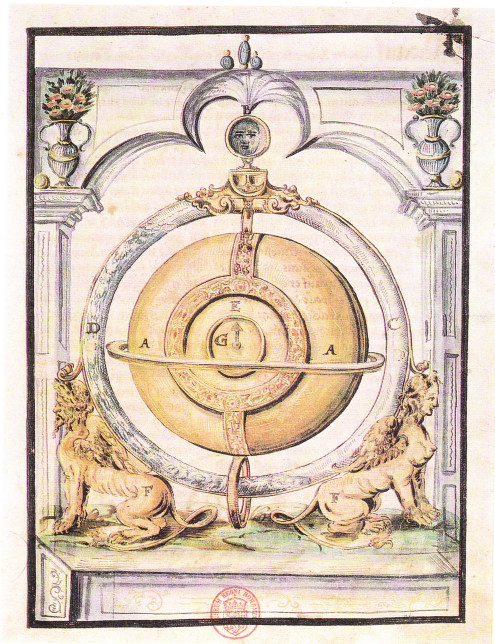


Fig. 12d. Czech National Museum, VI A 12, 50r.

91 H. M. Hieselerle von Chodau, Reiß Bach vnd Leben. Angeblich 1612, faktisch später (Kat. 438)

two months, it was found indeed to still be moving.³³⁶ In the Czech version, Z Chodů also specifies that Drebbel did indeed build the musical instrument he said he would when he was in the service of Rudolf the second; although Z Chodů himself didn't see it, many others did.³³⁷

We see another example of the attention to and respect for mechanics accorded by some Central European noblemen abroad in the travel account of Hertzog Ludwig Friedrich of Württemberg. Despite the attention to all social states inherent in the *ars apodemica*, there

³³⁶ The German and Czech versions of these events are largely identical. The order of events differs slightly, and the Czech version includes more details, particularly names. In the German version, Drebbel is described only as a "Netherlander." In the Czech version, he is a Hollander named Cornelius, and the perpetual motion he presents to the King is described as made of brass and set in an ebony case ("to mobile perpetuum v ebenovým dřevě vsazený a z mosazu udělaný" versus "einem Globum darinnen das mobile perpetuum"). Drebbel declared that all other philosophers searched for the perpetual motion and failed; in the Czech he also claimed that even Aristotle couldn't find it, though he went mad looking for it ("ano sám Aristoteles nemohší toho zpytovati, nad ním se zbláznil"). The Czech version concludes with King James thanking God that he has lived to see this art ("umění"). "Jistě sem takového velikého zpytování a tak velikého umění a od Pána Boha vyjevení u tak prostého člověka (na pohledění) nehledal ani se nenadál. A v pravdě tak jest, že on mobile perpetuum našel a jemu od Pána Boha jest tak veliká věc k umění a udělání jest dána." We hear of the same speech in Johann Rist's account of the perpetual motion (discussed further in the next chapter). Johann Rist, *Die Aller Edelste Tobrheit Der Gantzen Welt* (Hamburg: Naumann, 1664), 144. ". . . wie denn allerhöchstgedachter König Jakob über dise des fürtreflichen Drebbels wunderseltzamer Erfindung sich dargestalt erfreuet das Er auch Gott von Herten gedaneht der Jhn den Tag erleben lassen das Er solche fast Himmel gleichende und überaus schöne und anmuhtige Dinge mit seinen Augen hat ansehen mügen wie denn von disen sehr schönen und Sinnreichen Erfindugen."

³³⁷ "Jakož pak tomu i zadosti učinil a takovej instrument udělal, kderého sem já však neviděl, neb sem tu tak dlouho nevostal, ale od lidí potom, kdeří jej viděli, sem toho jistou zprávu i od něho samého (když k císaři Rudolfovi přijel) vzal."

was still a stigma against noblemen writing their own travelogues. What was acceptable for a minor nobleman such as z Chodù was not appropriate for a Duke such as Ludwig Friedrich. The travel account was therefore composed, as was typical, by the Duke's secretary Jacob Wurmsser v. Vendenheim.

The Duke, on a visit to London, went far out of his way to Eltham to see the perpetual motion machine of Cornelis Drebbel. He was extremely impressed with its inventor, whom his secretary described as, "of a very gentle fashion, completely unlike characters of his sort." It should be noted that the attention Ludwig Friedrich paid to visiting a mechanic such as Drebbel was equaled only in his visits to artists such as Hendrik Goltzius, who had formed Drebbel in his early education.³³⁸ The artistic claim to a liberal status dating back to the Italian Renaissance was now extended to inventors of Drebbel's "sort."³³⁹

Like z Chodù, Wurmsser also visited famous collections, such as that of the doctor Paludanus' collection at Enkhuisen ("ou elle a veu choses fort rares et admirables"). As themselves products of travel, collections were important destinations for travelers.³⁴⁰ Visits to collections were themselves "collected," since they proved a connection to individuals who, by dint of being famous collectors, were well connected.³⁴¹ Bornitz, for example,

³³⁸ Jacob Wurmsser v. Vendenheim, British Library Ms. 20,001, *Beschreibung des Reysss so mit dem Hertzog Ludewigh Fridrich zu Wurtenburg*. On Tuesday the first of May, 1610 (9v). "S.E. alla au parc d'Elthon pour veoir le perpetuum Mobile, l'Inventeur s'appelle Cornelius Trebel, Natif d'Alkmar homme fort blond et beau et d'une tres douce façon tout au contraire des esprits de sa sorte, nous y visme aussy des espinettes quie Jouent d'elle mesmes." On Sunday, June 10, in Haarlem (16r), "S.E. alla aussy chez ceuls premiers mr peintres de l'Europe comme Henry Goltzius, Cornelius Corneli, Henric Troom et Jansztoon Zittersen duqell elle accepta une jolie piece," and on Thursday the 25th, (16), "S.E. alla voir le grand Mr. Peintre Jacques de Gejn ou elle vit des pieces admirables."

³³⁹ On the efforts of artists such as Goltzius to assume a status within the liberal arts by reference to an encyclopaedic ideal, see Thomas DaCosta Kaufmann, "The Eloquent Artist: Toward an Understanding of the Stylistics of Painting at the Court of Rudolf II," *The Eloquent Artist: Essays on Art, Art Theory and Architecture, Sixteenth to Nineteenth Century* (London: Pindar, 2004), 33-70.

³⁴⁰ Stagl, 113.

³⁴¹ Swann, *Curiosities and Texts*.

boasted of his admittance to Paludanus' collection.³⁴² Paludanus' microcosmic collection served as a condensed form of travel; as the Imperial councilor Tobias Scultetus wrote on the page of Paludanus' inscription in the album of Joachim Morsius, all the contents of the world were contained in one house by Paludanus.³⁴³

Drebbel's perpetual motion, as itself a microcosm, could serve the same purposes, especially when installed in the royal palace at Eltham. Johann Ernst Burggrav was one of many travelers who visited Drebbel at Eltham. After he had read Drebbel's *On the Nature of the Elements* in its first edition, he sought out Drebbel in England, entering into an intimate friendship and commerce with him ("in vertrauwliche Freundt: und Kundschaftt gerahten") as he recounted in the preface to his 1628 German edition of Drebbel's work. Burggrav described him as "a very experienced man in that more secret (rather than the trivial) philosophy, who has gained great credit with his Imperial Majesty Rudolf the Second and with King James in England, with many other Lordships and persons of high estate, due to his great understanding in secret philosophy and alchemy." Burggrav went to see Eltham palace, where Drebbel was "liberally" maintained by King James. There, among other philosophical machines, he saw Drebbel's globe, "in which the natural movement and course of the heavenly firmament just as in the microcosm can be seen and sensed visually as though in a mirror."³⁴⁴ Drebbel's perpetual motion fulfilled a fantasy of universal autopsy;

³⁴² Jakob Bornitz, *Tractatus de Rerum Sufficientia* (Frankfurt: Weiss, 1625), 229. "Et in aedibus Paludani Medici Endici Enthusani, ob studium rerum exoticarum celeberrimi qui mihi presenti ad illa facilem adytum faciebat."

³⁴³ Morsius, *Album*, Lübeck Ms. 4a hist 25, 4, 874. "Quod mare, quod tellus, quod totus denique mundus/ Cuncta PALUDANI continet una domus." Note that in his discussion of Paludanus' collection in his *Itinerarium*, Hegenitius ascribed this poem to Hippolytus à Collibus, the ambassador of the Elector Palatine. The next poem on Paludanus' collection that appeared in Morsius' album labeled "Anonymous" was ascribed by Hegenitius to Scultetus. See Hegenitius, *Itinerarium* (1667), 31.

³⁴⁴ See Burggrav's preface to Drebbel's *Ein kurtzer Tractat von der Natur der Elementen* (Frankfurt: Röteli, 1628). "Dieser Cornelius Drebbel/ mit welchem ich hernacher in Anglia, in vertrauwliche Freundt: und Kundschaftt gerahten/ ist in secretiori illa, non triviali Philosophia, ein hocherfahrner Mann/ und bye Keyserlicher Majestat Rudolpho Secundo, unnd Jacobo Konig in England/ auch viel andern HerrenStandts und HohenPersonen/ wegen seines in der geheimen Philosophia & Chymia hohen Verstands und Wissenschaftt in grosem Ansehen gewesen. Unter andern philosophischen Technurgematis; hab ich in England bey ihm in dem königlichen

the structure of the heavens, which could otherwise only be reasoned about, was now open to direct inspection in one compact container as though in Zwinger's "Trojan horse."

Burggrav describes the sphere as having a hollow glass ring, in which there was a sky-blue liquid which travelled back and forth with the tides every six hours, which was a wonder to see. At this point, Burggrav's eye-witness account ended, and he continued to cite, in Latin and at length, the many classical sources concerning the Archimedean sphere, which can be compared to Drebbel's.

Burggrav defended Drebbel's reputation as a traveler, or at least defended him from the suggestion of Marcel Vranckheim that Drebbel was not a traveler. In circa 1608, Burggrav gave an account of Drebbel's perpetual motion in a letter to his friend Vranckheim. Vranckheim replied with a lengthy letter on the wonders of Drebbel's invention and that of other contemporary Netherlanders. This letter enjoyed quite a career (described further in Chapter Five), and was printed by Burggrav himself in various editions of his work on his "blood-lamp." Burggrav appended notes to Vranckheim's letter in later editions. Burggrav employed these notes to defend Drebbel against Vranckheim's suggestion that Drebbel stood opposed to travel in the pursuit of natural philosophy.

Vranckheim wrote that in order to pluck the spirit of the world (which Burggrav claimed served as the engine of Drebbel's machine) from the temple of Nature, the ancient sages "Democritus, Pythagorus, Plato, and Apollonius travelled to the Brahmans, the Gymnosophists and the columns of Hermes." Vranckheim referred to the legendary lost columns of Hermes. These columns represented the *prisca sapientia* in its original and

Schloss Althan/ da er von höchstgedachten König liberaliter unterhalten worden/ ein globum, oder sphaeram gesehen/ darinn die natürliche Bewegung unnd Lauff dess himmlischen Gestirns und Firmaments/ gleich wie in Macrocosmo, als in einem Spiegel augenscheinlich zu spüren und zu sehen gewesen. Selbige Sphaeram hat ein gläsern holer Raiff/ darinn ein himmelbaluwer liquor gewesen/ umbfast und umbgehen/ welches Wasser mit dem aestu, seu fluxu & refluxu Oceani, naturali motu, alle sechs Studen auff und abgeflossen/ welches mit Verwunderung anzuschauwen gewesen."

complete state, the longed-for universal knowledge of the ancients.³⁴⁵ As Ficino recounted in his translation of Iamblichus, Hermes had discovered everything and recorded his knowledge in his books. Plato and Pythagorus had drawn all their philosophy from the columns of Hermes in Egypt.³⁴⁶ They were now among the longed-for *deperdita* (lost writings) of Hermes.³⁴⁷ Drebbel, unlike the ancient sages, did not have to go seek out this knowledge from another source, however venerable. He discovered (*invenit*) this complete lost knowledge “alone in his own four walls.”

In his marginal gloss, Burggrav re-interpreted this statement into a metaphor for Drebbel's use of machines in natural philosophy rather than the bare exercise of intellect. The ancient philosophers refused to direct their philosophy toward such operational ends (*operationes hujusmodi & finem ceremonialem*) “lest they imprison great men in too narrow a compass.” They only oriented their philosophical exercises toward the bare, unconfined intellect. Thus, Burggrav interpreted Vranckheim's statement to reflect Drebbel's respect for a vernacular, artisanal philosophy, based “within his own bounds” (*in suo vel confini*), suggesting that these bounds were social and epistemological rather than geographical. Taken in Burggrav's sense, Drebbel in fact exceeded bounds more than the ancients by bringing together the disparate spheres of machinery and philosophy.³⁴⁸

³⁴⁵ On the columns of Hermes, see Walter Stephens, “Livres de haulte gresse: Bibliographic Myth from Rabelais to Du Bartas,” *Modern Language Notes* 120:1 Supplement (2005), 67. On the similar myth of the columns of Seth, see Nick Popper, “Abraham, Planter of Mathematics: Histories of Mathematics and Astrology in Early Modern Europe,” *Journal of the History of Ideas* 67:1 (2006) 87-106.

³⁴⁶ Iamblichus, *de Mysteriis Aegyptiorum, Chaldaeorum, Assyriorum* (Lyon: Tornaesius, 1570), 5, “De cognitione divinorum.” “Aegyptii scriptores putantes omnia inuenta esse à Mercurio suos libros Mercurio inscribebant. Mercurius prae est sapientiae, & eloquio. Pythagorus, Plato, Democritus, Eudoxus, & multi ad sacerdotes Aegyptios accesserunt. Dogmata huius libri sunt Assyriorum & Aegyptiorum, & ex columnis Mercurii. Pythagoras, & Plato didicerunt philosophiam ex columnis Mercurii in Aegypto. Columnae Mercurii plenae doctrinis.”

³⁴⁷ D. G. Morhof, *Polyhistor* (Lübeck: Petrus Böckmannus, 1747), 88, and J. A. Fabricius, *Bibliotheca Graeca* (Hamburg: Christain Liebezeit, 1720), 72-4. Fabricius listed them under the rubric of “Deperdita.”

³⁴⁸ Burggrav's marginal notation is critical of Vranckheim's view. *Biolechnium seu Lucerna* (Frankfurt: Fitzer, 1629). “. . . cuius è Naturae Adytis eruendi gratia prisci Sapientiae Dictatores, Democritus, Pythagoras, Plato, Apollonius, ad Brachmannas, & Gymnosophistas, & Hermetis columnas comigrarunt. Homo Batavus in suo

Of a different social status himself than z Chodù or the Duke, Johann Ernst Burggrav stressed Drebbel's great credit among royalty and aristocracy, and his own efforts to engage Drebbel in social commerce. Burggrav also mentioned the wearying labor of his travels with a frequency which is itself tiresome, yet he noted too the labor of those of much higher social status, particularly in the pursuit of alchemy.

Burggrav admired the labor, effort, and work ("Fleiss Mühe und Arbeit") of German potentates, who were themselves "industrios cultores" of alchemy, in setting up court and city pharmacies, and in having alchemy introduced into their academies. In his travels through many German cities, as well as England, France, and the Netherlands, he had also witnessed the serious desire and labor ("Ernst Begierd und Fleiss") of magistrates and princes, counts, and lords in organizing public pharmacopiae. Not only potentates, but also philosophers, physicians, theologians, lawyers, and politicians, have allowed themselves to fall in love with alchemy ("das studium Chymicum . . . ihnen belieben lassen").

Burggrav himself invested labor, effort, and work ("Fleiss Müghe und Arbeit") in his study of ancient authorities, in visiting native and foreign academies, and with travels lasting nine years, so that he might gain "experientz" in Medicine. He has not spared any labor, effort, danger nor expense ("Fleiss, Mughe, Gefahr, noch Unkosten") in his peregrinations, and has visited many Nations, and people of high and low social rank ("hohen und niederstands Personen"), whose Medical and chymical persuits he has observed with labor ("mit Fleiss"), collecting their medicinal recipes and testing them on many sick people.

vel confini solo invenit. [margin: Qui veterum philosophorum, ad nudum intellectum dispositas putat exercitationes, non ad operationes hujusmodi & finem ceremonialem, nimis arcto & angusto vado augustos viros includit]."

Furthermore, he stood willing to communicate all this to the “Medical Republic of Letters.”³⁴⁹

Margaret Jacobs has stressed the place of alchemy in the history of cosmopolitanism, pointing to the many adepts who chose the name “cosmopolite” to symbolize their universal quest for a universally desired object.³⁵⁰ Due to her overall emphasis on civility, reason, and control leading to the Enlightenment, Jacobs discussed cosmopolitan alchemy as a development of western Europe, and England in particular.³⁵¹ Yet cosmopolitan alchemy owed much to Central Europe, not only as the most active area of alchemy in general, but as the arena where alchemy entered the academy. The importance of academic alchemy cannot be overemphasized in the development of new attitudes towards openness in alchemical letters, including the emergence of an alchemical printing industry and the merging of humanist and alchemical ideals and practices (as discussed further in Chapter Seven).

³⁴⁹ Johann Ernst Burggrav's preface to Balduin Clodius, *Officina Chymica* (Frankfurt: de Bry, 1620). “Ebenmassig hab ich in meiner Reiss in vielen Reichstatten in Teutschland wie auch in Engelland Franckreich und vornemsten Provintzien der Niederlanden gespuret und befunden dass daselbsten mit sonderlichem Ernst Begierd und Fleis der Magistraten und Obrigkeiten die Chymica Medicamenta in die offentliche Officinas Pharmacopaeorum angeordnet worden. Welchs auch noch fast in aller vornemmer Fursten Graffen und Herrn Hofen observirt eirt. . . . hochehrfahner Philosoporum, Medicorum, ja wol auch etlicher vornemmer Theologorum, Jurisconsultorum und Politicorum, welche das studium Chymicum zur Lust und Frewd wie auch zum helsamen Gebrauch und Nutz in der Artzney ihnen belieben lassen. . . . Als hab ich nach dem ritu & instituto Majorum ich meine studia Philosophica und Medica, ex fundamentis Aristotelis, Hippocratis, Galeni, &c. in etlichen vornemmen so wol einheimischen als ausslandischen Academiis, mit geburlichem Fleiss Mughe und Arbeit absolviret, mich dem peregrineiren und reisen uber die neun Jahr lang continue ergeben damit ich die experientz und Erfahrung in der Medicin, welche daheim hinderm Ofen nicht zuerjagen hin und wider erkundigen und erlernen mochte: Hab in dieser meiner langwiriten peregrination kein Fleiss Mughe Gefahr noch Unkosten gesparet und immitels bey unterschiedlichen Nationen, hohen und niederstands Personen, welche das Medicum und Chymicum studium mit Fleiss tractir haben mich bekant gemacht und allerhand merck und denckwürdige kunstliche Bereitungen der animalischen vegetabilischen und mineralischen Medicinen bey ihnen colligiret und gefast auch durch die Erfahrun in vielen Menschlichen leibs Gebrachen und Schwacheiten heylsam und bewerth befunden. Bin auch Willens und Bedacht geliebts Gott so mir der Allmachtig das leben Fristen und Gelegenheit verleihen wirt was ich nutzlich und bewerth erfahren und befunden dasselbe Reip. literariae Medicae fideliter zu communicieren.”

³⁵⁰ Margaret Jacob, *Strangers Nowhere in the World: the Rise of Cosmopolitanism in early modern Europe* (Philadelphia: University of Pennsylvania Press, 2006).

³⁵¹ Although she does mention the work of Jean D'espagnet, which as it happens, resembles Drebbel's *On the Nature of the Elements* in form, content, and readership.

A collaborative program to scrutinize and analyze all of nature empirically and to amalgamate the accumulated information into a system owed much to Petrus Severinus, according to Massimo Bianchi. Bianchi has credited Petrus Severinus, the late sixteenth-century methodizer of Paracelsus, with the development of a new approach to the empirical study of nature based on a wholesale anatomical (in the chemical sense) autopsy of the world.³⁵² Severinus grafted a philosophical system onto the empiricism of the French occult empiricist Jean Fernel. He agreed with Fernel that there was more than meets the eye in the chemical structure of the universe. The Aristotelian four elements, which are apparent to the senses, cannot explain all the phenomena of nature. Like Fernel, Severinus also claimed that there was something hidden within the elements, but he suggested for this occult level both a method of discovery and a way to integrate what was discovered into a system. Severinus urged the reader to go out into the world and begin a program of empirical analysis to discover just what the chemical structures of things were, and as a result, how they could be used to understand and cure disease.

Joachim Morsius suggested in his 1621 edition of Drebbel's work that Drebbel personified this Severinian model of empirical analysis of the world, by quoting in the paratext from Severinus' major work, the *Idea Medicinae Philosophicae*.

Unhappy mortals, we spend our lives in useless quarrels & questions. The special treasure houses of Nature, in which are the medicines for the gravest of ills, placed there from on high, we leave untouched. Nor do we only neglect those, but we prohibit, impede, & afflict a thousand mockeries (*ludibriis*) upon others who wish to investigate, and stupidly we laugh at (*irridemus*) the one devoted and consecrated to truth & divine wisdom.³⁵³

³⁵² Massimo Bianchi, "Occulto e manifesto nella medicina del Rinascimento: Jean Fernel e Pietro Severino," in *Atti e memorie dell' Accademia Toscana de Scienze e Lettere, la Colombaria*, 47 (Florence, 1982), 185-248; On Severinus, see Jole Shackelford, *A philosophical path for Paracelsian medicine: the ideas, intellectual context, and influence of Petrus Severinus (1540/2-1602)* (Copenhagen: Museum Tusculanum Press, 2004).

³⁵³ Cornelis Drebbel, *De Quinta Essentia*, Joachim Morsius, ed. (Hamburg: Carstens, 1621), "Infoelices mortales, inutilibus quaestionibus & disputationibus vitam traducimus. Naturae praecipuos thesauros in quibus gravissimorum morborum medicinae, ab altissimo collocata sunt, intactos relinquimus. Nec ipsi solum

Border-crossing, indicated Morsius, had become serious business. The ancient exercises of “bare intellect,” once the province of great men, should be spurned. The storehouses of Nature should not be left untouched (*intactos*), but should be manually manipulated and anatomized in a program of discovery. The one devoted to a peripatetic manual investigation of the hidden parts of nature should not be considered a ludic aberration from the path of reasoning through *quaestiones* and *disputationes*, but a key participant in the investigation of nature.

Johann Ernst Burggrav claimed that all his studies, travels, collections, and printing activities were leading up to a major work, a complete spagyric analysis of animal, vegetable, mineral, and metallic bodies (“ein vollkommene unnd perfectam Analysis Spagyricam Corporis Physici Animalis, Vegetabilis, Mineralis & Metallici”). He had worked toward this with great labor, effort, and expense (“Fleiss, Mühe und Unkosten”) and hoped to advance the Republic of Letters and the common good (“Reipub. Literariae, und gemeinem Nutz”) with it. However the unrest that would become the Thirty Years war had hindered his project, which would have been a nucleus of all nature.³⁵⁴

As the ensuing violence impeded universal and Utopian projects across Central Europe, Central European intelligencers such as Samuel Hartlib and Henry Oldenburg went elsewhere, carrying their universalist ideas and practices with them. The contingency of the Thirty Years war should not obscure Central Europe's importance in the idea of cosmopolitanism, which the international nature of the Holy Roman Empire itself

relinquimus, sed alios inquirere volentes, prohibemus, impedimus, condemnamus & mille ludibriis afficimus, avotumque fidelem veritatem & divinam scientiam stultè irridemus.”

³⁵⁴ “Dann diss mein vorhabend hochnützlich Werck/ darinn der Nucleus totius Naturae, menschlicher Gesundheit, zum besten/ An Tag gelegt und eroffnet werden wirdt/ durch das hochbeschwerlich Pfälzisch Unwesen/ Unruh und Kriegslast/ darinnen ich auch biss dahero verhaftet und begriffen gewesen mercklich verhindert worden.”

encouraged.³⁵⁵ Through the *ars apodemica*, Central Europeans were already on the move well before their native lands became a theatre of war.

Many others noted seeing Drebbel on their travels, most famously Constantijn Huygens and Rubens (discussed above). As the philosopher Johann Bisterfeld complained to Johann Heinrich Alsted at Herborn in 1625, he couldn't visit Drebbel because of the plague, Bacon was leading a "private life" and he couldn't see him, and there was nobody else in London worth talking to, since the English are all "immersed in vulgar arts" and uninterested in the occult.³⁵⁶ Bisterfeld did, however, stay with the Küfflers' associate Johann Moriaen in Amsterdam.³⁵⁷

Well after Drebbel's death, travelers were still seeking fragments of information about him from others such as Moriaen and the Küfflers. The Dane Olaus Borrichius, in his history of alchemical letters, listed Drebbel among the greatest Netherlandish alchemists. Thus it is not surprising that he recorded discussing Drebbel during his travels in the Netherlands in his *Itinerarium*. On the 6th of June, 1662 Borrichius visited the surgery of Lützow with the Surgeon Salomon. The Haarlem doctors Klerch and le Febre, as well as D. Barbettius, came along. They discussed Drebbel's quest for the stone, and Borrichius learned that "for many years Drebbel sought the stone in vulgar Mercury alone, working with the two Amsterdam consuls, De Graevius senior and one other, but in vain."³⁵⁸ Borrichius

³⁵⁵ See Thomas Da Costa Kaufmann, *Court, Cloister and City: the art and culture of Central Europe, 1450-1800* (London: Weidenfeld and Nicolson, 1995), Howard Louthan, *The Quest for Compromise: Peacemakers in counter-Reformation Vienna* (New York: Cambridge University Press, 1997), and Henry Frederick Schwartz, *The Imperial Privy Council in the Seventeenth Century* (Cambridge: Harvard University Press, 1943).

³⁵⁶ See Howard Hotson, *Johann Heinrich Alsted, 1588-1638: Between Renaissance, Reformation, and Universal Reform* (New York: Oxford University Press,) 231.

³⁵⁷ J.T. Young, *Faith, Medical Alchemy, and Natural Philosophy: Johann Moriaen, Reformed intelligencer and the Hartlib circle* (Brookfield, Vt.: Ashgate, 1998).

³⁵⁸ Olaus Borrichius, *Itinerarium 1660-1665*. II. Oct. 1661-May 1663 (London: Brill, 1983), 143. "Drebbelium narratum est multis annis lapidem quaesivisse in solo Mercurio vulgi, laborando cum duob. consulibus Amstelodamensib. De Graevijj parente, et quodam alio, sed frustra."

referred to Jacob de Graeff and P. J. Hooft, who pursued alchemy together and were also known for building a perpetual motion machine to rival Drebbel's own.³⁵⁹

We hear more about Drebbel from Borrichius' visit to Moriaen on the 24th of July, 1662. Borrichius described his "excursion with Joh. Olaf Moÿdam to Moriaen of Nürnberg, who was occupied still in dying cloth a dark color, in such a way that it leaves no stains in the hands of those touching it. Moriaen was formerly a learned Reform minister, now a septuagenarian, and a friend to Drebbel and Küffeler."³⁶⁰ Küffler and Moriaen had entered into a venture dying cloth with the scarlet dye Drebbel had invented, yet as Borrichius learned at Moriaen's "The color of Cochineal is not imitated anymore since before a span of scarlet would cost an imperial, now three barely fetch 28 shillings." He did, however, see "The furnace of Drebbel made through employing Mercury in a bent glass, which is contracted and expanded according to the action of the heat."³⁶¹ Borrichius also heard Moriaen's account of Drebbel's perpetual motion machine, which Moriaen saw "operate so magnetically that if the sun is covered by clouds for two hours, at the moment the sun appears the hand of the clock would shift, for example from the 12th to the 2nd hour."³⁶²

³⁵⁹ *Hooft: Essays*, Breugelmans, ed. (Amsterdam: Querido, 1981), 114. On de Graeff, see H.A. Naber, *Oud Holland* (1904), 206-8. Note also that the Hooft family was related to the family of both Constantijn Huygens and Jacob Pergens, who himself was part of Moriaen's network, and to whom Burggrav dedicated his German 1628 edition. P.C. Hooft's biographer Brandt described P.J. Hooft as the "onderzoeker der naature, Pieter Janszoon Hooft, den vinder van dat vermaarde werktuigh der Eeuwige Beweeghing (voordeezen t'onrecht aan Drebbel van Alkmaar toegeschreeven) die, naa 't bezoeken van veele Landen en Hooven, zeer liefgetal was by Kaizar Rudolf, en eindelyk, in zyn vaderlyke stadt gekeert, het Scheepen- en Vroedtschapampt met lof bekleedde." Geraardt Brandt, "t Leeven van den Weleedelen, gestrengen, grootachtbaaren Heere, Pieter Corneliszoon Hooft," P.C. Hooft, *Nederlandsche Historien* (Amsterdam: Wetstein, 1703), 2.

³⁶⁰ Borrichius, 165. "Eo die excurri cum Joh. Olavio Moÿdam ad Dn. Morian Noribergensem, qui in tingendo jam panno pullo colore occupatus est, ita ut nullas maculas in manibus tangentium relinquat, ante sacerdos doctus Reformatus, jam 7tuagenarius Drebbelii et Cöfflero familiaris, apud eum notata sequentia."

³⁶¹ *Ibid.* "Drebbelii furnus fit per adhibitionem Mercurii in vitro incurvato, qui contrahitur et extenditur, pro ut calor agit. Chermesinum colorem non imitatur amplius, quia cum ulna panni chermesini ante constaret imperial: tribus, jam non constant nisi 28 solidis."

³⁶² *Ibid.* "Perpetuum mobile Drebbelii se vidisse tradit (forsan ex Mercurio) in vitro cum horologio, ita magneticum ut acus horologii, si propter nebulas sol per duas horas non conspiceretur, adveniente sole momento se transferret acus ex: gr: ab horâ XII ad IIDam."

V: Printed Itineraries: Transporting with Wonder

The preference for personal autopsy supported by the *ars apodemica* did not lack for critics. Joseph Hall, for instance in his *Quo vadis? A Just Censure of Travell as it is Commonly Undertaken by the Gentleman of our Nation*, claimed there was nothing that could be learned in travel that could not be discovered at home. What could a foreign visitor to England learn about the country that Camden had not already published? Such sober sources were far more suitable to the wise man, who ought not to engage in enthusiastic and wonderful conversation.

As for that verball discourse, wherein I see some place the felicity of their trauell (thinking it the onely grace, to tell wonders to a ring of admiring ignorants) it is easie to answer; that table-talk is the least care of a wise man; who like a deepe streame desires rather to runne silent; and as himselfe is seldome transported with wonder, so doth he not affect it in others. . . .³⁶³

The “world about vs is so full of Presses,” that it will impart even “the present occurences of the time” to all countries. The tales told in the press may not be true, but “our eares abroad are no whit more credible, then our eyes at home.” In fact, we may “oft-times better heare and see the newes of *France*, or *Spaine*, vpon our Exchange, then in their *Paris*, or *Madrill*.”³⁶⁴

A traveler such as Rubens might retort that things can look very different up close than from afar. It is precisely through personal encounters than we can be transported with wonder, spying a “a wonderful something” in a wise man wrapped in a coarse cloak. Intimate conversation allows us to scrutinize this “something” further and to reach a judgment not dependent upon *publica fama*.

Printed travelogues catered to the taste for these intimate encounters by offering the reader a cast of wonderful characters. Such virtual encounters might aid the traveler on the

³⁶³ *Quo vadis? A iust censure of travell as it is commonly vndertaken by the gentlemen of our nation* (London: Nathaniel Butter, 1617), 37.

³⁶⁴ *Ibid*, 40-1.

road or allow the armchair traveler to be transported. Many printed itineraries appeared in handy small formats, which unlike the Baudartius' magnum opus, could be brought easily on the road. For example, the Elzeviers first published Gottfried Hegenitius' popular guidebook to the Lowlands, *Itinerarium frisisio-hollandicum*, in a very portable 11 by 7 centimeter edition which included Abraham Ortelius' *Itinerarium gallo-brabanticum* (Leiden: Elzevier, 1630).

Hegenitius' *Itinerarium* would be republished in a duodecimo in 1661 and 1667.

Gottfried Hegenitius of Görlitz traveled around the Netherlands with his friend Joachim Morsius, another inveterate traveler and Drebbel's publisher.³⁶⁵ In his travel guide, Hegenitius noted the eminent men past and present of each city, describing the epitaphs of several of the deceased, and offering epigrams for several of those still alive. He also noted the contents of remarkable collections, such as that of Paludanus at Enkhuizen, and of the University of Leiden.

As a friend of Morsius, it is not surprising that Gottfried (who called himself a lover of chymistry) described Drebbel in terms reminiscent of Morsius' Severinian devotee as the "most experienced priest & lover of Nature" ("peritissimum Naturae mystem & amasium").³⁶⁶ Drebbel, whom Hegenitius reported to be currently in London, numbered among Alkmaar's famous sons, along with the doctor Petrus Forestus, the humanist Petrus Nannius, and the Franeker professor Adrian Metius. Hegenitius decided to translate into Latin a portion of Drebbel's Dutch letter to Ijsbrand van Rietwijck, so that his experience in natural things, which has been admired by many, but imitated perhaps by none, would be the more apparent. Besides being the "author of the perpetual motion," he was able to achieve,

³⁶⁵ Hegenitius describes an antiquity in Katwijk, and the interpretation given it by Morsius, who was there with him. See Hegenitius (1667), 79. ". . . qui mecum erat, vir inusitatae eruditionis Cl. & Nobil. Dn. Joach. Morsius, quem amicitiae ac fraternae conjunctionis nostrae causa nomino." He also described the observations on an antique monument in Voorburg made by his friend ("Amicos noster dum viveret, Thomas Segethus"), who was also of friend of Morsius. See *Ibid*, 86.

³⁶⁶ Hegenitius described himself as a "Philochymicus" (lover of chymistry) in Morsius' *album amicorum*, Lübeck MS. 4a 25, Vols. 1, 88.

not without the wonder and amazement of all, that optical display he described in his letter.³⁶⁷ Unlike Hegenitius' descriptions of physical monuments and inscriptions, his description of Drebbel did not offer the reader information he could use to go and see the famous priest of Nature. The wonderful tale served rather to transport the reader, already in Alkmaar, to a deeper level of wonder in his experience of the town.

The travel account of Balthasar de Monconys is of a much larger format not intended to be taken on the road. Monconys recorded innumerable encounters, but not in the wonder-provoking style of Hegenitius. Hegenitius offered a frosting of wonder the reader could use to enrich the more tedious aspects of the traveler's experience. Monconys reveled in the tedium, drily noting the exact date, place, and substance of his conversations. He gave the reader the different thrill of a vicarious journey. Furthermore, respect for "matters of fact" recounted in an "objective" plain style among Monconys' target audience encouraged the bare relation of the often highly technical information Monconys had gained in travel.

Monconys' published *Voyages* resembled Borrichius' unpublished *Itinerarium*. Monconys, like Borrichius, also sought ought Drebbeliana during his travels, which he indexed carefully in his volume. He even provided an engraving of Drebbel's oven and a model of Drebbel's perpetual motion machine built by Christopher Wren.

³⁶⁷ Hegenitius, *Itinerarium* (Leiden: Elzevir, 1630), 72. "Dedit enim nobis Cornelium van Drebbel, peritissimam Naturae mystam & amasium, qui iam Londini apud Brittanos agit. Petr. Forestem Medicum Celeberimum, Petr. Nannium, Adrianum Metium jam Professorem Franekeræ: alios.

Sed de Drebbelis non possum quin heic apponam, quod ipse ad amicum suus Isebrandum à Rietwick ante paucos annos Alcmariam litteris perscripsit. Quis e sermone Belgico, quo ille utitur in Latinum *καλα ποδα* fidelissime transtuli, lectu ut arbitror hanc in jocundas, ex queis & viri circa res naturales peritia magis emineat, admiranda cunctis, aemulanda forte nemini. Praeterquam enim quod Motus perpetui autor sit ista non sine omnium stupore ac miraculo efficere potest sic autem scribit ille Protheus. . . ." Hegenitius' activities as a traveller and literary agent paved the way to a political career. Hegenitius signed a liminary poem in Johann Rist's *Neüer Teütscher Parnass* (Lüneburg: Stern, 1652), 861 as "illustrissimi & augustissimi Guelphorum Ducis D. Augusti quondam Consiliarius intimus."

The first encounter with Drebbel's *Nachlass* Monconys recorded occurred, interestingly, in La Rochelle, where on the 31st of October, 1645, Monconys visited M. Merendiere, who owned a version of Drebbel's ovens ("l'invention de donner le feu au degré qu'il veut, & de l'y conserver").³⁶⁸ We don't hear of Drebbel again until Monconys reached England in the 1660's. There he travelled about with Henry Oldenburg, visiting various local lights of natural philosophy, including Drebbel's son-in-law Johann Sibbert Küffler and Robert Boyle. Monconys first discussed Drebbel with Henry Oldenburg on the 26th of May 1663, who confirmed what he had heard about Drebbel and his quintessence of the air, and informed him of Drebbel's son-in-law.³⁶⁹ On the 2nd of June, he and Oldenburg took a carriage to Stratford-Bow, four miles from London, to talk with Doctor Küffler, despite that all Küffler knew of any value he had gained from his father-in-law ("il n'ya trouué rien de nouveau, & tout ce qu'il sçait de plus beau, c'est ce qu'il a profité de feu son beau-pere").³⁷⁰ Nevertheless, Monconys learned much about Drebbel from Küffler.

Küffler disabused Monconys of the notion that the liquor in Drebbel's perpetual motion followed the motions of the sea so closely, that it would become agitated along with the motion of winds on the high seas. He did say that Drebbel had a way to keep air pure and ready for respiration, and that he could build a submarine, which was only possible with his secret of the air. For otherwise, the air heats up or thickens, or rather according to his opinion, it consumes itself, because Drebbel believed that there was a certain quintessence in the air which we breathe, and which keeps us in life. Without it, we will die, which occurs if you stay long in an enclosed atmosphere. Drebbel could prevent this with a quintessence he made, which he called "the quintessence of the air." One drop of this would spread in the air

³⁶⁸ Balthasar De Monconys, *Journal des voyages de Monsieur de Monconys*, Vol. I (Lyons: Horace Boissat & George Remevs, 1665-1666), 41-2.

³⁶⁹ De Monconys, Vol. 2, 33.

³⁷⁰ *Ibid*, 40.

and allow one to breathe with pleasure, as though one were located outside on a beautiful hillside. Unfortunately, of all of Drebbel's secrets, Küffler had only obtained that of the self-regulating oven, and he was currently working to obtain the privilege for producing it in Frances as well as in England, Germany, and elsewhere. Monconys remarked that although the Doctor was very courteous, and had a "quite good physiognomy, he would not reveal this secret, which he said his father-in-law valued equally with that of the great Work [philosopher's stone], saying frequently that he would only give it to the person who would give him the Work."³⁷¹

On the twelfth of June Monconys discussed Drebbel further with Christopher Wren, who had built a machine with a tube of glass containing a liquid which moved based on the changing temperature of the air, which Wren believed, could have been "la machine de Drebel du flux, & du reflux, ou du mouuement perpetuel."³⁷² At the age of sixteen, Wren had built his first version of Drebbel's perpetual motion machine, with the added feature that the machine could self-record the changes in weather it measured. As Monconys noted, Wren was also working on a version of Drebbel's self-regulating ovens. Indeed, Wren's versions of Drebbel's machines became a collective project of the Royal Society. At the meeting of the Royal Society on December 9, 1663, Wren's description of his "weather-clock" was read aloud. Robert Hooke was assigned the task of improving it further. By 1679 Hooke had developed a version of the perpetual motion that kept an account of "all the changes, that happen in the air, as to its heat and cold, its dryness and moisture, its gravity and levity, as also of the time and quantity of the rain, snow, and hail, that fall."³⁷³

³⁷¹ *Ibid*, 41. "car bien que ce Docteur soit fort courtois, & quoy que borgne, d'assez bonne physionomie, il ne voulut pas descourir ce secret, qu'il dit que son beau-pere estimoit à l'égal de celuy du grand Oeuure, disant souuent qu'il ne le donnerot pas qu'à qui luy donnerot l'Oeuure. . . ."

³⁷² *Ibid*, 54.

³⁷³ Hebbel E. Hoff and L. A. Geddes, "The Beginnings of Graphic Recording." *Isis* 53:3 (1962), 287-324.

VI: Conclusion

In *On the Nature of the Elements*, Drebbel purported to offer an explanation for all the changes witnessed in the heavens.³⁷⁴ He could also produce these changes through his demonstration of wind and his artificial production of thunder and lightning.³⁷⁵ He built wonderful displays incorporating several devices showing the various motions of the heavens. As Sir Frances Kynaston told Hartlib in 1635, “Drebbelius et Cuffler especially the first had made a glasse wherin hee could raise both lightning and thunder with another weather-glasse which both were presented to the King.”³⁷⁶ The fact that Drebbel did not install a scale on his perpetual motion so that fluctuations could be measured and noted has meant that his machines failed to gain recognition as scientific instruments.³⁷⁷ Yet, rather than asking why Drebbel did not measure these motions, we might ask why Wren and other members of the Royal Society did.

Lorraine Daston has recently drawn attention to observation in the history of science. Why did the literary tradition of observation come to be trained upon the natural world, through widely co-ordinated networks of notation and accumulation of records?³⁷⁸ As Daston has written,

³⁷⁴ *On the Nature of the Elements* offered an explanation of how the elements caused wind, rain, lightning, and thunder, and how they could be used (*der Natur der Elementen Und wie sie den Windt/Regen blitz und Donner verursachen und wozu sie nutzen*).

³⁷⁵ Samuel Hartlib mentioned Drebbel's artificial production of thunder and lightning more than once. See *Ephemerides*, 29/3/55B-56A, 1635, where he listed among Drebbel's inventions, “Vitra Tonitrium et fulgurum.” Hartlib also compared Descartes' automata and their possible didactic uses to Drebbel's artificial thunder and lightning. See *Ephemerides*, 29/3/62A, 1635. “De Cardes hase a new device to make a Statua or Babie to walke vp and downe to eat to concoct to disgorge itself, which is admirable also for didactiks to shew the manner of concoction So Drebbels feate to shew the didactik of thundring and lightning.”

³⁷⁶ Hartlib, *Ephemerides*, 29/3/48B, 1635.

³⁷⁷ W. E. K. Middleton, *Invention of the Meteorological Instruments* (Baltimore: Johns Hopkins Press, 1969), 49 and 245.

³⁷⁸ For observation as, primarily, a literary practice, see Dirk van Miert et. al., eds., *Observations in Early Modern Letters, 1500-1650* (London: Warburg Institute Colloquia, forthcoming in 2008).

The collective empiricism institutionally launched by seventeenth-century academies such as the Academia Naturae Curiosorum or the Royal Society of London depended on the recruitment and reciprocal calibration of observers in correspondence networks. This was most obvious in the case of weather observers, who were encouraged to standardize their instruments, hours of observation, and recording forms, but also held for astronomy, anatomy, and natural history.³⁷⁹

I've argued that the investment of labor displayed by such attentive observers, as well as their tendencies to join into collective networks, can be linked to the ideal of the *liefhebber* or the related model of Boyle's new virtuoso. The training of methodical attention upon pre-selected categories of objects around the world defined the *ars apodemica*. The methodical art of travel sharpened the skills of observation, notation, copying, and collecting so well exemplified by the inhabitants of Johann Daniel Major's New World.

Although van Meteren might have praised Drebbel for his travels, Drebbel did not practise the *ars apodemica*. He was not a methodical note-taker. While he carefully observed slight changes in the world around him, he was more interested in how such knowledge could be deployed. He sought to display his own power to recreate the motions of the universe, not his ability to observe, measure, and record the motions of nature itself.

The Central European methodical art of travel promoted by Bacon, did however, continue to be championed by members of the Hartlib circle and thereafter by early members of the Royal Society. As John Pell told Hartlib, "One meanes that will mightily encrease all manner of knowledge is to finde out a true Art of Navigation and to teach the Navigators and great Travelers a certain Topica Inventionis."³⁸⁰ Just as Petrus Ramus had advised taking a mathematical walk around Paris and Gabriel Harvey had noted the

³⁷⁹ Lorraine Daston, "On Scientific Observation," *Isis* 99:1 (2008), 102.

³⁸⁰ Hartlib, *Ephemerides*, 29/3/17B, 1635. Hartlib added, "vide desideratum hoc ex literis," alluding to one of his many *desiderata* lists.

mathematical practitioners throughout London, Hartlib also imagined a survey of London.³⁸¹

When he described a local invention in his *Ephemerides*, he occasionally would note its suitability for inclusion in a didactic tour of the city (“Didactica Apodemica Londinensis”).

He did so in the case of Drebbel's camerae obscurae and cooling and heating machines.³⁸²

Drebbel may not have practiced the *ars apodemica* himself, but methodical travelers from home and from abroad noted both his persona and his inventions.

Boyle's new virtuosi, who were, as he made clear, identical with experimental philosophers, continued to practice the laborious art of universal observation. They surveyed the world and diligently recorded, collected and communicated their observations. Recalling the advice given by sixteenth-century German writers on the *ars apodemica*, John Evelyn encouraged Maddox while on a trip to Montpellier to seek out “many excellent receipts to make perfumes, sweet powders, pomanders, antidotes, and divers such curiosities.” Such things should not be beneath his notice since, “gentlemen despising those vulgar things, deprive themselves of many advantages to improve their time, and do service to the desiderants of philosophy; which is the only part of learning best illustrated by experiments . . . Every body hath book-learning, which verily is of much ostentation, but of small fruit unless this also be superadded to it.”³⁸³

While Drebbel's inventions informed many of the projects of the Royal Society, Society members added an interest in notation and the accumulation of records. For example, Wren composed a *A Catalogue of New Theories, Inventions, experiments, and Mechanick Improvements, exhibited by Mr. Wren, at the first Assemblies at Wadham-College in Oxford, for*

³⁸¹ For Harvey's mathematical walk around London, see Nicholas Popper, “The English Polydaedali: How Gabriel Harvey Read Late Tudor London,” *Journal of the History of Ideas* 66:3 (July 2005), 351-381.

³⁸² Hartlib, *Ephemerides*, 29/3/55B, 1635. “Drebbel or Cuffler hase optical Chambers and hase a device How to coole roomes in Summer as wel as to heate them by his Stoves in Winter. Didactica Apodemica Londiniensis. Experientia Physica.”

³⁸³ *Diary and Correspondence of John Evelyn*, ed. William Bray (1859), III, 84.

Advancement of Natural and Experimental Knowledge, called then the New Philosophy: Some of which, on the Return of the publick Tranquility, were improved and perfected, and with other useful Discoveries, communicated to the Royal-Society. Wren included such Drebbelian inventions as his “Perpetual Motion, or Wheather-Wheel and Weather-Clock compounded,” “Probable Ways for making fresh Water at Sea,” and “Ways of submarine Navigation.”³⁸⁴

As Sprat described in his history of the Society, it was Wren's proposal “to comprehend a Diary of Wind, Weather, and other Conditions of the Air, as to Heat, Cold, and Weight. . . .”³⁸⁵ Weather had become another one of those collectibles to be noted during a methodical survey of the world.³⁸⁶ “Because the Difficulty of a constant Observation of the Air, by Night and Day, seem'd invincible,” he attached a register to his meteorological instruments that automatically recorded their measurements during the observer's absence.

Just as Drebbel developed his perpetual motion into an amalgam of several machines, displaying all the movements of the universe, Hook extended Wren's “Perpetual Motion” with the addition of several other motions. Machines, however, took over the job of noting and recording that had been the work of the zealous keeper of diaries. As Sprat recounted, “to his Invention of the Weather clock, other Motions were afterwards added by Mr. Robert Hook . . . first a Pendulum Clock, . . . a Barometer, a Thermometer, A rain Measure. . . a Weather-Cock . . . a Hygroscope. . . each of which have their Register . . . All working upon a Paper falling off of a Rowler which the Clock also turns.”

Hooke himself described Wren's projects in the preface to his *Micrographia*, and again we catch echoes of Drebbel's inventions. Wren had worked on a “Vessel for cooling and

³⁸⁴ Christopher Wren, *Parentalia, or, Memoirs of the Family of the Wrens* (London: Osborn, 1750), 198.

³⁸⁵ Cited in *Parentalia*, 207.

³⁸⁶ Vladimir Jankovic, *Reading the Skies*.

percolating the Air at once. . . .” This instrument made him realize that there was “something else in Air” “requisite for Life, than that it should be cool only, and free from the fuliginous Vapours and Moisture.” Wren, deciding “that nitrious Fumes might be found requisite, he contr’vd Ways to supply that too, by placing some benign chymical Spirits, that by fuming might infect the Air within the Vessel. . . .” In the latter half of the seventeenth century, many across Europe debated whether Drebbel had sustained the sailors in his machine by releasing vital aerial particles, perhaps nitrous ones, into the air, or whether cooling the air would be sufficient.³⁸⁷

Hooke also recounted how Wren “has found out perpetual, at least long liv’d Lamps, and Registers of Furnaces, and the like, for keeping a perpetual Temper, in order to various Uses; as hatching of eggs, Insects, Production of Plants, chymical Preparations, imitating Nature, in producing Fossils and Minerals, keeping the Motion of Watches equal, in order to Longitudes and astronomical Uses, and infinite other Advantages.” Yet, despite the obvious resemblance between the self-regulating ovens of Wren and Drebbel, Hooke did not compare Wren to Drebbel. He preferred Archimedes, since whose time “there scarce ever met in one Man, in so great a Perfection, such a mechanical Hand, and so philosophical a Mind” as Wren.³⁸⁸

³⁸⁷ See for instance Etmuller, who gave several responses to the account Boyle had given of Drebbel’s liquor. Etmuller argued that the submarine was built in such a way as to cool the air, rather than that Drebbel had indeed employed Mayow’s nitrous vital particles. Etmuller, *Operum omnium medico-physicorum* (Venice: Combi & La Noù, 1695), 721. “Quamvis etiam navigatio longius protracta fuerit, attamen naviculae singularis structura, nec non Aquae marinae, illam undiquaque supra, infra, ante, post & ab utroque latere ambientis, frigus valde huc conducere poterit Multo magis citiusque halitus navigantium à frigore marino facile condensandi, ac in defluentem liquorem resolvendi respirantibus minus obesse poterunt. 4. Vitalium in aëre particularum existentia nunquam directe probata est; quorsum videantur, quae supra 5. huius capitis contra Mauooium adduximus. 5. Multo minus probabili modo explicari poterit Liquorem quendam chymicum sive destillatum, sive alia quacunque Enchiresi praeparatum, potuisse vitalium in aëre, si quae sint, partium vices gessisse; adeoque Liquor Drebbelii pro hac opinione concludere nequit, cum talis conclusio niteretur Postulato nondum probato.”

³⁸⁸ Cited in *Parentalia*, 212-3.

In the next chapter, we will continue to trace the relationship between survey, collection, and the “desiderants of philosophy.” Great men were desirable parts of collection, to be noted in one’s itinerary and recorded in one’s album.³⁸⁹ The collection of such great men went beyond bootlicking. The pursuit of eminent personalities also served to fulfill the “desiderants of philosophy.” As Johann Daniel Major wrote in his *Journey to A New World*, their fame fueled the appetite of the lovers (*liebhabern*) urging them forward in their heroic feats of travel, collection, and communication.

Drebbel’s persona was never at rest, both during his life in his constant search to devise something more wonderful each day, and after his death, as travelers both collected and scattered again pieces of Drebbeliana. Drebbel’s persona served as a version of the marketplace described by Zwinger. Drebbel offered his own persona to others, and they in turn “recaptured from there, just as from a Trojan horse,” stories, examples, and parables.

Through this constant competitive exportation, Drebbel circulated around the world. His very eccentricity as a *Tausendkünstler* helped him fulfill central desires in a period of hybridity and invention. In the next chapter, we will explore contemporary theories of desire and its place in a period of shifting borders and infinite possibilities. When this period came to an end with the rise of new disciplinary boundaries, institutions, professions, and sources of authority, Drebbel’s persona lost its usefulness. Despite continued attempts to remake Drebbel’s persona, from Geysbeek and Groenewoud’s award of posthumous degrees to H. A. Naber’s hagiography, Drebbel’s scattered remains did not cohere into a persona that fit easily with the emerging narrative of the Scientific Revolution.

³⁸⁹ A Christopher Wren, perhaps the famous Wren’s father, signed the album of Johan van Heemskerck on the very last page in the early 1620’s. Christopher Wren Sr. had graduated Oxford in 1620. See Wren, *Parentalia*, 135. Wren was highly conscious of joining a theater of illustrious men. See Koninklijke Bibliotheek, Ms. 131 H 7. “Sed sequor Illustres, quorum mihi sola Theatrum/ Nomina: nec absque crimine. / Innumeris possum meritis diffidere, mente / Manuque cui faciunt fidem / Heinsius, Erpenius, Cunaeus, Vossius (addo) Rivetus atque Meursius.”

Those who followed in Drebbel's footsteps set new standards to be held out as an example to posterity. For instance, unlike Monconys, Hooke chose not to point out the relationship between Wren's projects and Drebbel's. Drebbel's role as stimulator of Wren's appetite for invention quietly faded away. Eventually, J.C. Adelung, in his *History of Human Folly*, would cast Drebbel in the role of the fool and charlatan. Like J.A. Vollgraff almost two hundred years later, Adelung placed Drebbel among the irrational fools opposed to the serious learned men of science.³⁹⁰ The memory of the role Drebbel's persona once served was eradicated. Yet the glimpses we can catch of Drebbel here and there in exchange and circulation show us a world once constantly in motion.

³⁹⁰ J. C. Adelung, "Cornelis van Drebbel, ein Charlatan," *Geschichte Der Menschlichen Narrheit*, Vol. 2, (Leipzig: Weygand, 1786).

Chapter Two: From the Columns of Hermes to the Columns of Hercules

I: Introduction

II: Diversifying Desire

III: Communicating Desires: *Desiderata* and Society

IV: Art, Nature, and Mercantilism

V: Truth and Myth in the *Desiderata*: the Tales of Amadis and the Deeds of Caesar

VI: In Praise of Folly: Pursuing the Impossible

VII: Drebbel Among the *Desiderata*

VIII: Drebbel's *Desiderata*

IX: Conclusion

I: Introduction



Fig. 1. Hendrick Goltzius, *Allegorie auf die Eitelkeit (Alchimie)*, 1611. Kunstmuseum, Basel, Martin Bühler.

Goltzius' *Allegory* of 1611, his largest surviving painting, has long eluded interpretation.³⁹¹ The figure of alchemy, holding a retort and crowned with fire, features prominently in the painting, as a fool plays behind her. Some have therefore seen the

³⁹¹ See Otto Hirschmann, *Hendrick Goltzius als Maler, 1600-1617* (Den Haag: M. Nijhoff, 1916), 58, and the exhibition catalogue, Huigen Leeftang, Ger Luijten, et. al., *Hendrick Goltzius (1558-1617): Drawings, Prints and Paintings* (Zwolle: Waanders, 2003), 294-5.

painting as a vanitas scene in which Goltzius, himself an alchemist, renounced the art. However, many were fully conscious in the period of the risks and dangers associated with alchemy without giving up the art; alchemists themselves frequently distanced themselves from and lambasted foolish or deceptive alchemists, just as astrologers frequently subjected other astrologers to unsparing criticism.

The painting need not represent a decision for or against alchemy, but a process of judgment. A symposium unfolds in the background, perhaps as a reminder of the classical discussions of which art can lead to the greatest good, such as Plato's *Gorgias*. In the foreground, a king sits in judgment, ringed round by various figures seeking his attention. On the dais next to him stands a figure of Minerva. She is illuminated with a celestial ray, and her gown is dotted with the sun, moon and stars. Perhaps she offers the king knowledge of the heavens through the study of divinity. Yet the king pays no attention to her, or to the two arguing philosophers behind her, perhaps Plato and Aristotle. One of them holds a spoon. The spoon was a typical Aristotelian problem for debate. Although straight, the spoon appeared bent within water, cautioning the natural philosopher against the testimony of the senses.³⁹² Yet the spoon was also a symbol of folly.

The king seems far more interested in what the arts can offer him, as they display their wares before him. Here too a wide range of options confront him. To the left stand the liberal arts, including the laureated poet, the astronomer offering the king an armillary sphere, and between the two, the painter in the person of Goltzius himself. The illiberal arts recline closer to the ground. Geometry, in the pose of a river god, leans on a sphere resting on a rippling blue cloth. Geometry might remind the king how engineering made dry land

³⁹² See, for example, Aristotle, *Problematum Aristotelis sectiones duaequadraginta* (Lyons: Paul Miralliet, 1551), 217.

rise out of the waves so successfully in the Netherlands, and how mathematics could also be used for charting the open seas.

Playing fire to Geometry's water, Alchemy is even more canny than Geometry in her appeal to the king and is by far the most attractive candidate for his attention. She turns her lowly position to her advantage, lying upon a lavish litter adorned with a royal baldachin. Alchemy represents herself as the fulfillment of all desires. She offers herself to the king in, as it were, an updated Felix Capella. Here, rather than Capella's Marriage of Mercury and Philology, it is Alchemy who wishes to join forces with royal power. Her own dowry includes wealth, health, power and the enjoyment of *Kunst*. An abundance of glittering objects symbolizing these desires (coins, jewels, *Kunstskammer* collectibles, a retort, a crown and scepter, the papal tiara and keys, a palette and book), tilt toward the viewer and tempt him as well. Above it all, Alchemy holds up a tiny alchemical furnace, promising the philosopher's stone. Furthermore, Alchemy lies halfway between philosophy and the other arts, indicating her access to both art and the knowledge of nature. Following the path of desire might lead to both the enjoyment of temporal goods and to philosophy. Yet behind Alchemy lurks a fool, while putti blowing bubbles overhead indicate the fragility of worldly things.

As Tara Nummedal has shown in *Alchemy and Authority*, Central European princes in the sixteenth century were fully aware that alchemy could be a risky business.³⁹³ They did not miss the lurking fool, but they were also intrigued by alchemy's inordinate appeal. Until recently, patrons of alchemy such as Rudolf II were considered fools themselves for buying into the alchemist's vain promises. Yet, as Nummedal has demonstrated, many princes shared a very sophisticated view of folly. They entered into commercial agreements with

³⁹³ Tara Nummedal, *Alchemy and Authority in the Holy Roman Empire* (Chicago: University of Chicago Press, 2007).

their alchemists, assessed possible gains against possible losses, insured themselves against fraud, and attempted to control folly. In this realm of attractive choices and high stakes, the border between possibility and impossibility was hazy. The ruler who navigated this enthralling yet dangerous terrain weighed his desires against the claims of art. Goltzius' figure of Alchemy showcases both the advantages and disadvantage of following one's desires. Goltzius showed the king with one hand open to alchemy and another to the liberal arts still in the midst of deciding whether or not to play with fire.

Several recent studies have emphasized the desire for and commerce of objects as agents in the growth of empirical natural philosophy. Demand for worldwide goods generated an infrastructure of communication and exchange operating across a vast social register.³⁹⁴ Such demands integrated the works of empirics, artisans, and instrument-makers with philosophers, academics, statesmen, and consumers of all stripes in the project of discovery. Dethroning reason, and replacing it with passion or desire, these studies have stressed that in the early modern period, communicative empiricism had to struggle against the pre-eminence of universal *ratio*.

Although the link between economics and science is an old one, the most recent scholarship counters a Weberian emphasis on capitalism and self-interest with an exploration of the relationship of individuals to society and private to public. Projects of Utopian or philosophical discovery of the period were frequently concerted efforts. The studies of Cook, Harkness and Nummedal have offered fine-grained analyses of exchange between vast constellations of consumers and producers which have stressed the agency of the former.

³⁹⁴ See Harold Cook, *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age* (New Haven: Yale University Press, 2007), Deborah Harkness, *The Jewel House of Art and Nature: Elizabethan London and the Social Foundations of the Scientific Revolution* (New Haven, Conn.: Yale Univ. Press, 2007) and Tara Nummedal, *Alchemy and Authority in the Holy Roman Empire* (Chicago: University of Chicago Press, 2007).

Chapter Two: From the Columns of Hermes to the Columns of Hercules

The contingency of empiricism and its communicative aspect as a matter of exchange drew upon a culture of credit to validate the witnessing of matters of fact.³⁹⁵ Reputations were also matters of exchange. Yet, like alchemy, credit was a risky investment. Commercially-tied credit altered ancient notions of personal honor.³⁹⁶ As the Castilian bankruptcy had recently reminded Europe, anyone could default on their debts.³⁹⁷ While one's credit as a businessman was supposed to ensure honest dealings, credit could also be achieved by the mere claiming of it. As one writer put it in 1666, Holland owed its credit to the activity of its banks, which was "a real cheat, for no considerate man can believe that they have so much Money in their Banks, as they give out bills for."³⁹⁸

Nor could truth be assured by social status. Traditional social status did not always translate into financial credit, as King James I's venture into the production of copper Tokens illustrates.³⁹⁹ Under Elizabeth, the lack of coin had caused the rapid proliferation of leaden tokens minted by individual merchants and exchanged in lieu of actual coin, "so that by the ninth year of James I, fully 3,000 vintners, tapsters, bakers and other retailers were circulating lead tokens."⁴⁰⁰ Elizabeth always refused to associate her name with the production of a "Token" with no intrinsic value. In 1613, however, James I did so, replacing the private leaden tokens with copper ones issued in his own name. According to Hartlib, Drebbel was originally supposed to invent an entirely new sort of "blew copper" to be

³⁹⁵ Stevin Shapin, *The Social History of Truth: Civility and Science in Seventeenth-century England* (Chicago: University of Chicago Press, 1994) and Craig Muldrew, *The Economy of Obligation: The Culture of Credit and Social Relations in Early Modern England* (London: Macmillan Press, 1998).

³⁹⁶ See Pamela Smith, *The Business of Alchemy: Science and Culture in the Holy Roman Empire* (Princeton, N.J.: Princeton University Press, 1994), Alexandra Shepard, "Manhood, Credit and Patriarchy in Early Modern England c. 1580-1640," *Past and Present*, 167 (2000), 75-106 and Scott Taylor, "Credit, Debt, and Honor in Castile, 1600-1650," *Journal of Early Modern History*, 7: 1-2 (2003), 8-27.

³⁹⁷ A. W. Lovett, "The Castilian Bankruptcy of 1575," *The Historical Journal* 23:4 (1980), 899-911.

³⁹⁸ Edward Ford, *Experimental Proposals How the King May have Money*, 1666, 1-3, 4, *op cit.* Appleby, 213.

³⁹⁹ As Lawrence Stone writes, peers frequently had to rely upon their own servants as sureties for their debts. See *Crisis of the Aristocracy*, 520.

⁴⁰⁰ E. A. J. Johnson, "Gerard de Malynes and the Theory of the Foreign Exchanges," *The American Economic Review* 22: 3 (1933), 444.

produced centrally.⁴⁰¹ In the end, the monopoly for producing the King's "Tokens" fell to the economic theorist Malynes. Yet the project failed. The King's name could not make people accept his copper tokens in the way they had accepted the leaden ones of tapsters and bakers.

Viewing the emergence of empiricism as a matter of exchange validated by a system of credit suggests a host of problems. The commercial aspects of credit introduced the morally dubious profit motive, while a global scale of exchange stretched credit to its limit. Furthermore, Renaissance historicism supported the idea of change over time not only in the arts, but in the fabric of the natural world itself.⁴⁰² How could the global market of constantly shifting and conflicting desires direct discovery in a world which was itself always in flux? How could Goltzius' king enjoy his luxury goods, avoid folly, and participate in the symposium of the philosophers?

In this chapter I study the early modern bookkeeping techniques used to direct and control desire. Through the proliferation and diversification of *desiderata* (wish) lists in the period, individuals explicitly framed the search for a future in terms of enumerated desires. The *desiderata* list offered both a rhetoric and a research tool for philosophers envisioning what they considered a radical reform of learning.

According to a period physiology, a desire for curious novelties motivated the individual to philosophize.⁴⁰³ Francis Bacon, while observing that the momentum of desire could goad human industry forward, also sought to reign in desire through the careful

⁴⁰¹ Hartlib was informed by Drebbel's son-in-law Dr. Kuffler of the project in 1656. See his *Ephemerides*, 29/5/100B. "Drebbel in the time of King James was to invent a blew kind of Copper, that should bee current money for the kings extraordinary occasions that no body should bee able to counterfeit. It should bee made only by one man etc. But that Project did not proceede."

⁴⁰² Anthony Grafton, "Renaissance Histories of Art and Nature," *The Artificial and the Natural: An Evolving Polarity*, Bernadette Bensaude-Vincent and William R. Newman, eds., (Cambridge: MIT Press, 2007), 185-210.

⁴⁰³ Adrian Johns, "The Physiology of Reading and the Anatomy of Enthusiasm," *Religio Medici: Medicine and Religion in Seventeenth-Century England*, Ole Peter Grell and Andrew Cunningham, eds. (Brookfield, VT: Ashgate, 1996), 136-170.

discipline of social superiors. He noted and feared the possible chaos of the marketplace as the desire for objects drove the mob blindly forward. Bacon attempted to energize philosophy through *desiderata*, while deploying his own authority to fix the credit of natural philosophy.⁴⁰⁴

The stakes in controlling human desires were both epistemological and economic. In the seventeenth century, curiosity underwent a quantitative and qualitative change. From something morally bad, curiosity became something morally good, and began to indicate desire for a much broader range of objects.⁴⁰⁵ Yet such desire could also lead to enthusiasm (the belief that one was in the presence of absolute authority), and the too easy crediting of what one read.⁴⁰⁶ Meanwhile, the specter of the charlatan of the marketplace offering illusion and myth in return for the best intentioned Utopian enthusiasms haunted rulers no less than philosophers.

Jan Lazardzig has argued that in a period of “epistemological openness,” seventeenth-century projectors offered a “theater of knowledge in which reality and illusion, the doable and the thinkable, the probable and the impossible constantly came into conflict.” This was an area in which “the border between the possible and impossible was strangely permeable.”⁴⁰⁷ However, as Eric Ash, Deborah Harkness and Tara Nummedal have shown,

⁴⁰⁴ On Bacon’s attempt to fix knowledge by fixing print, see Johns, *The Nature of the Book* (Chicago: University of Chicago Press, 1998), 51.

⁴⁰⁵ See Neil Kenny, *Curiosity in Early Modern Europe: Word Histories* (Wiesbaden: Harrassowitz, 1998) and *Uses of Curiosity in Early Modern France and Germany* (Oxford: Oxford University Press, 2004).

⁴⁰⁶ On the relationship of curiosity to enthusiasm, see Johns (1996) and Barbara Benedict, *Curiosity: A Cultural History of Early Modern Inquiry* (Chicago: University of Chicago Press, 2001).

⁴⁰⁷ Jan Lazardzig, “Masque der Possibilität: Experiment und Spektakel barocker Projektenmacherei,” *Spektakuläre Experimente: Praktiken der Evidenzproduktion im 17. Jahrhundert*, Helmar Schramm, Ludger Schwarte, eds. (Berlin: de Gruyter, 2006), 184 and 185. “Die Projektmacherei ist aber- genau besehen- einer jener Schauplätze des Wissens, an dem Realität und Illusion, das Machbare und das Denkbare, das Wahrscheinliche und das Unmögliche beständig miteinander in Konflikt geraten. “ “Die Grenze zwischen Möglichem und Unmöglichem ist seltsam durchlässig.”

princes across Europe had already experienced a century of “big science” and projecting.⁴⁰⁸ They were all too eager to find practical ways to police that border at the edge of the possible. Projectors acted more in a market than a theatre, and rulers wanted to keep that market under control.

It was in this period that the dynamics of the marketplace first became an object of study. Joyce Appleby called this development a “Kuhnian paradigm shift” to be found in the writings of Thomas Mun in the 1620’s.⁴⁰⁹ Yet this shift took place in Central Europe even before it did in England. Economic thinkers of the Holy Roman Empire described the forces of desire at play within the market. They discussed the desirability of art, and recommended that the manufacture of goods would bring in more coin than the export of natural commodities. Such thinkers rushed to the side of rulers in the quandary faced by Goltzius’ king, promising both expertise and method in the judgment of the arts.

This idea that man could improve the value of nature through art was based in the perfective arts.⁴¹⁰ This idea implied a transformation of man’s place in nature. Such thinkers did not stress man’s fallen nature, but the special God-sanctioned abilities possessed by man to perfect nature. The perfective arts also suggested a re-alignment of society, with greater status accorded to groups of men granted the abilities of art. As Jakob Bornitz said,

Crafts, or mechanical artifices, which the state requires and which are called “artes” by classical authors . . . and “Handkünste vnd Handwercke” in the vernacular, have a share in civil society. For art not only imitates nature, but helps, advances, emends, improves, corrects, and indeed often surpasses it through the work of hands. . . . Indeed the bare effects of nature on their own, are often

⁴⁰⁸ Although I would not go as far as Harkness who argued that after a period of disillusionment, “big science” in London ended with the accession of James I. Drebbel’s career in the court of James I and Charles II shows otherwise.

⁴⁰⁹ Joyce Appleby, *Economic Thought and Ideology in seventeenth-century England* (Princeton: Princeton University Press, 1978), 41.

⁴¹⁰ Cf. Appleby, who describes the development of abstract models of economic action as naturalizing economic behavior through regular laws. At the same time, Appleby acknowledges contemporaries’ realization of the newly artificial nature of economic disasters.

Chapter Two: From the Columns of Hermes to the Columns of Hercules

considered not useful for either civil or human life, unless they are rendered suitable by the manual work. . . . We note with pleasure and particular wonder what especially today can be obtained through chymical works.⁴¹¹

God himself, as an example for humans, “made use of the spagiric art in the work of creation.”⁴¹²

Otto Mayr has related self-regulating clockwork systems and Drebbel’s inventions in particular, to ideas concerning the balance of trade in commerce and the balance of powers in liberal political systems seeking equilibrium.⁴¹³ Yet economic and political thinkers in Central Europe turned to a chemical, rather than a mechanical model for economic and political systems. Just as God employed the art of alchemy in the creation of the world, they sought to build functioning microcosms through separation, transformation and purification.⁴¹⁴

⁴¹¹ Jakob Bornitz, *Tractatus Politicus de Rerum Sufficiencia in Rep. & Civitate procuranda* (Frankfurt: Weiss, 1625), 57-9. “Sunt enim opificia, sive artificia mechanica, etiam portio societatis civilis, quibus civitas indiget, quae et artes dicuntur auctoribus classicis . . . vulgo Handkünste vnd Handwercke. Ars enim naturam imitatur, eandemque iuvat et promovet, supplet, corrigit et castigat, imo saepe superat manus operâ. . . . Adeo ut effecta naturae nuda et perse, saepe considerata, nec usui sint vitae humanae et civili, nisi manus opera idonea reddantur. . . . Quod inprimis operâ chemicâ expediri hodie, non sine delectatione et admiratione singulari videmus, de qua Crollius in *praefat Basilicae*, Thomas Muffett. in *Apologia chymica*. Severin. in *Idaea philosoph. et Auctor* in *Offenbahrung Göttlicher Majestät, lib. 19. inproaemio*, erudite et eleganter agunt. Quin quod Deus ipse sapientissimus, veluti ad praeludium et exemplum ingenio humano ostenderit, opus creationis et divisionis stupendum, creando primum chaos mundi, deinde lucem à tenebris dividendo, aquas à terra dispescendo, uti innuit *Offenbahrung Göttlicher Majestät, lib. 19. cap. 2. et seqq. et ex cap. 1. Genes*. luculentissime videre licet. Quod Deus sapientia sua summa, spagiricâ in opere creationis usus fuerit.”

⁴¹² Cf. Günter Damman, “Modernität durch hermetisches Denken. Alchemie und Ökonomie bei Johann Joachim Becher,” *Scientiae et artes: die Vermittlung alten und neuen Wissens in Literatur, Kunst und Musik*, Barbara Mahlmann-Bauer ed. (Wiesbaden: Harrassowitz, 2004), 717-732, who credited Becher but not earlier economic theorists such as Bornitz and Besold with using alchemy to structure economic thought. Several early economic theorists supported alchemy. Indeed, the tale of a transmutation of lead into gold in the Hamburg marketplace recounted by Hermann Lather in his *De Censu* (Frankfurt: Jennis, 1618) was cited as evidence for alchemy by Johann Ulrich Resch, *Osiandrische Experiment* (Nürnberg: Endter, 1659), 304.

⁴¹³ Otto Mayr, *Authority, Liberty and Automatic Machinery in Early Modern Europe* (Baltimore: Johns Hopkins Press, 1986).

⁴¹⁴ In politics, this could mean that parts of the system were not considered dead material to be ordered mechanically, but vital entities endowed with qualities which needed to be reconciled. In the midst of the Thirty Years War, Johann Angelius von Werdenhagen gave desire a Platonic and Behmenist interpretation as a transformative force unifying diverse individuals into a society. See Werdenhagen, *Rebuspublicis Hanseaticis Tractatus* (Frankfurt: Merian, 1641), Chapter One, “De Universitate, Communione & origine civitatum. Ubi insignis ex hac occasione locus Platonis ex symposio eius, iuxta Teutonicum, explicatur”, 20. The search for the philosopher’s stone, as for the ideal political system, should be sought in a Christian rebirth and

A balance of trade was therefore insufficient; nature needed to be refined and transformed through art for the benefit of the state. Yet Bornitz not only qualified some arts as “useless,” he was also understandably hesitant to spend resources on what might be impossible. He did not miss the fools lurking behind the distracting comparisons of the most tempting arts. Bornitz segregated some of the most enthralling arts of his period into a separate category on the edge of impossibility requiring further investigation. Such arts should not be shunned as suspect, but recognized as both appealing and dangerous.

Bornitz, Bacon and others employed lists to weigh the appeals and possibilities offered by various arts, judging whether projects belonged on lists of *desiderata* (desirables), possibilities, or impossibilities. Such categories might be aligned with socially differentiated programs of research. Bacon in particular used *desiderata* to direct the discovery of the inventive mechanics, while rejecting those things he sagely deemed impossible. According to a period association of status and reason, social superiors (and thus the rational) would balance the books, countering the claims of the marketplace with competing lists of impossibilities. By pointing to the practice of listing impossibilities, I do not perforce side with the socially conservative views of the period. Rather, I underscore the fact that even those who put forward extremely hierarchical views of state-sponsored industry and invention, such as Francis Bacon and Johann Joachim Becher, recognized the agency of desire as a motive force for human ingenuity as well as the centrality of mechanics to fulfilling those desires, even as they sought methods of discipline and control.⁴¹⁵

transformation. “Si vestrum quis lapidem Philosophorum quaerat, is se ad regenerationem in Christo praeparet; alias inventu vobis minime facilis erit. Tinctura enim haec communicationem ingentem habet cum coelesti essentia ; quod si haec à faecibus suis immixtae turbae liberaretur, & perduceretur ad fixationem iuxta crystallinum splendorem sive perfectionem sui, facili materia illa agnosceretur.” See Alfred Voigt, *Über die Politica generalis des Johann Angelius v. Werdenhagen* (Erlangen: Universitätsbund, 1965).

⁴¹⁵ For the ethical and political philosophy underlying these views, see Horst Dreitzel’s study of Henning Arnisaeus, *Protestantischer Aristotelismus und absoluter Staat. Die ‘Politica’ d. Henning Arnisaeus (ca. 1575-1636)* (Wiesbaden: F. Steiner, 1970). Werdenhagen was a student of Arnisaeus.

II: Diversifying Desire

The desiderata list was not new to the early modern period. Yet the list underwent then both a temporal and material turn, shifting the practices of desiring in the early modern world. Classically, desiderata, or desirables, were inventories of desired manuscripts. Galen reported how the libraries at Alexandria and Pergamum caused many forgeries by circulating a list of their desired authors, which demand forgers were all too happy to satisfy.⁴¹⁶ The most famous list of the Renaissance period was that of Niccolò Niccoli.⁴¹⁷ Niccoli gave his lists to friends travelling to Germany and France where, he hoped, they might find the works of particular authors he desired. The desiderata list in its classic form, therefore, was intended for communication and was associated with travel and discovery. Through a concerted effort, the desirer would obtain the objects of his desire. Yet the list was not oriented to the future. The items on the list already existed somewhere in the world. They should be invented only in the old sense of *invenire* (to come upon). An attempt to fulfill the list with something new would be, as Galen indicated, no less than forgery.

Cataloguing desired books continued through the seventeenth century (as it does today).⁴¹⁸ Indeed, the early modern print industry often marketed works as fulfilling widely held desires. Some variation of “*hactenus desiderata*” frequently appears in early modern book titles.⁴¹⁹ As Johann Ernst Burggrav said in the forward to his 1628 German edition of Drebbel, he had translated Drebbel’s works into Latin and German and reprinted them in order to fulfill the *desiderium* of many (“Als hab ich solches/damit ich *multorum desiderio* ein

⁴¹⁶ Galen, *Opera omnia*, Vol. XV, Carolus Gottlob Kühn, ed. (Leipzig: C. Knobloch, 1821-1833), 105-7.

⁴¹⁷ Rodney P. Robinson, “The Inventory of Niccolò Niccoli,” *Classical Philology* 16:3 (Jul., 1921), 251-255.

⁴¹⁸ The journal *Speculum*, for instance, circulated a list of *Desiderata Photostatica* during World War II of manuscripts in risk of destruction which were therefore good candidates for reproduction.

⁴¹⁹ See for example, Jozef Strus, *Ars Sphygmica seu Pulsuum Doctrina: Supra M.CC. Annos perdita, & desiderata; Omnibus Tamen Medicinam cum nominis celebritate, maximaque utilitate facere volentibus summe necessaria* (Basel: König, 1602).

genügen thete/ in Lateinisches unnd Teutscher Sprach auff's new zu drucken und auff zulegen/ anordnung gethan”).

Yet desiderata lists diversified in important ways in the period, encompassing a wide range of possible objects. The temporality of the desire also shifted from items which already existed to those which did not. The desirables became a Utopian genre for imagining the future as a blank sheet of paper, awaiting a series of potentially unlimited desires.

The first definition of *desiderata* in Johann Jacob Hofmann's *Lexicon Universale* was baptism, the Eucharist, and the conversion of the Jews – the *pia desiderata*, or holy desirables.⁴²⁰ *Pia Desiderata* were a favorite of the pietist movement as a way to direct individuals away from overly rational religion toward internalized yet also communal spiritual desires.⁴²¹ Christian Utopians used *desiderata* to exhort their flock toward concerted efforts for the common good. Cotton Mather, for instance, wrote his *Bonifacius* in 1710 so that “Brethren” should “Dwell together in Unity, and carry on every Good Design with United Endeavours.”⁴²² To that end, he appended a “Catalogus Desideratorum” with the *pia desiderata* he hoped would be fulfilled at all levels of society.⁴²³

In Robert Boyle's list [Fig. 2] we find a different (though related) set of *desiderata*.⁴²⁴ There we see not a list of books or manuscripts or religious aims, but various projects and inventions such as the art of flying, the transmutation of metals, the discovery of longitudes, the making of malleable glass, or a perpetual light. It is on this type of *desiderata*, including

⁴²⁰ Johann Jacob Hofmann, *Lexicon Universale* (Leiden: Jacob. Hackius, Cornel. Boutesteyn, Petr. Vander Aa, & Jord. Luchtmans, 1698).

⁴²¹ The *pia desideria* continued through the Enlightenment. For Jacobi's *Pia Desideria* see Frederick C. Beiser, *The Fate of Reason: German Philosophy from Kant to Fichte* (Cambridge, Mass.: Harvard University Press, 1987).

⁴²² Cotton Mather, *Bonifacius* (Boston: Samuel Gerrish, 1710), iv.

⁴²³ *Ibid.*, 174-180.

⁴²⁴ Royal Society Boyle Papers, Vol. 8, 207v-208v. Available online at http://www.bbk.ac.uk/Boyle/boyle_papers/bp08_docs/bp08_207v-208r.htm. Consulted July 29, 2008. Boyle repeated this list, and added another list of desiderata aimed more at collection and methodizing than individual inventions in Vol. 36, fol. 77v-78r. For instance, one of the desiderata on this list is a “Catalogue of desiderata and polychresta.” See the discussion of the polychrest experiment in Bacon, below.

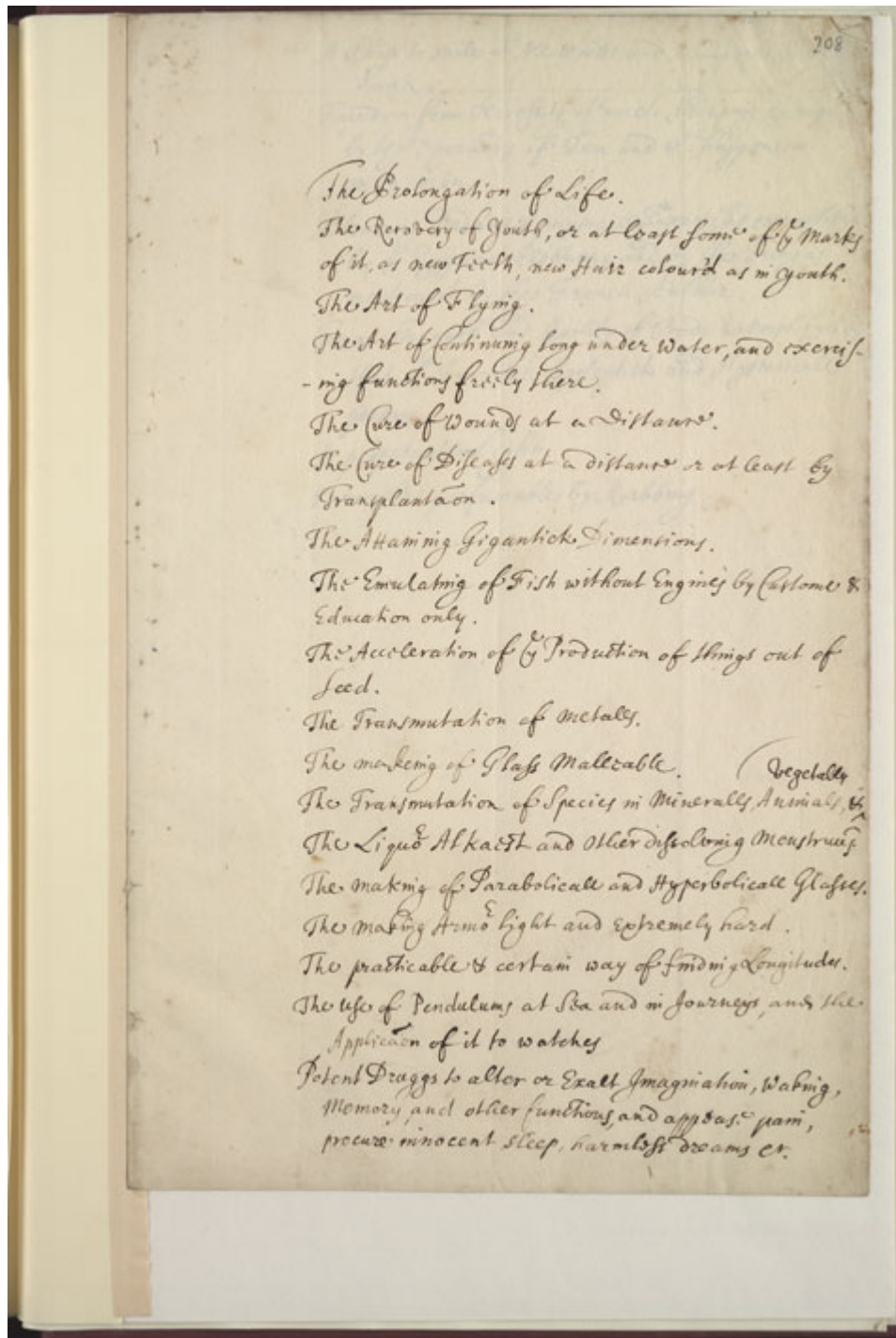


Fig. 2. a. Boyle Papers, Vol 8., Fol. 208r.

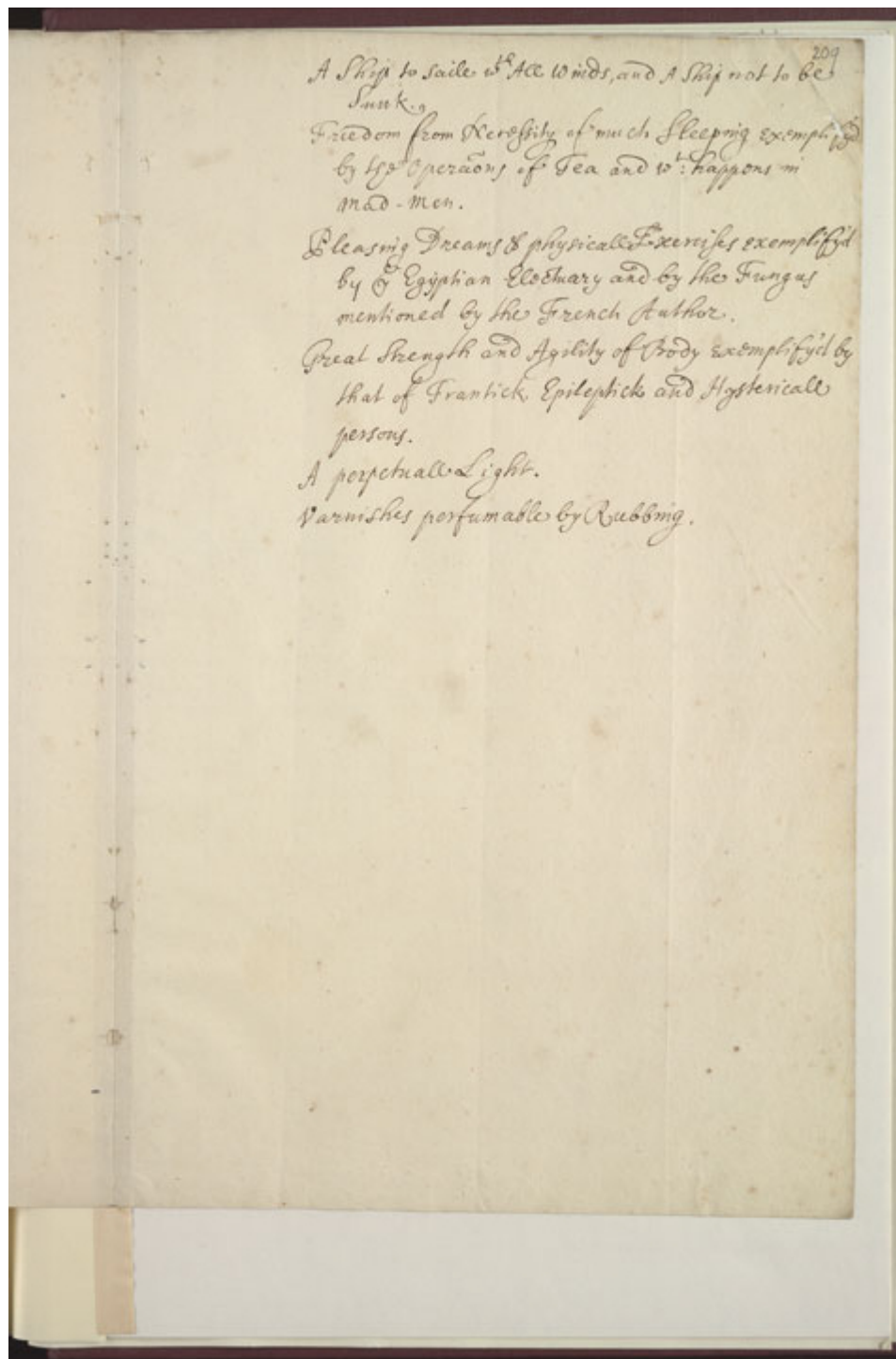


Fig. 2. b. Boyle Papers, Vol 8., Fol. 209r.

desired institutions, arts, and discoveries, that I will concentrate in this chapter, although it was by no means the only sort to be found in the period. All lists of *desiderata* did share, however, certain formal characteristics, which will allow me to include here a number of lists with titles closely analogous to *desiderata*, such as *optativa*. The list, marshaled in neat columns, did not appear chaotic, yet it contained no internal divisions, boundaries, or apparent rationale. Like Bacon's aphorisms, desirables presented "knowledge broken" in a flight from method.⁴²⁵

This was in contrast to many rational listing practices of the period. The widely prevalent dichotomous "Ramist" tree, for instance, offered a way to break down and organize practically anything, from the contents of a book to the parts of a discipline, in a methodical way. Someone drawing up a methodical tree employed universal reason to clarify dependences and hierarchies concealed beneath the surface of things. By contrast, the keeper of desirables imagined a boundless future to be spent investigating an infinite realm. Like the genre of the essay, the desirables represented an exploratory individual foray away from logical schemata.⁴²⁶ This did not mean that desirables were a merely personal exercise. *Desiderata* were intended for communication, concerted effort, and the common good.

Nor were they constructed entirely at random. According to an early modern etymology, the word *desiderare* implied the outcome of a tempest. Something was said to be desired which had disappeared, and was no more.⁴²⁷ In other words, it was found "wanting." A Gothic tempest had blown through the ancient world of learning, leaving wrack and ruin

⁴²⁵ Stephen Clucas, "A Knowledge Broken: Francis Bacon's Aphoristic Style and the Crisis of Scholastic and Humanistic Knowledge Systems," *English Renaissance Prose: History, Language and Politics*, Neil Rhodes, ed. (Tempe: Medieval & Renaissance Texts & Studies, 1997), 147-72.

⁴²⁶ For a thesis of an anti-Ciceronian individualized "Baroque" rhetoric, see Morris Croll's *Style, Rhetoric, and Rhythm* (Princeton, NJ.: Princeton University Press, 1966).

⁴²⁷ Hoffmann, *Lexicon*. "Propriè autem *Desiderare*, significat finem & exitum tempestatis vel sideris, quod desiit χεῖμα ζεῖν, seu siderare: unde desiderari res dicta, quae abiit, nec ampliùs extat. Salmas. ad Solin. P. 425." It was perhaps no accident that seventeenth-century historians of projectors considered Noah's Ark to be the first project. See Lazardzig (2006).

behind. Early modern man collected the pieces of what remained and noted what was missing in order to rebuild. In the practice of early modern list-keepers, desirables were often the halfway houses between the ancient and the modern worlds.

The notion of desire and loss were intimately connected. Bacon used two terms interchangeably to express the ideas of the desirables- *optativa* and *desiderata*, translated in early modern editions of his works respectively as “wishes” and “deficints” [sic]. Both “Deficients” and “Desirables” were used by other authors to refer to *desiderata*, which also frequently appeared untranslated.⁴²⁸ The loss of the past constituted wishes for the future.

Bacon’s depiction of discovery as a voyage beyond the Columns of Hercules is well known. Why, asked Bacon “should a few receiued Authors stand vp like *Hercules Columnes*, beyond which, there should be no sayling, or discovering, since wee haue so bright and benigne a starre, as your Majesty to conduct and prosper vs?”⁴²⁹ Yet this journey of discovery to a New World can also be related to the re-invention of the lost Columns of Hermes, the dream of a once perfect, complete, and pansophic corpus of knowledge. Bacon also compared King James to Hermes, and argued that like the ancient Hermes, James deserved his own eternal legacy, not only for the “admiration of the present time, nor in the Historie or tradition of the ages succeeding; but also in some solide worke, fixed memoriall, and immortall monument.”⁴³⁰ The lost Columns of Hermes directed a course of discovery beyond the Columns of Hercules to a final monument of infrangible permanence, what Johann Daniel Major called the “port of Perfection.”

⁴²⁸ Cotton Mather referred to his “Catalogus desideratorum as a Catalogue of Desirables.” See Cotton Mather, *Bonifacius*, 174. In *Baconiana, or, Certain genuine remains of Sr. Francis Bacon* (London: Richard Chiswell, 1679), 90. “Etiam Optativa eorum, quae adhuc non habentur, unâ cum proximis suis, ad erigendam humanam industriam, proponimus” is translated as “Furthermore, we propose *wishes* of such things as are hitherto only desired and not had, together with those things which border on them, for the exciting the Industry of Man’s Mind.”

⁴²⁹ *Of the proficience and aduancement of learning, diuine and humane* (London: Henrie Tomes, 1605), 38.

⁴³⁰ *Ibid*, 4-5.

III: Communicating Desires: *Desiderata* and Society

Although, ironically, universal real certainty was one of John Locke's *desiderata*, *desiderata* originated in the contingent desires of individuals.⁴³¹ They could not be deduced from universal reason, and thus required communication to spread. Although lists of projects and *desiderata* could be found in manuscript papers and collections of ephemerides (which may also have been used in limited circulation), writers also published their *desiderata* in an attempt to influence the shape of future knowledge more broadly.⁴³² They also discussed the relationship of *desiderata* to the related lists of *deperdita*, *nova reperta*, and *impossibilia*.

There were several ways modern inventions could be related to the ancient world. They could be completely new, never having been imagined by the ancients, such as gunpowder, the compass, and printing. They could be ancient *desiderata*, now fulfilled by the moderns, such as, according to Pancirolli's popular list of *deperdita* and *inventa* (cited by George Hakewill), the quadrature of the circle.⁴³³ Or, they could be lost ancient arts which became *desiderata*, and thence were candidates for rediscovery.

⁴³¹ John Locke, *An Essay Concerning Humane Understanding* (London: Thomas Basset, 1690).”§. 18. Where ever we perceive the Agreement or Disagreement of any of our *Ideas*, there is certain Knowledge; and where ever we are sure those *Ideas* agree with the reality of Things, there is certain real Knowledge. Of which Agreement of our *Ideas* with the reality of Things, having here given the marks, I think I have shewn wherein it is that *Certainty*, *real Certainty*, consists; which whatever it was to others, was, I confess, to me heretofore, one of those *Desiderata* which I found great want of.”

⁴³² Examples of manuscript *desiderata* lists can be found in the papers of Robert Cotton, Robert Boyle, Samuel Hartlib, and William Petty.

⁴³³ George Hakewill, *An apology* (Oxford: William Turner, 1635), 246. “I will instance onely in one *demonstration*, which is the *Quadrature* of a *Circle*. This *Aristotle* in diverse places calls *scibile* but not *scitum*, a thing that might be knowne, but as then not knowne, in asmuch as the meanes of finding it out, though much laboured, yet was it in his time vnknowne among the *Ancients*: *Antiphon*, *Bryse*, *Hippocrates*, *Euclide*, *Archimede*, *Apollonius*, *Porus* travelled long & earnestly in the discovery hereof, but *Buteo* in a book written of purpose, hath accurately discovered their errorrs herein. And *Pancirollus* in his *nova reperta* tels vs, that *annis abhinc plus minus triginta Ars ista fuit inventa, quae mirabile quoddam secretum in se continet*: about thirty yeares since was that Art found out, which contains in it wonderfull secrets; & to shew that it is indeed found out, he there makes *demonstration* of it, approoued & farther explicated by *Salmuth*, who hath both translated him, & written learned commentaries vpon him. Notwithstanding *Ioseph Scaliger* in an *Epistle* of his to the *States* of the *Vnited Provinces*, challenge this Invention to himselfe: *Nos tandem in conspectum post tot secula sistimus*, wee at last after so many ages haue brought it to light, & exposed it to publique view.”

In period discussions of these categories, we find the world figured as a list of objects or reified ideas constantly shifting in place through time.⁴³⁴ Objects found in the world might fall off into the *deperdita* – lost things, from whence they might be plucked and placed among the *desiderata*. The abyss of the *deperdita* constantly lurked under the feet of modern inventors. Writers such as William Petty often cited the cautionary tale of the ancient inventor of malleable glass (a *deperditum* and a frequent *desideratum*), who “was secretly made away for his pains.”⁴³⁵ Petty urged that modern inventions be supported, lest they too “fill up the Number of *lost things*.”⁴³⁶

Despite the differing attitudes towards invention and change represented by these categories, they co-existed in the period in sometimes contradictory ways. The chymist William Johnson, for example, reviewed a work entitled *A Letter concerning the present State of Physick; Written by a Person of Quality, and without dispute great Learning, who has so effectually and fully discust the whole matter, and proposed such excellent means and wayes, as well to prevent the like for the future, as for the advancing all the desiderata of this Profession*.⁴³⁷ Johnson described the author’s principal aim as “the restoring of this Practise of Physick to its antient Constitution.” The author argued that “Till good Learning came to be over-thrown and laid wast by the Furious irruption of the Goths” it “was then the sole care of the Physitian onely” “though it now stands devided, between the Chirurgion and Apothecary.” Like so much else of ancient learning, the practice of medicine had been broken and fragmented, in this case between the various offices of the Surgeon, Apothecary, and Physician. Yet, countered Johnson, “it is observ’d

⁴³⁴ For the period conception of knowledge as something which needs to be placed, see Ann Moss, “Locating Knowledge,” *Cognition and the Book: Typologies of Formal Organisation of Knowledge in the Printed Book of the Early Modern Period*, Karl A.E. Enenkel and Wolfgang Neuber, eds. (Leiden: Brill, 2005), 35-50.

⁴³⁵ William Petty, *An account of several new inventions and improvements now necessary for England* (1691), 12-3.

⁴³⁶ *Ibid*, 34.

⁴³⁷ *Agyrto-mastix, or, Some brief animadversions upon two late treatises one of Master George Thomsons, intituled Galeno-pale, the other of Master Thomas O’Dowdes, called The poor mans physitian: with a short appendix relating to the Company of Apothecaries* (London: Henry Brome, 1665), 130.

likewise, that this Profession in general never flourish'd better then it has in these three Branches, (*viz.*) Physicians, Chirurgeons, and Apothecaries; nor has there been a greater improvement in Physick, in any Age of the World, then what has been made within this Thirty years last past. . . .”

The magical arts, the means by which mankind could transform nature through art, offered special opportunities and dangers in the shifting landscapes of the *desiderata*, *deperdita*, and *impossibilia*. On the one hand, these magical arts were part of the ancient *prisca sapientia*. As the title of a manuscript advertised by Joachim Morsius in 1626 claimed, the “natural magic of the ancient philosophers,” included the “greatest secrets of the whole world, the which treasure gives the greatest *desiderata*, which means everything which Man might want in this life, such as wisdom, understanding, true justice, riches, and a long, healthy life.”⁴³⁸

John Webster wrote in a similar way concerning the art of making magical amulets. “This piece of learning may justly be numbred amongst the *Desiderata*, and might very well have been placed in the Catalogue of the *Deperdita* of *Pancirollus*; yet was it well known unto the ancient Magicians, and by them often with happy success put into practise,” he says.⁴³⁹ Webster surveyed the history of the body of learning from classical times to his own. He referred to the popular work of Pancirolli, *Rerum Memorabilium sive Deperditarum Pars Prior*, suggesting that “pieces of learning” such as the amulet should have been included in that standard reference, since amulets were successfully made by the ancients. The amulet too

⁴³⁸ Joachim Morsius, *Nuncius Olympicus* (“Philadelphia”: 1626), #139. “Magia naturalis intacta veterum philosophorum, ein unaussprechlicher Schatz der gute unde güter Gotes, darinne die grossen geheimnussen der gantzen Welt in der Natur ruhendt begriffen werden/ welcher Schatz die höchsten desiderata gibt/ das ist zu verstehen alles was ihme der Mensch in diesem leben erwünschen mag/ als Weissheit/ verstand/ where Gerechtigkeit/ Reichthumb und langes gesundes leben/ das wir hierin ohn allen verhalt genug und getrewlich dargethan.”

⁴³⁹ John Webster, *The displaying of supposed witchcraft wherein is affirmed that there are many sorts of deceivers and impostors and divers persons under a passive delusion of melancholy and fancy, but that there is a corporeal league made betwixt the Devil and the witch ... is utterly denied and disproved: wherein also is handled, the existence of angels and spirits, the truth of apparitions, the nature of astral and sydereal spirits, the force of charms, and philters, with other abstruse matters* (London: Printed by J.M. and are to be sold by the booksellers in London, 1677), 156.

was a *deperditum* which might be restored if it were placed among the desired things, the *Desiderata*. Webster wanted to make sure that magical knowledge would not be omitted from the reconstructed world.

Yet magical arts, as integral to new Paracelsian philosophies, were also often included among the *nova reperta*. Arts using “magnetic” sympathies were compared by writers on progress to one of the most famous *nova reperta*, the magnetized needle of the compass (discussed further in Chapter Six). For example, the sixteenth-century medical theorist, Jean Fernel, compared his “magnetic” account of occult diseases to the three discoveries of the moderns: gunpowder, printing, and navigation.⁴⁴⁰ George Hakewill similarly offered a sympathetic long-distance communicator as another example of a magnetic modern invention like the compass.⁴⁴¹

The moderns drew upon two different arguments illustrating their inventive prowess: they had the ability to restore the world to its former glory by fulfilling the *desiderata* of the lost arts. At the same time, they also claimed that certain arts had never been better. To add to the confusion, the world underneath their feet was not stable either. Due to the progress in the history of the arts, many believed that the history of nature was changing too.⁴⁴² In this world of shifting possibilities, how could Goltzius’ king possibly decide whether to trust the claims that the perfective arts held out for the future, or to pay more attention to the folly lurking behind her throne?

⁴⁴⁰ Jean Fernel, *On the Hidden Causes of Things: Forms, Souls, and Occult Diseases in Renaissance Medicine* (Leiden: Brill, 2005), 107-109.

⁴⁴¹ Hakewill, *Apologie*, 267. In this Hakewill was followed by Jonston, *Constancy of Nature* (London: Streater, 1657), 109.

⁴⁴² Anthony Grafton, “Renaissance History of Art and Nature,” *The Artificial and the Natural: An Evolving Polarity*, Bernadette Bensaude-Vincent and William R. Newman, eds. (Cambridge: MIT Press, 2007), 185-210.

IV: Art, Nature, and Mercantilism

In the Holy Roman Empire at the turn of the seventeenth century, a group of economic and political advisors recognized the value of labor over commodities, or in their terms, art over nature. Seeking to fill the imperial coffers, these theorists recommended manipulating the human desires for artfully worked luxury goods by promoting industry, exporting worked goods, and importing raw natural materials. This favorable attitude toward man's ability to transform nature supported the idea that art could be used to improve nature, increase commerce, and enrich the Empire.

Economic historians have criticized the term "mercantilism" as reifying a theory that was not maintained consistently in practice. However, Central European "mercantilists" such as Hieronymus Elver (?-1624), Jakob Bornitz (1560-1625), Christoph Besold (1577-1638), Hermann Lather (1580-1643) and Kaspar Klock (1583-1655) recognized the value of *Kunst* over commodity well in advance of their western European counterparts. In their constant quotation of each others' works, these thinkers did form a clear group.⁴⁴³

One member of this *Kunst*-promoting group also participated in other associations for the promotion of art. A friend to Andreae, Hess, and Kepler, the extremely prolific political theorist, historian, and calculator of the end of days, Christoph Besold, has long been suspected as one of the three authors of the *Fama*, first Rosicrucian tract to be published (1614).⁴⁴⁴ The identities of this thinker as an economic theorist on the one hand and an enthusiastic fraternist on the other have yet to be brought together. Yet, for one

⁴⁴³ I discuss the citations of Elver, Lather, Bornitz, and Besold below. While Kaspar Klock devoted far less space to the mechanical arts than did Bornitz, he followed Bornitz' *Tractatus de Rerum Sufficientia* and cited it in his *De Aerario* (Nürnberg: Endter, 1651), Chapter XXV, "De Mechanicis Artibus ex Opificiis Aerarium Divitantibus," 321-9.

⁴⁴⁴ For recent reviews of this question, see Edward Thompson's introduction to J. V. Andreae's *Christianopolis* (Dordrecht: Kluwer, 1999), 16-8 and Didier Kahn, "The Rosicrucian Hoax in France (1623-4)," *Secrets of Nature: Astrology and Alchemy in Early Modern Europe*, W. Newman and A. Grafton, eds. (Cambridge, MA: MIT, 2001).

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working in a setting with state-sponsored interests in both the mastery of nature and finding the funds to fit the imperial ambitions of an art-loving monarch, a fusion of mercantilism and Rosicrucianism made perfect sense.

In practice, Central European princes had engaged in entrepreneurial alchemical ventures through the sixteenth century.⁴⁴⁵ Such rulers engaged expert mediators to canvass the field of wonderful projects and sift the possible from the impossible. For example, Prince August of Anhalt-Plötzkau, the ruler of one of the smallest entities in the Empire, certainly could benefit from art to enhance the assets of his miniscule realm. He became an enthusiastic reader of the *Fama* and a supporter of such alchemists as Karl Widemann and Adam Haslmayr.⁴⁴⁶ Having heard of Drebbel's perpetual motion in 1607, he immediately turned to Besold's friend Kepler for his advice on whether the device could be used in mining, emphasizing that he only cared whether the machine would actually work.⁴⁴⁷ Likewise Altdorff professor Daniel Schwenter recorded being asked for his opinion concerning the story of Drebbel's optical display by "a person of high standing." He informed the man that he believed such a display, and even more, could be possible.⁴⁴⁸

⁴⁴⁵ Nummedal, *Alchemy and Authority in the Holy Roman Empire*, "Chapter Three: Entrepreneurial Alchemy." Deborah Harkness and Eric Ash also demonstrate the respect for expertise and the "Big Science" practiced in Elizabethan England.

⁴⁴⁶ Carlos Gilly, *Adam Haslmayr: der erste Verkünder der Manifeste der Rosenkreuzer* (Amsterdam: In de Pelikaan, 1994) and *Cimelia Rhodostaurótica: die Rosenkreuzer im Spiegel der zwischen 1610 und 1660 entstandenen Handschriften und Drucke* (Amsterdam: In de Pelikaan, 1995), 40.

⁴⁴⁷ Johann Kepler, *Opera Omnia*, Vol 5, (Frankfurt: Heyder & Zimmer, 1864), 645. ". . . Hab ich befunden vom Belga Drublero und seiner profession ein wunderlich Sach. So Im nun nicht zuwieder, seiner action halben mich darüber zu berichten., wehr es mir gar angenehm (lieb die praxin veram) zu vernehmen. Mit Verlangen sein Gutachten über die WasserKunst erwartet würdt, so Drublerus ein guttes könt einratten, wehr mir woll geholfen, damit Got in sein schutz befohlen."

⁴⁴⁸ In the preface to his section on Optics in *Deliciae Physico-Mathematicae oder Mathematische und Philosophische Erquickstunden* (Nürnberg: Dümler, 1636), 251, Schwenter promised the reader, "Was Cornelius Drebbel durch die Perspectiv zu weg bringen kan folget in der 13 Auffgab dieses Theils/ ja ich sag dass in der Optic solche Geheimnuss stecken/ dergleichen in andern Mathematischen Künsten wenig anzutreffen." There (263), Schwenter recalled, "Mir hat vor der Zeit eine hohe Person/ Corneliü Drebel's eines Niderländers/ vorgeben zugeschickt/ meine meynung/ davon zu entdecken Auff solches antowrtete ich: Ich glaubte diss und noch ein mehrers. . . ."

The mercantilist promoters of *Kunst* hoped through their writings to serve as expert mediators, offering a theory of how art could benefit government, and how one could distinguish between projects. They discussed how several long standing institutions of universal autopsy, exchange, and association – collecting, travel and commerce – might be employed for the betterment of the Imperial Treasury.

Elver, cited later by Besold and Lather, proved particularly influential.⁴⁴⁹ His ruminations on the role of manufacture in the increase of wealth were entitled *Apodemie Delights*, since they grew out of his methodical travels through Italy, France, Belgium, Britain, Germany and Poland. As Besold wrote in his *Political Discourse on the Public Treasury*, citing Bornitz, Lather, and Elver, the increase of coin depended not upon natural materials but upon the growth of industry.

. . . How Republics may enhance their monies, through the constant attraction of foreigners, in the pursuit both of agriculture & crafts, Bornitz teaches accurately in book 2 *De Nummis*, chapter 8. Lather, book 30, chapter 19, num. 109, etc. and chapter 20, number 27 & many following. Hieronymus Elver also wrote about this matter in *In delitiis Apodem.* Letter 41: It is certain that he has been led into a great error of opinion, who thinks that for the increase of the Republic & an abundance of inhabitants, fertility in a region has a greater effect than the industry of its inhabitants. Let Belgium be an example for us, in which there are no mines of silver or of gold, and furthermore many Regions poor in crops. But nonetheless, that people is much more blessed today in riches & luxury than Hungary and “Fruitful Arabia.” It has thus evidently thrived through the industry of men, and the most fruitful commerce of every sort. Florence, London, and Nürenburg can serve us as an example, where more make their living from art than from nature. Let Princes and the governors of Republics learn from this to forbid undeveloped and simple materials of nature to be exported out of their Regions abroad, for that material, having been refined & elaborated, will fetch a better price than when undeveloped and natural. They will better fill the Treasuries of Princes, and the Cities with inhabitants. For where there is an abundance of materials, there will also be an abundance of residents and of profit. But I will

⁴⁴⁹ Hieronymus Elver, *Deliciae Apodemicae: Hoc est, Selectiorum discursuum Ethico-Policorum Sylloge Epistolica: Nata in Perigrinatione Italica, Gallica, Belgico-Britannica, Germanica, Polonica* (Lipsiae: Apelius, 1611).

end my remarks here: but I add only this in conclusion: there is so much wealth in the arts, the skill and the industry of men, that the mines of silver and gold of the Indies, and the silver-bearing mountains of fruitful Arabia and Hungary, cannot compare to them. *Thus far Elverus.*⁴⁵⁰

The constant importation of exotic raw materials and the domestic refining of them into luxury goods for export was the “oblique” way to mine the Indies of its silver, explained Jakob Bornitz in his *De Nummis* of 1608.⁴⁵¹ This was a much more certain way to gain currency than chrysopoeisis, which Bornitz warned was a matter still under debate, and full of danger.⁴⁵² Yet while desire for art might be able to fill the Imperial coffers, one must beware lest this desire seduce one’s own people.

The soul eager for novelty and rarity falls in love with these [works of art which surpass nature], and often is seduced into throwing away cash. And it is to be mourned, that certain completely frenzied and blind peoples give raw material for sale to foreign nations in the hope of a little petty cash. Which when later clothed in various

⁴⁵⁰ Christoph Besold, *Discursus Politici de Aerario Publ.* Cap. IV. (Strasburg: Zetzner, 1626), 92. “Ac quomodo Republicae nummis accumulentur, per assiduam attractionem & illationem exoticorum, studio item agriculturae & opificiorum; accuratè Bornitius docet. *libr. 2. d. Nummis, cap. 8. Lather. 30. cap. 19. num. 109 &c. ac c. 20 num. 27. & multis seqq.* Eademque de re sic etiam scribit Hieronymus Elver. *in delitiis Apodem. Epist. 41.* Id certum est, magno opinionis errore duci eum, qui putet, ad Republicae incrementum, Ut & incolarum multitudinem; plus facere fertilitatem Regionis, quam ipsam incolarum industriam. Exemplo nobis Belgium esto; in quo nullae auri argentive fodinae; imò etiam plures Provinciae, frumento haud abundantes. Attamen nihilominus Hungaria & illa felici Arabia, opulentia hodiè & divitiis gens ista longè felicior est. Ita nimirum crevit hominum industria, & commerciis in omni genere uberrimis. Exemplo quoque nobis esse potest Florentia, Lugdunum, Noriberga; ubi plures ab arte quam naturâ victitant. Discant porrò hîc Principes & Rerumpublicarum gubernatores, vetare, ne rudes & simplicis naturae materias, suis è Regionibus ad externos exportari sinant; materia namque illa, expolita & elaborata, plus exhibet lucri, quam rudis & nativa; magis illa Principis implet Gazophylacium; magis incolis Urbes. Nam ubi abundantia materiarum, incolarum quoque erit atque lucri. Sed desino plura hîc commemorare: id tantum adjicio pro clausulâ; tantas divitias inesse artibus, solertiae atque industriae hominum; ut nequaquam argenti, aurique fodinas Indicas, nec Ungariae, felicisve Arabiae montes auriferos iis comparare queas. *Hactenus Elverus.*” Elver was also cited by Lather in his *De Censu* (1618), 978-979.

⁴⁵¹ Jakob Bornitz, *De Nummis in Repub. percutiendis & conservandis Libri Duo* (Hanau: Wechel, 1608), 89-90.

“Hispanos ex India maximos thesauros acquisisse constat. Quod modo directo & obliquo fieri potest. Directo, conventionem & contractum cum iis, qui auri & argenti copia abundant. Obliquo, verò, cum per indirectum nummi ex alienis Rebuspubl. attrahuntur, si nimirum Resp. iis bonis & artibus floreat, quae exteris maximam merciorum causam praebeant.”

⁴⁵² Bornitz, *De Nummis*, 90. “Sunt qui putant non posse aurum arte produci: alii opinantur, quasi perfectum fieri posse, quod tamen vero non aequi polleat, nec ignem sustineat: alii sibi persuadent, perfectius redde posse arte, quam id quod natura existit. Denique sunt qui dubitant, fieri posse, & proinde sibi non satis hac de re constare . . . Ego quid sentiam? Dubito. Nec autor essem Principi, ut hac arte defectum naturae refarcire conaretur. Res periculi plena.” Bornitz did soften considerably in his attitude towards alchemy by the *De Rerum Sufficiencia* of 1625.

forms is then resold for a hundred times as much to those, by whom it was first obtained.⁴⁵³

Although it was important to export rather than import luxury goods, a good reason did remain for collecting wonderful objects within a princely *Kunstammer*. It was the responsibility of Princes and Governors to showcase the power of art over nature. Their wonderful collections of artificialia and naturalia would lead, obliquely of course, to benefits for all. True, said Lather, there are those who say that useless wonders of art serve no purpose. Yet, he claimed, the human industry remains to be admired in those who can write the entire *Iliad* on one page, or even within a nutshell.⁴⁵⁴ Bornitz concluded his entire treatise *De Rerum Sufficientia* of 1625 with a chapter on the *Kunstammer* (“De Technicothesis Principum, Fürstliche Kunst Kammer”). Besold recommended that the state build tourist attractions and facilities for travelers and merchants for the increase of trade.⁴⁵⁵

We find a vastly elevated respect for mechanics in the work of our mercantilists, both in the mechanics’ ability to increase coin, and in their general benefits to society. Bornitz argued that although the mechanical arts dirty one’s hands and “seem to be disregarded by Philosophy and the liberal arts, nevertheless it is evident that they are most deserving of liberal talent.”⁴⁵⁶ Bornitz’s support for artisanal philosophy and attention to natural and mechanical details in travel reflected a Ramist emphasis on the importance of

⁴⁵³ *Ibid*, 93. “Quarum amore animus novitatis & raritatis avidus ducitur, & saepe cum iacturâ nummorum seducitur. Et dolendum est, populos quosdam admodum vecordes & caecos exteris nationibus materiam rudem venalem exponere spe exigui lucelli. Quam indutam postmodum variis formis centuplo revendant iis, à quibus eam nacti fuerint.”

⁴⁵⁴ Lather, 997. “Interim tamen humana solertia est admiranda, & eius industria laudanda, qui universam Homeri Iliadem tanta membrana conscripserat, quanta posset in nuce includi.”

⁴⁵⁵ Christoph Besold, *Discursus Politicus De Incrementis Imperiorum, Eorumque Amplitudine procurandi* (Strassburg, Zetzner, 1623), 14.

⁴⁵⁶ Bornitz (1625), 60. “And although such (arts) cannot be handled without filth, nevertheless they are not to be despised, nor are all to be considered and dishonored as sordid. . . . And although they seem to be disregarded by Philosophy and the liberal arts, nevertheless it is evident that they are most deserving of liberal talent and use the aid of philosophy.”

“Et quamvis quaedam sine sordibus tractari nequeant, inde tamen non aspernandae, nec omnes pro sordidis habendae et prostituendae sunt. . . . Et quam vis eas à Philosophia et artibus liberalibus seponi videri: constat tamen quamplurimas ingenio liberali dignas esse et adminiculo philosophiae uti.”

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basing education in and for works. Indeed, he translated a work on the education of princes by Jean Bodin, the *Consilia Johannis Bodini Galli* (Vinariae: N.A., 1602), one of his favorite authors, in which Bodin made a rare reference to Ramus as the best authority on logic.⁴⁵⁷ In turn, Bornitz's work was much appreciated by Ramist pansophic encyclopaedists; Jan Amos Comenius, for example, suggested in 1645 to Cyprian Kinner that Bornitz's *De Rerum Sufficientia* could be used as the source for the section on *artificialia* in Comenius' new didactic work, the *Systema Sensualium, pro erudiendâ Scholâ Vernaculâ*.⁴⁵⁸

Which arts in particular should be promoted? Only those, according to Lather (citing Bornitz' *De Praemiis*), which benefited common life, and either restored lost arts or discovered new ones ("obliteratas artes reparant, aut novas inveniunt").⁴⁵⁹ Bornitz reasoned also in his *Tractatus de Rerum Sufficientia* of 1625 that arts followed a cycle, which he treated in three chapters of the *deperdita*, the *nova inventa*, and finally those we hope to discover before the end of the world. This last category included suspect arts which ought to be further investigated ("adhuc reperienda et investiganda"). Through this category, man explored a changing world "for both God and Nature are inexhaustable, and through the harmony of macrocosm and the microcosm, human nature is always desirous of the new."⁴⁶⁰

Not only did a changing *ingenium* keep pace with a shifting nature through global harmony, but many of Bornitz' *desiderata* in this section were themselves notable for their ability to change nature and its relationship to man. Such arts included the discovery of the *Electrum magico-physicum*, or the Hermetic magnet of nature, magical amulets, Johann

⁴⁵⁷ Kenneth D. McRae, "Ramist Tendencies in the Thought of Jean Bodin." *Journal of the History of Ideas* 16:3 (Jun. 1955), 320.

⁴⁵⁸ Hartlib, *Ephemerides*, 1/33/87A.

⁴⁵⁹ Lather (1618), 861. "21. Quae vero artes potissimum exercendae sint, hoc ipso & praecedente cap. 19. n. 111. diximus, nimirum quae usum in vita communi habent. Unde admodum bene merentur artifices, qui civitatem illustriorem & ditiores reddunt, & oblitteratas artes reparant, aut novas inveniunt. Jacob. Bornit. *libr. 1. de praemiis. c. ii.*"

⁴⁶⁰ Bornitz, 227. "Deus enim & natura in exhausta sunt. Et ingenium humanum est avidum novitatis, astro macrocosmico & microcosmico conspirante."

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Ernst Burggrav's blood-lamp (the Biolychnium), transparent silver, a magical mirror in which the motions of the heavens could be seen, the perpetual motion, a ship to sail against the wind or under water, the wonderful sphere built by Cornelis Drebbel showing the motions of the tides and his solar-powered musical instrument, the Kabbalah and true Magic.⁴⁶¹

Drebbel's sphere, which quickly garnered fame as one of the most wonderful discoveries of mankind, was of much interest to art-promoting mercantilists. Besold, who was also a reader of Drebbel's natural philosophy, cited Drebbel's machine as the only example of perpetual motion in his *Thesaurus Practicus*, although he doubted whether perpetual motion was possible.⁴⁶² Bornitz himself had already mentioned Drebbel's sphere

⁴⁶¹ *Ibid*, 227-8. "Adhuc inveniendum Electum magico-physicum: Magnetis naturae spiritualis et invisibilis Sympathici et Antipathici Hermetici enucleationem. Vide Gilbert. *in tract. singulari de magnete*, Goclen. *in dissert. pro unguento armar*. post alios quam plurimos, quorum tamen nullus lectori satisfaciet.

Amuletorum curam, curam magneticam ex mumia Theophrasti: Biolychnium, id est, lampadem, ex sanguine humano vitae et mortis indicinam; et totius vultudinis cynosuram, quae tamen quibusdam satis iam nota esse videtur. Ioh. Ernestus Burggravius.

Argentum instar vitri perspectibile. Offenbar. *lib. 19. cap. 26*.

In Mathe maticis speculum magicum in quo motus caelestes conspiciuntur, Offenbar. Göttl. *Mai. cap. 5*.

Motum perpetuum, de quo dubitat Flamand. et Lorinus. At simile quoddam inventum fuisse ab Helvetio quodam, refert Robert. de Fluctib. *tit. de variis machinis*.

Ignem perpetuum, quadraturam circuli, de qua Ioseph. Scalig. . . .

Et quod pote sit vento adverso navigare, vel etiam sub aqua.

Nec rationem et causam sphaerae in Anglia prodigiosae, à Cornelio Drebbelio fabricatae, quae motus caelestes et aestus maris refert: Item, organi musici, quod musicam edit ad motum caeli et splendorem Solis, reddere aut investigare quis valet, ex scholis vulgaribus Mathematicorum, Physicorum et Musicorum. Uti testatur Kepplerus noster *in Epist. ad Calvisium scripta*, vide Marcell. Wanckemium *in Epist. ad Burggrav.* et confer D. Sennert. *de consens. Galen, et Chimicor. c. 7. pag. 148*. ubi de spiritu mundi quaedam attingit. . . . Ut taceam de Cabala et Magia, vera, non inani, superstitiosa et diabolica restauranda. Michael Poitier *in indicio de Fr. R. C.* post alios. Confer Picum Mirandul. Reuchlinum et Pet. Galatium, Crollium, Dobericium, Nagelium, Felgenhaver. etc."

⁴⁶² Besold's library has been preserved at Salzburg, including his copy of Drebbel's *De Natura Elementorum* (Frankfurt, 1628) and *De Quinta Essentia* (1621). According to an electronic communication from Salzburg Rare Books Librarian Beatrix Koll, he has inscribed on the inside of the frontcover:

ATS + CTC

Sancta trinitas

unus deus;

miserere nobis!

1633

Christophorus Besoldus

Quam mihi, dum specto

sydera, sordet humus!

In cruce stat securus

Amor.

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several times in *De Rerum Sufficiencia*. In his chapter on automata, he mentioned a wonderful automaton with a globe showing the motions of the heavens (although he did not ascribe this globe to anyone) in the court of the English King. His friend the doctor Johannes Pelargus had described it to him, and he planned to publish this description along with some “singular manuscripts” (but alas died before he had an opportunity to do so).⁴⁶³ In his chapter on the art of celestial and terrestrial globes he did describe Drebbel’s globe, this time citing Marcellus Vranckheim’s description in his published letter to Johann Ernst Burggrav, and a (now lost) letter from Kepler to Seth Calvisius.⁴⁶⁴ It is a current dispute, he said, whether the work is moved by the spirit of the world and a magnetic celestial virtue, or not. We will hear more about this dispute in Chapter Five.

Drebbel’s machine was of particular interest for its relationship to a *deperditum*, the lost art of the Archimedean sphere. Drebbel himself had made the comparison, as did many others such as Vranckheim.⁴⁶⁵ There were even those that thought he might have built the machine out of the famous malleable glass.⁴⁶⁶ Indeed, we find the Archimedean sphere among Bornitz’s list of lost arts. The Emperor Rudolf, according to Bornitz, wished to rediscover this art, but “hindered by death and the burden of wars he left the work

For Besold’s discussion of Drebbel’s perpetual motion machine, see *Thesaurus Practicus* (Nürnberg, 1643), 678. Besold cites Drebbel’s letter to King James in Joachim Morsius’ edition, Burggrav’s *Bioychnium*, and Staricius’ *Heldenschatz*.

⁴⁶³ *Ibid*, 166. “Est admirandum Automatum in aula Regis Angliae, quod Astrolabium et Chronolabium, cum Globo, qui caelum et caelestes imagines, etc. continet, cuius integram descriptionem ab amico D. Iohanne Pelargo Medico mihi communicatam, aliquando luci dabo, cum aliis M. S. singularibus.”

⁴⁶⁴ *Ibid*, 178. “Hic recordor globi Drubleri, Belgae, qui ad motum caeli moveri, perhibetur: plurimi magieum quiddam subesse putant, quod corpora naturalia sine adminiculo immobilia. Naturae, qui conveniens esse, disputant, spiritus mundi universalis vel caelesti virtuti magneticae adsignant. Ideo adhuc sub Iudice lis est. Cuius meminit Marcell. Wanckemius, in *Ep. ad Burggravium*, et Keplerus noster, in *Epist. ad Sethum Calvisium*.”

⁴⁶⁵ Cornelis Drebbel, “Dedication” (see Appendix I) and Marcellus Vranckheim, *Epistola*, in Johann Ernst Burggrav, *Bioychnium*.

⁴⁶⁶ Andreas Libavius, *Investigatio Caussarum Physicarum, Aliarumque Globi Archimedaici novi & instrumenti musici per se absque evidente motore mobilium* (Coburg: Bertsch, 1612), #30: “. . . ex materia levissima, subtiles (ponimus ex vitro tenuissimo, quod fortasse est flexile, ex crystallo & lapide Philosophorum: haec enim materia esse affirmatur à Philosophis mysticis. . . .”

unfinished.”⁴⁶⁷ Here too Bornitz did not mention the fact that it was Drebbel who came to Prague to build the sphere for Rudolf shortly before Rudolf’s death. The *deperditum* of the Archimedean sphere, the imperial quest to rediscover it, as well as the possibility that the sphere might be moved “magnetically,” must have made Drebbel’s sphere a considerable *desideratum* for Bornitz.

Bornitz’s list “*adhuc reperienda et investiganda* was not entitled *desiderata* for many of its contents had already been invented, such as the devices of Burggrav and Drebbel. However, they had not yet been investigated to Bornitz’s satisfaction (he particularly urged in the case of Drebbel’s instruments “reddere aut investigare quis valet, ex scholis vulgaribus Mathematicorum, Physicorum & Musicorum”).⁴⁶⁸ These devices were so new and ill-explored that they fell into a special category of those things on the cutting-edge of existence, teetering between the desirable and the impossible. It is a category we will encounter again in the works of Francis Bacon.

V: Truth and Myth in the *Desiderata*: the Tales of Amadis and the Deeds of Caesar

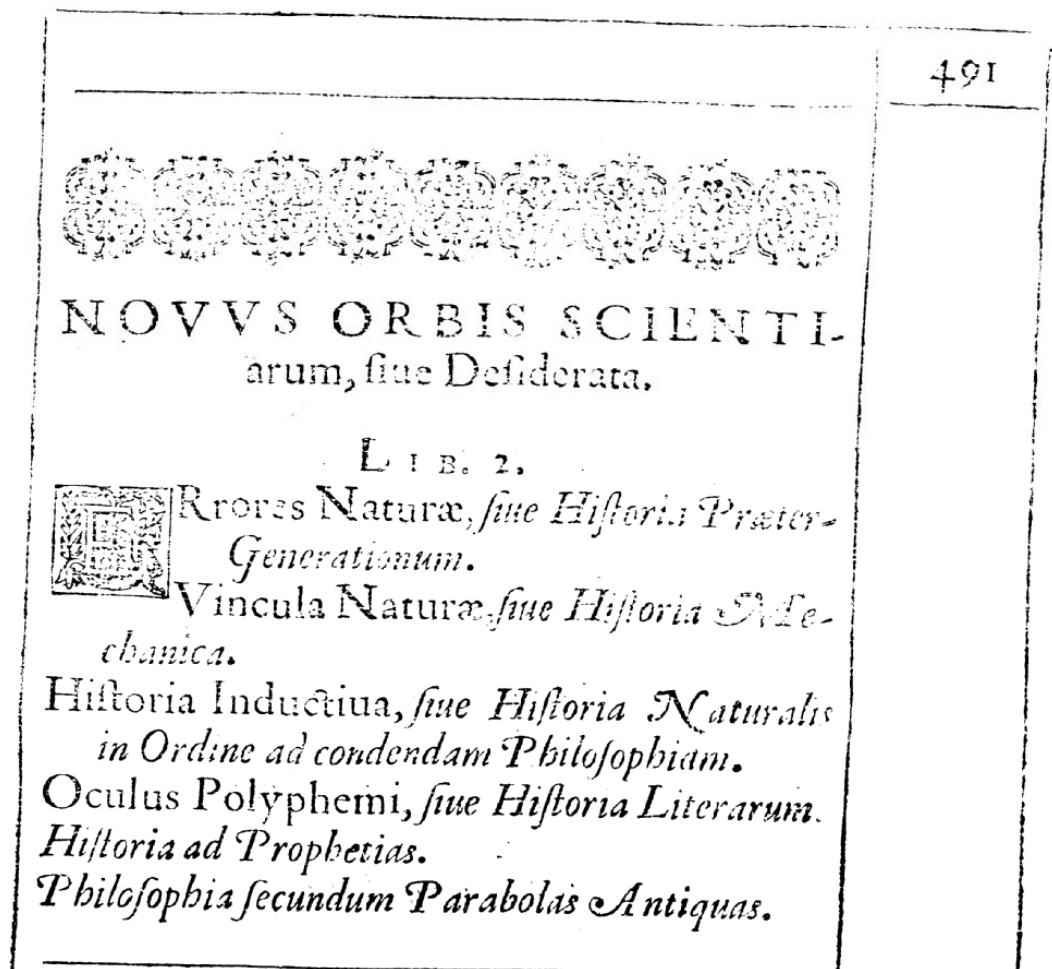
For many in seventeenth-century Europe, the catalog of desires published by Francis Bacon provided not only a model for how to orient a *desiderata* list towards the collective advancement of knowledge, but a specific program of research to fulfill. For instance, in his 1667 dissertation on the reform of legal education, Leibniz included a catalog of *desiderata* for the future study of law.⁴⁶⁹ Leibniz claimed to imitate Bacon, who concluded the

⁴⁶⁷ Bornitz (1625), 225. “Archimedes Syracusanus Sphaeram vitream fecit, in qua motus coli et stellarum cursus incrementum et decrementum ante oculos posuit, ut Stradius refert *ex hist.* Qualem Rudolph. II. Imp. affectasse fertur, sed morte et mole bellorum impeditus im perfectum opus reliquit.”

⁴⁶⁸ *Ibid.*, 227. “Nec rationem et causam sphaerae in Anglia prodigiosae, à Cornelio Drebbelio fabricatae, quae motus caelestes et aestus maris refert: Item, organi musici, quod musicam edit ad motum caeli et splendorem Solis, reddere aut investigare quis valet, ex scholis vulgaribus Mathematicorum, Physicorum et Musicorum.”

⁴⁶⁹ Leibniz, *Nova Methodus Discendae Docendaeque Jurisprudentiae Ex artis Didacticae Principiis in parte Generali praemissis, Experientiaeque Luce* (Frankfurt: Johann David Zunner, 1667). “Hoc omine finiremus, nisi praestaret

Advancement of Knowledge with something he called the “*Novis Orbis Scientiarum, sive Desiderata*.” Superficially, Bacon’s list [Fig. 3] resembled the classical desiderata, since it contained the titles of books. Yet these books were not yet written, and therefore they represented diverse areas of knowledge that Bacon hoped would be explored by someone in the future.



dispersa quaedam in superioribus in unum contrahi, primum Computationem temporis; deinde Catalogum desideratorum ad imitationem Fr. Baconis in *Augmentis Scientiarum*.”

Fig. 3. Part of Bacon's *Novus Orbis Scientiarum, sive Desiderata*.

Like many others, Leibniz also cast himself as working towards fulfilling the particular *desiderata* communicated by Bacon.⁴⁷⁰ For example, in the *Combinatory Art*, Leibniz wrote, “. . . because Verulam put it in the catalog of desiderata in his *Augmentis Scientiarum*, it should be considered sufficient, if we arouse a suspicion of such an art for men, which another may produce with incredible benefit for mankind.”⁴⁷¹ Leibniz stressed here the agency of *desiderata* even as myth. *Desiderata* existed to motivate others for the common good. Even a suspicion that progress on the art was being made should be enough to encourage others to join the quest.

While Bacon was doubtless important in developing the temporal and material turn of the Utopian *desiderata*, he alone was not responsible for these changes. The transformation of the *desiderata* can be linked to changes in the nature of the related rhetorical commonplace, which underwent a material and temporal turn in the sixteenth century (discussed further in Chapter Six). Yet as a model explicitly followed by many in the period, Bacon's own view of what the *desiderata* could achieve merits attention.

The relationship between desire, lack and progress was all too apparent to Francis Bacon. He complained in the *Novum Organum* about the different time-frame of desire and advance operating in the mechanical arts versus philosophy. Progress occurred quickly in the mechanical arts, which at first appear rude and onerous but quickly gain new virtues and convenience. Progressing even more quickly however, were the desires and appetites of men (“*studia hominum & cupiditates*”), which moved on to something else before the arts even

⁴⁷⁰ These included Nathaniel Wanley, *The Wonders of the Little World* (London: Basset et. al., 1673), 3, discussed further in Chapter Five, and Robert Boyle, *Tentamen porologicum* (London: Samuel Smith, 1684), 2; John Peachi, *Some observations made upon the root caled casmunar imported from the East-Indies* (London, 1693), 8, and Claude Fleury, *THE HISTORY, Choice, and Method OF STUDIES* (London: S. Keble, 1695), 4.

⁴⁷¹ Leibniz, *Mathematische Schriften* (Halle: H.W. Schmidt, 1859), 42, “. . . et quod in catalogo desideratorum suis augmentis Scientiarum Verulamius fecit, satis habituri, si suspicionem tantae artis hominibus faciamus, quam cum incredibili fructu generis humani alius producat.”

reached their perfection.⁴⁷² By contrast, philosophers were congratulated on the present state of their discipline, and as a result it did not progress.

It was the always shifting, never satisfied avarice of men which pushed forward inventions, and which constantly spawned new endeavors in the mechanical arts. Yet since, claimed Bacon, mechanical artists cared nothing for philosophy, their inventive powers were never focused upon the advancement of learning. Bacon hoped to direct the desire of men towards the future progress of learning.

Directing desires was no simple task. Bacon had divided the investigation of nature into hierarchies corresponding to a social hierarchy, developed most fully in Bacon's vision of Solomon's House. At the very top stood the Interpreter of Nature. Yet, as Bacon discussed in the *Novum Organum*, even "in the very work of Interpretation concerning particular subjects I always give a place to a List of things human, or List of Optativa. For to wish intelligently is as much a part of science as to inquire intelligently."⁴⁷³ While recognizing the motive force of desire, the Interpreter did not trust to desire at large to direct future inquiry. Rather, the communication of his own *desiderata* would chart the course of communal discovery.

Indeed, Bacon castigated those new philosophers who did not "wish intelligently." These, responding to the desires of many, proposed the impossible and therefore cast doubt upon all new philosophical enterprises. He gave a long list of promises put forward by "idle boasters and cranks," whose unfulfilled assertions only served to highlight the solidity of the

⁴⁷² *Novum Organum*, Oxford Bacon, 12, "In artibus autem mechanicis, contrarium evenire videmus – quae, ac si aurae cujusdam vitalis forent participes, quotidie crescunt & perficiuntur; & in primis authoribus rudes plerunque & ferè onerosae, & informes apparent, postea verò novas virtutes, & commoditatem quandam adipiscuntur, è usque, ut citius studia hominum & cupiditates deficiant & mutantur, quàm illae ad culmen, & perfectionem suam pervenerint. Philosophia contra, & Scientia Intellectuales [sic], statuarum more, adorantur & celebrantur, sed non promoventur

⁴⁷³ *Ibid*, 418-9.

ancient sciences by contrast. We might recognize many of these promises from Boyle's *desiderata* list.

Now the Ancient sciences have acquired a great deal of prestige and credit from the vanity and folly of those who have set out new ones, especially in the active and operative part of natural philosophy. For there has been no shortage of idle boasters and cranks who, partly from credulity and partly from guile [*impostura*], have loaded the human race with promises, guaranteeing and holding out the prospect of prolonging life, delaying old age, relieving pain, making good natural defects, deceiving the senses, binding and stimulating the affections, illuminating and extending the intellectual faculties, transmuting substances, reinforcing and multiplying motions at will, making impressions and alterations on the air, drawing down and managing celestial influences, foretelling things to come, representing things distant, revealing things hidden, and so on *ad infinitum*. But with these public benefactors it would not be wrong to reckon that in the doctrines of philosophy their nonsense differs from real arts as much as the deeds of *Julius Caesar* or *Alexander the Great* differ from those of *Amadis of Gaul*, and *Arthur of Britain* in the annals of history.⁴⁷⁴

The charlatans claimed to be “public benefactors” yet in fact they were ruining the credit of new philosophy with their illusions. Bacon argued that great things could indeed be accomplished by the operative part of natural philosophy, just as Caesar and Alexander did indeed win immense successes. Yet the fictions of the cranks clouded the possible, though still fabulous, deeds of operative natural philosophy.

Here Bacon recalled what he had written in his first edition of *The Advancement of Learning* regarding the three parts of operative natural philosophy (experimental, philosophical, and magical), and especially the last. Magic, corresponding to the metaphysics of speculative philosophy, was an extremely important arena for future research.⁴⁷⁵

⁴⁷⁴ *Novum Organum*, Oxford Francis Bacon, 139. Gabriel Naudé argued in a similar fashion in his *History of Magick*, 304-5, yet there were also others who supported a “fabulous way of philosophizing” in the late seventeenth century in England. See Adrian Johns, “The Ambivalence of Authorship in Early Modern Natural Philosophy,” *Scientific Authorship: Credit and Intellectual Property in Science*, Mario Biagioli and Peter Galison, eds (New York: Routledge, 2003).

⁴⁷⁵ Both were deficient, and to be desired. See Francis Bacon, *The Advancement of Learning*, Book III, (1605), 32.

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In his 1623 edition, he defined magic as the discovery of hidden forms, and the manipulation of these forms to produce works by the joining together of actives and passives.⁴⁷⁶ He sought to clear the reputation of magic as a credible form of inquiry from the incredible claims of imposters.

For as for the NATVRAL MAGICKE whereof now there is mention in books, containing certaine credulous and superstitious conceits and obseruations of *sympathies*, and *Antipathies* and *hidden Proprieties*, and some friuolous experiments, strannge rather by disguisement, then in themselues, It is as far differing in truth of Nature, from such a knowedge as we require, as the storie of King *Arthur* of *Brittaine*, or *Hughe* of *Burdeaux*, differs from *Caesars* commentaries in truth of storie.

Bacon had a tactic for distinguishing between fact and fiction, which would at the same time not blunt the edge of human ingenuity. Careful list-keeping would help manage the claims of public goods and charlatans' fables. Charting a course gingerly between *desiderata*, *deperdita*, and *impossibilia*, Bacon recommended "a *Kalender* resembling an *Inuentorie* of the estate of man, containing all the inuentions, (being the works or fruits of Nature or Art) which are now extant, and whereof man is already possessed, out of which doth naturally result a Note, what things are yet held impossible, or not inuented."⁴⁷⁷

In a later edition, Bacon added to this list "such inventions, as is manifest have bin in times past celebrated, but are now perisht."⁴⁷⁸ In addition to the *desiderata* and *impossibilia* (and *deperdita*), Bacon argued that the "*Kalender* will bee the more artificiall and seruiceable, if to euery *reputed impossibilitie*, you adde what thing is extant, which commeth the nearest in

"If therefore we haue reported METAPHISICKE deficient, it must followe, that wee doe the like of NATVRAL MAGICKE, which hath relation thereunto." Bacon, *Opera* (London: Havaland, 1623), 173.

"Si igitur desiderari eam partem *Metaphysicae*, quae de *Formis* agit, posuimus, sequitur ut *Naturalis* etiã *Magia*, quae ad eam est Relativa, similiter desideretur."

⁴⁷⁶ Bacon (1623), 173-4. "Nos verò eam, illo in sensu intelligimus, ut sit Scientia, quae cognitionem *Formarum Abiditarum* ad Opera admiranda deducat, atque, quod dici solet, *Activa cum Passivis conjungendo*, Magnalia Naturae manifestet."

⁴⁷⁷ Bacon (1605), 32.

⁴⁷⁸ Bacon (1623), 176, ". . . adjectis iis, quae olim innotuisse constat, nunc autem perierunt;"

degree to that *Impossibilitie*; to the ende, that by these *Optatiues* and *Potentialls*, Mans enquirie may bee the more awake in diducing direction of works from the speculation of causes.”

Like Bornitz, Bacon included a category of items teetering on the edge of impossibility.

These, so to speak, seemed to be stories by Amadis but were really the deeds of Caesar. They served to “waken” man’s inquiry, or as Bacon put it in a later edition, impossibles “set an edge on mans enquiry” while the almost impossible “may in a sort direct it.”⁴⁷⁹

Besides directing desire towards the future and away from current claims of the imposters, Bacon also suggested directing the experimental part of operative natural philosophy towards the future. In addition to the catalogue of optatives and potentials, Bacon recommended that those “*experiments* be not onely esteemed which haue an immediate & present vse, but those principally which are of most vniuersall consequence for inuention of other experiments, & those which giue most light to the Inuention of causes.”⁴⁸⁰ While the imposters promised instant gratification, Bacon plotted the increase of knowledge as slow, steady, and collaborative. To that end, experiments which gave rise to future inventions or the discovery of hidden causes were the best investment in the future. The example he gave in the 1605 edition was one of the three greatest modern inventions – the magnetic needle of the compass.

Bacon did not wish progress to careen forward wildly with the reins in the hands of the mechanicks who would heedlessly follow the blind appetites of men. Rather, as interpreter of nature, he would direct the future course of desire so that each part of learning

⁴⁷⁹ *Ibid.* “. . . ad hunc finem; ut qui ad nova Inuenta accingitur de iam inventis & extantibus, negotium sibi non facessat. Hoc verò *Inventarium* magis erit artificiosum, magisque etiam utile; si quae communi Hominum opinione *Impossibilia* reputantur, in unoque genere adiunxeris; atque unà *Proxima Impossilibus*, quae tamen habentur, copules; ut alterum Humanam Inventionem acuat; alterum quatantenùs dirigat; utque ex his *Optatiuis*, & *Potentialibus*, *Activa* promptiùs deducantur.”

⁴⁸⁰ Bacon (1605), 32.

might be led to its perfection. Nowhere do the terrors of the untrammelled market appear more vividly displayed than in the works of Johann Valentin Andreae.

Although always committed to the idea of Utopian brotherhoods, due to the reactions generated by the Rosicrucian tracts, Andreae, experienced a change of heart concerning the Rosicrucians in particular and enthusiastic projectors in general in his satires of 1617-18.⁴⁸¹ In his *Christian Mythology, or three books on the virtues and vices of men* (1619) we find a chapter entitled “Markets” laying out the objects offered for sale in the bazaars of the charlatans.

There were men of letters, who expounded in great numbers the books of Esdras and Solomon, and who described a new Jerusalem. The quadrature of the circle was offered for sale by the mathematicians, the perfect algebra by the Arithmeticians, and more than all the mystic, prophetic, and judicial numbers, as well as the harmony of all chronologies, the Microcosm was for sale by the doctors, with the signatures of creatures and the heavenly harmony, the gates of intelligence, acrostichs, anagrams, and combinations and figures of letters were being sold by the Cabbalists. The commodity for the Grammarians was the art of memory, the cubes of languages, steganography, new didactics, & sign language. The mechanics brought perpetual motion, the marine tides, a moving sphere, weaving machines, the horn of Alexander, wings for flying, diving bells, ships for ferrying across the land, and canals for penetrating the north. The historians carried in monsters from the south, Giants, remarkable customs, as well as the miracles of the Jesuits. But most of all the proficient Chymists offered with a great clamor and many oaths the philosopher’s stone, the universal medicine, the panacea, the perpetual light, transparent gold, malleable glass, rejuvenation, longevity, the transmutation of things, the counterfeiting of coins, the quintessization, the anatomy of the Universe, and the reformation of knowledge. Nor were there lacking those who boasted of Philosophic mirrors, lunar telescopes, burning mirrors, and sigils, characters, starry bells, familiar spirits, hermetic rings, divining rods, and hunted roots. And there were also to be seen those who made gems and who sold stones of invisibility, strength, languages, and riches, and those who devised little boxes of fortune and little wishing caps, and those who devoted their labor to the digging out treasure, interpreting the

⁴⁸¹ See Donald Dickson, “Johann Valentin Andreae’s Utopian Brotherhoods,” *Renaissance Quarterly* 49:4 (1996), 760-802.

language of animals, interpreting dreams, predicting the future, applying prophecies and sacrifices, and elucidating mythologies. All these were besieged by the curious, the credulous, and the prodigal and were overwhelmed by masses of money. One of the shopkeepers survived, who had for sale bells, little ears, rods, whips, lashes, and nooses, since he found only a few, wise buyers [of these] for controlling the frantic.⁴⁸²

Andrea's market was full of enthusiasts of all stripes, from interpreters of Esdras to inventors of "the perpetual motion machine" and "marine tides" such as Drebbel.⁴⁸³ Many of these heterogeneous claims of the marketplace listed by Andreae could also be found in contemporary list of desiderata such as malleable glass, rejuvenation, etc. Yet the charlatans who answered the desires of the market only engendered chaos which had to be beaten into shape.

For Bacon, the division between directing desire and the matters of exchange was clear, and clearly related to social status. As he wrote in the *Parasceve*,

I shall perhaps conquer by my own efforts the part dealing with the actual work of the intellect. But the materials for the intellect are so

⁴⁸² Johann Valentin Andreae, *Mythologiae Christianae sive virtutum & vitiorum vitae humanae imaginum libri tres* (Strasburg: Zetzner, 1618), Book V. no. 32, 259-61. "Cum nuper imposturae haberentur Nundinae, dici non potest, qui Mercatores, qui Emptores confluerint. Erant enim inter literatos, qui libros Esdrae 40. & Salomonis magno numero exponerent, qui novam Hierosolymam delinearent. Prostabat mathematicis Circuli quadratura, Arithmeticae cossa perfecta, ac supra omnia numeri mystici, Prophetici, Judiciales, ac contentus temporum, Medicis venalis Microcosmus, signaturae creaturarum, harmonia Coelica, Cabalistic portae intelligentiarum, & acrosticha, anagrammam, literarumque figurae & combinationes veniebant. Grammaticis ars memoriae, cubi linguarum, steganographia, didacticae novae, linguae mutae, & nutuum merx erat. Mechanici perpetuum motum, aestus marinos, sphaeros mobiles, Machinas paneraticas, cornu Alexandri, volandi alas, urinandi capsas, transfretandi terram naves, penetrandi Septentrionem canales attulerant. Historici monstra Austri, Gigantes, pygmaeosque & consuetudines miras, tum miracula jesuitarum advexerant. Sec maxime operosi Chymici lapidem Philosophicum, Medicinam Universalem, Panaceam, lumen perpetuum, aurum pellucidum, vitrum ductile, rejuvenescentiam, longaevitatem, transmutationes rerum, monetarum fucationem, & quintesseonationem, anatomiam Universi, Balsamum incorruptioris, reformationem scientiarum magno clamore, multis juramentis offerebant. Nec deerant, qui specula Philosophica, perspicilia Lunatica, specula comburentia, & qui sigilla, characteres, campanas constellatas, Spiritus familiares, annulo hermeticos, virgulas divinas, radices consecratas jactarent. Sed & gemmas facere & invisibilitatis, roboris, linguarum, divitiarum lapides vendere, Fortunati loculos, optandi pileolos consuere, videre erat, & qui effodiendis thesauris, interpretandis brutorum linguis, explicandis insomniis, praedicandis futuris, applicandis vaticiniis & sacrificiis, illustrandis mythologiis operam addicebant. Omnes hi obsidebantur à curiosorum, credulorum, prodigorum, &c. turba, & multo aere obruebantur. Unus supererat institorum, cui nolae, auriculae, virgae, flagella, scuticae, laquei venales erant, is paucos, nec nisi sapientes, emptores pro coerendis furiosis reperit."

⁴⁸³ For a study of Esdras in the period see Alastair Hamilton, *Apocryphal Apocalypse: The Reception of the Second Book of Esdras (4 Ezra) From the Renaissance to the Enlightenment* (New York : Oxford University Press, 1999).

widely spread out that they ought to be sought out and gathered in (as if by agents and merchants) from all sides. I think too that it is rather beneath the dignity of my enterprise to spend my own time on a matter which is open to practically everyone's efforts.⁴⁸⁴

Bacon was, as it were, a mercantilist of knowledge. The raw materials for knowledge should be sought from all sides and brought to him. He would engage in the most remunerative activity by transforming that material, without being seduced by the claims of the charlatans into throwing away cash on impossibilities.

For many writers besides Bacon, the relationship between the enthusiasm of *desiderata* and the discipline represented by *impossibilia* was a social one. Those responsible for reigning in the desires of the market and the mechanics who filled it were invariably drawn from a higher social plane. As Stevin Shapin and Simon Schaffer have shown in the case of Restoration England, the distance between truth, discipline, and reason on the one hand and charlatanry, enthusiasm, and desire on the other was clear, even for natural philosophers who supported the role of art in philosophy.

Yet at the same time, the directors of desire depended upon the mechanics to fulfill their own *desiderata*. This dependency perhaps allowed for more social mobility than Shapin and Schaffer would have us suppose. For instance the question of social status was foremost for the Utopian writer Samuel Gott. He recommended that we all "Consult together the Advancement of true Knowledg." "Academical Philosophers" could inquire about experiments from "Chymists and Mechanikes." In turn, "Mechanickes may be also much Assisted and Directed Philosophers, with many Rules and Regular Proportions; whereby they may be Instructed, and also Cautioned from attempting Impossibilitys, or any thing Impracticable; as the Philosophers Stone, Perpetual Motion, or Fire, and the like; and also

⁴⁸⁴ Bacon, "Parasceve," *Instauratio Magna, Part 2. Novum Organum*, Graham Rees and Maria Wakely, eds. (Oxford: Clarendon 2004), 451.

much Advantaged in the Attempts of Possibility. . . .” It was the task of the rational philosopher to discipline and restrain the enthusiasms of the Mechanickes, who might be carried away in the pursuit of impossibilities.

Yet, concluded Gott, “Mechanicke” was not “so mean a Title in Human Society as” was “commonly reputed,” since mechanics attempted inventions for the benefit of humankind.⁴⁸⁵ Their ability to fulfill the *desiderata* of mankind raised their status in his eyes beyond the socially accepted level, even if at the same time they required the restraining reason of their betters to manage and control those desires.

And if I should endeavor any such Profitable Inventions, I had rather be assisted therein by a Corporation of Mechanicks, then any College of Philosophers: and I would kiss that mans Hands, yea his Feet, who should Collect and Publish an exact and faithful History of Artificial Experiments, not only Chymical and Curious, but Mechanical, and of all Trades and Artifices: which together with the History of Extraordinary Natural *Phaenomena*, are very great *Desiderata*, and would be of very much Use and Improvement.⁴⁸⁶

Not only could mechanickes best fulfill *desiderata*, but their history was itself also a *desideratum*.

Particularly as the structure of the world shifted, the stability and regular proportions of the rational gave way to the desires of the mechanicks. Leibniz in his history of the earth, the *Protogaea*, suggested the radical change over time in both art and nature. The contingent history of the world suggested to Leibniz and others that the future too had many different possibilities to offer – possibilities which the mechanics might be most aware of.

Many things familiar to mechanical artisans and to empiricists are familiar to the common people but are unknown to the learned, who consider such things miraculous if now and then they come to be outlined in books. From which it happens that while the

⁴⁸⁵ Samuel Gott, *The divine history of the genesis of the world explicated & illustrated* (London: Henry Eversden, 1670), 11.

⁴⁸⁶ *Ibid*, 12.

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mechanics are unaware of the possible uses of their observations, the learned, in their turn, are unaware that their desiderata might already have been satisfied by the work of mechanics.⁴⁸⁷

This vision of a world of infinite possibilities informed Leibniz's vision of a carnivalesque form of education which would include even the antics of charlatans.⁴⁸⁸

VI: In Praise of Folly: Pursuing the Impossible

How did one contrive a list of impossibilities? And how did one rehabilitate an art to a list of possible desiderata? One tactic would be to amass authorities on one side of a question or another. Jan Schilperoort, for instance, in his work *The Long-known Possibility of Sympathetic Operation* (1697), cited Drebbel in a string of authors attesting to the spirit of the world, including Hermes Trismegistus and Paracelsus.⁴⁸⁹ Another tactic, as we have seen in the case of Webster and Hakewill, would be to argue from historical example, whether drawn from the *deperdita* or analogous *nova reperta*. Writers on the sympathetic cure of disease and magical armor frequently cited long lists of wonderful inventions to encourage belief in the possibilities of the new “magnetic” arts.⁴⁹⁰

⁴⁸⁷ On Leibniz's history of nature and the contingency of the universe, see Chapter Nine, “Possible Worlds and the History of the Real World,” in Paolo Rossi's *The Dark Abyss of Time: The History of the Earth and the History of Nations from Hooke to Vico* (Chicago: University of Chicago Press, 1984), 49- 65.

⁴⁸⁸ Leibniz, *Drole de Pensée, Sämtliche Schriften*, Series IV, Vol. I (1970), 562-568. See Paolo Rossi, *Philosophy, Technology and the Arts in the Early Modern Era*, S. Attanasio, trans., (New York: Harper & Row, 1970), 134.

⁴⁸⁹ Jan Schilperoort, *De aloude bekende mogelijkheid van de sympathetische werkinge* (Rotterdam, 1697), 8. See also Juliette van den Elsen, “The Rotterdam Sympathy Case,” *Aries* 2:1 (January 2002), 39.

⁴⁹⁰ Johann Ernst Burggrav's work on his “magnetic” blood-lamp, *Biohychnium* (Franeker: Balck, 1611), discussed at length in Chapter Six, was prefaced with a thirty page letter by his friend Marcellus Vranckheim on the wonderful inventions by modern Dutchmen including Drebbel. Burggrav's work on magical armor, *Achilles Panoplos Redivivus; seu Panoplia physico-vulcania* (Amsterdam: Hendrik Laurentius, 1612), 55, also included Drebbel to show what was possible through art, as did another major authority on magical armor, Johann Staricius in his *HeldenSchatz/ Das ist; Naturkündliches Bedencken uber un[d] bey Vulcanischer/ auch Natürlicher Magischer Fabrefaction und zubereitung der Waffen deß Helden Achilles in Griechenland* (Frankfurt: Steinius, 1615), 9-14. Writers on the sympathetic cure of disease such as Petrus Servius, *Dissertatio de Unguento Armario sive de Naturae Artisque Miraculis* (Rome: Marciano, 1642), 57, also cited Drebbel in a list of wonderful works of art.

Those supporting or denying the possibility of a suspect art through historical examples allied inventions on one side of a polemical debate. Contemporaries forged just such an alliance between the works of Drebbel and the highly dubious arts of the Rosicrucians. According to the *Fama*, a *minutus mundus* or microcosm could be found in the Rosicrucian treasury.⁴⁹¹ In *Silentium post Clamores* (1617), Michael Maier argued that since both Archimedes and “Dreppels” have succeeded in building such a microcosm, it was perfectly possible that the Rosicrucians had done so as well.⁴⁹²

Andreas Libavius, as we will see in Chapter Five, was a great admirer of Drebbel’s natural philosophical texts and his inventions. Yet, we see another side to his reception of Drebbel in his polemics against the Rosicrucians. When the vital philosopher Johann Ernst Burggrav and his friend Marcel Vranckheim adduced Drebbel’s inventions as evidence of what was possible, Libavius turned against Drebbel and Burggrav.

Burggrav, in his *Achilles Panoplos Redivivus*, had argued that the ancient poets hid natural truths in their fables, as in their accounts of Achilles’ armour. He interpreted Achilles’ armour as a celestial magnet attracting energies to be turned upon one’s enemies. Proof of what might be possible could be found in other examples of wonderful arts. There were too many wonderful automata of antiquity and of the current century, particularly in Germany, said Burggrav, to list individually. More wonderful than such common automata as Archytas’ dove or Regiomontanus’ fly were the “mercurial statues” and talking heads of Albertus Magnus and Roger Bacon, and the perpetual motion of Drebbel. A union between art and nature produced the latter, which could attract celestial virtues magnetically, just like

⁴⁹¹ *Fama Fraternitates* (Kassel: Wessel, 1614), 107.

⁴⁹² Michael Maier, *Silentium Post Clamores* (Frankfurt, Jennis: 1617), 49. “Regem quendam (Hieronem Siciliae) Caelum factitium ex vitro habuisse cognouimus, cum motu & contiguitate singulorum orbium suis planetis dictatorum, in cuius centro, quasi terra sedens oculis notare potuit effigiem & Epitomen totius vniversi, per se circumducti & moti Spiritibus inclusis; Eiusmodi machinamenta aut iis similia mirae artis quidam Teutonicus Com. Dreppels iam pridem effectus & maiora machinatur.”

Burggrav's armour. Such "Archimedean and Drebbelian" globes might seem incredible. Yet one should neither doubt eye-witnesses (which included Burggrav himself),⁴⁹³ nor the *fides* of a great author, since the same thing had been written about Archimedes' sphere.⁴⁹⁴

Libavius attacked such arts as Burggrav's celestial magnet as spurious, in addition to those arts professed by other magi such as Roger Bacon (in his *De Mirabilis Artis & Naturae Potestate*) and the Rosicrucians. When discussing the Rosicrucian microcosm, he ridiculed the tiny microcosm of both Archimedes and Drebbel.⁴⁹⁵ Yet Libavius took another tack when assailing Oswald Croll's concept of magic. He listed many examples of Roger Bacon's secrets which appeared wonderful but could be made through art alone, such as the machine which allowed one to walk "in the sea and under water" recently invented by the Dutch peasants ("Batavi rustici"), microscopes, telescopes, and magic lanterns. Even the microcosm could be made by art, as the cases of Archimedes and Drebbel demonstrated.⁴⁹⁶

⁴⁹³ Burggrav had given his friend Marcel Vranckheim his own eye-witness account of Drebbel's machines at Eltham Palace. Vranckheim responded with a thirty-nine page letter on the wonders of art which Burggrav included in his *Bioychnium* and refers to here in his *Achilles Panoplos Redivivum*. See Marcellus Vranckheim, "Epistola" in Johann Ernst Burggrav, *Bioychnium* (Franeker: Balck, 1611).

⁴⁹⁴ And about a sphere seen by the learned Politian. Burggrav, in calling Politian learned, pointed to his excellent *fides* as a witness. See Johann Ernst Burggrav, *Achilles Panoplos Redivivus; seu Panoplia physico-vulcania*. Amsterdam: Hendrik Laurentius, [1612], 55: "De Globo Archimedaeo & Drebbeliano alibi quaedam scripsit amicus noster, raro Vir ingenio: in quo Automato siderum cursus cum coeli ratione congruens explicatus sit. Quid? incredibilia videntur tibi illa? Sed videantur, inquam tantum. Imò credas oculis necesse est, ubi intueris quotidie. Nec vacillet in magno authore fides ampliùs ubi tale quid à Syracusano illo quondam legis fabricatum. At fidem absolvit planè doctissimus Politianus, apud quem ceu oculis praesentem inuere machinulam."

⁴⁹⁵ See Andreas Libavius, "Exercitatio Paracelsica Nova de Notandis excerpto Fraternalitatis de Rosea Cruce," *Examen Philosophiae Novae* (Frankfurt: Peter Kopff, 1615), 265, where he compared the microcosm of the Rosicrucians to the magical mirror in a fairy tale such as *Amadis*, and to such powers as those to be found in "Achillaea armatura Burggafii," and in *ibid*, 285, to the microcosms of Archimedes and Drebbel: "Minutus vester mundus, globus Archimedaeus, Drebbelianus, &c. eandem habeant melodiam, & tonum eundum." See further discussion in Chapter Five.

⁴⁹⁶ Libavius compared Drebbel's sphere to Bacon's machines in his "Paracelsica Sententiarum Biblicarum Depravatio ex Oswaldi Crollii," *Examen Philosophiae Novae* (Frankfurt: Kopff, 1615), 58. "16. Celestem familiam transferre in globum terrenum, & totam oeconomiam exacte repraesentare, quale quid fecisse dicitur *Archimedes*, *Drebellius*, & alii. Non vero tanti est descriptio, quanti motus, ad quem singularis materia & artificium requiritur, vt sic incendant apud nos stellae, sicut in coelo. Arbitratur *Rogerius* materiam posse inueniri, quia quaedam apud nos sic mouentur vt coelum, veluti Cometae, maris aestus, &c. Verum haec opinio est. *Drebellius* aliud videtur excogitasse, ad exemplum motus, qui sit in arcano lapidis vitro inclusi, &c." There he also described "6. Instrumenta parare, quorum beneficio quis in mari & subaquis abulet. Eam artem Batavi rustici dicuntur callere, adeo, ut sub aqua etiam ignem accendant, & cantent."

Chapter Two: From the Columns of Hermes to the Columns of Hercules

In return, Libavius was attacked and Burggrav defended in the edition of Roger Bacon's letter on the power of art and nature published with the *scholia* of John Dee, and dedicated to the Rosicrucian brotherhood.⁴⁹⁷ The editor, P.S. (Patrick Saunders), provided examples of modern inventions which recalled Libavius' own, such as a ship which could go under water. Yet he also responded to Libavius on behalf of the Rosicrucian brethren and Burggrav. According to Saunders, Burggrav's magnetic cure alone was worth more than all the commentaries of Libavius.⁴⁹⁸

Marcel Vranckheim's letter on Drebbel's perpetual motion and other wonderful inventions and the 1618 edition of Roger Bacon became well known sources for examples of wonderful arts. Like Burggrav, John Webster, in *The Displaying of Supposed Witchcraft*, argued that the wonderful things that could be achieved through art were too many to be enumerated, yet "those that would have more ample satisfaction concerning the stupendious things that are produced by art, may receive most large satisfaction in reading that most learned and elaborate Epistle written as a preface before the Book *Johannes Ernestus Burgravius* called *Biolychnium vel de lampade vitae & mortis*, by *Marcellus Uranckheim* Doctor of both laws, as also in reading that profound and mysterious piece written by *Roger Bacon, de admirabili potestate artis & naturae, & de nullitate magiae*, with the learned notes of Dr. *Dee* upon it. . . ."⁴⁹⁹

⁴⁹⁷ *Epistolae Fratris Rogerii Baconis, De Secretis Operibus Artis et Naturae, et De Nullitate Magiae/ Operis Johannis Dee Londiniensis e Pluribus Exemplaribus Castigata Oliem, et ad Sensum Integrum Restituta* (Hamburg: Froben, 1618). The work was dedicated to "Clarissimis Restitutionis universi Phosphoris, illuminatis. Roseae Crucis Fratibus." For Patrick Saunders as the editor and his mention of Drebbel's submarine, see Julian Roberts and Andrew G. Watson, *John Dee's Library Catalog* (London: Bibliographical Society, 1990), 63, 71.

⁴⁹⁸ Roger Bacon, 76: ". . . pluris esse curationem Burgravii magneticam, quam omnes Andreae Libavii Divinationes." P.S. refers to the "Divinationes" published in Libavius' *Hermetic Revelations* on authors such as Sendivogius and Drebbel.

⁴⁹⁹ Webster, 269. Note that Webster, who advocated reforming English university education through the study of chymistry, studied under the Hungarian alchemist Jan Banfi Hunjades (who supplied Morsius with Drebbel's *On the Quintessence*), and owned an edition of Drebbel's works in his library. See Webster, *Metallographia* (London: Kettilby, 1671), 161.

Self-proclaimed Rosicrucians might be less eager to embrace Drebbel's inventions as support for their assertions than those who argued on their behalf. One Petrus Mormius claimed to detail the arts known to a sect of the Rosicrucians active at Delft in his *Most Secret Arcana of all of Nature*.⁵⁰⁰ Whoever wished to get in touch with him, he said, could do so by contacting Victor Du Boys in his house on St. Jacob's Canal in Leiden. Du Boys actually did exist, although any letters sent to him might have gone astray. His house on St. Jacob's Canal was sold to his creditors the very year Mormius published the *Most Secret Arcana*.⁵⁰¹

Mormius began his work with a discussion of the three desires which motivated mankind and how to fulfill them. If only the ancients had studied man's nature correctly, he said, they would not have diverged in so many different opinions concerning the *summum bonum*. As everyone knew, when led by nature alone, man desired pleasure, life, and power. All these could be achieved through *scientia*. Thus man, from the moment he opened his eyes, studied whatever art he thought would gain him riches, power, and health.

Unfortunately, however, man's nature had fallen, such that he ran after whatever he thought would fulfill his desires, and hated whatever he thought restrained him, even God. Wiser men perceived the snake smiling in the grass – they knew that wealth and the honors belong to the judgment of fortune, and health and life to the decree of inevitable death. Thus Mormius proposed “a triad of new desires: seeing god, delighting in god, and being at rest in god.” Thus God, not fallen nature, would enflame their souls through three instruments: faith, hope, and charity. Yet there was one path that led to these three

⁵⁰⁰ Petrus Mormius, *Arcana Totius Naturae secretissima, nec hactenus unquam detecta* (Leiden: Joseph Navius, 1630).

⁵⁰¹ Leiden Municipal Archives, Aflezingboeken, no. I. fol. 55, 13 April 1630.

instruments: *scientia*. For who without that will trust to faith, out of hearsay alone? Who without faith will hope? Who without hope will love?⁵⁰²

Therefore the impious hunted his desire through *scientia*, yet, “because it is a fraud, just like a shadow pursued by a fool, it flees,” while the *scientia* of the pious was true and inspired. “For your sake then, o pious reader, and not for the impious, this book sees the light,” Mormius said. Although many philosophers in every age had discussed the same secrets, “as though they were more profitable than all other arcana, they have never been able to reveal them, as I can; or if they revealed or invented them, they then denied them to posterity.” The three great arcana which man desired were the perpetual motion machine, the transmutory art, and the universal medicine.⁵⁰³ In the rest of the work, Mormius outlined the various types of these three greatest *desiderata* which the Dutch Rosicrucians had on offer.

Mormius argued that the perpetual motion had never before been invented, despite what people said about Archimedes. One of his friends, however, told him about the

⁵⁰² Mormius. “Hinc novorum desideriorum triga; videndi deum, fruendi deo, quiescendi in deo. quibus non naturae lapsae vires, sed divina misericordia, animos eorum succendit. Ad quae pariter tria sunt instrumenta: fides, spectans visionem; spes, fruitionem; & charitas, quietem. Quae unum sunt. sicut pater, (quem respectat visio) filius, imago patris, (quem fruitio,) spiritus sanctus, qui caritas utriusque, (quem quies) unus deus sunt personaliter distincti. Ad haec etiam tria commune instrumentum seu via sternitur; scientia. Quis enim sine eâ, quae ex auditu est, fide credet? quis sine fide sperabit? quis sine spe amabit? Et vicissim; qui in deum credet qui non sit eum visurus? quis visurus qui non fruiturus? quis fruiturus qui non quieturus? nimirum tanquam in eo qui abyssum desideriorum compleere valet.”

Mormius’ curious conception of *fides* through *scientia* can also be found in the conclusion of Drebbel’s *On the Nature of the Elements*. “Darumb der die Elementen lehrt kennen der lehrnet Gott sich unnd die natur kenne ohne welche wir Gotttes Almacht unnd güthe nicht recht mögen lieben wer zeugt von Gott über die natur? dan wir sein nach Gottes eben bildet geschaffen auff das wir durch diese dinge die himlische gaben könten kennen lernen, welche wir von unserem Schöpfer neben unserer schöpfung empfangen haben damit wir wissenschaft dar vonbetten so viel uns in diesem leben nötig ist zur erkantenisse Gottes und unser auch zu erforschung der natur. Darumb sollen wir uns vor zancken hütten und was wir nicht verstehen weder loben noch schälten so wirdt unsere Sehle ruhe finden und Gottes Weisheit schmecken dan wie mügen wir kennen das wir nicht sehen schmecken noch fülen? oder lieben das wir nicht kennen? ist dan nicht notig die natur der Elementen zu erforschen? die natur kennen zu lernen? und Gott zu lieben? welchem allein sei ehre in Ewigkeit. Hiermit nim vor lieb und ersuch die natur so wirstu hier von gezeugen und lernen verstehen was hier nach folgen wirdt nemlich das gröste Wunder das wir inder natur in den Elementen sehen zu lob und ehre unsers Seligmachers Amen.”

⁵⁰³ Mormius. “Tria sunt arcana majora, quibus homo nil majus hac in mortali vitâ desiderare potest. videlicet, motus perpetuus, ars transmutatoria, medicina universalis.”

perpetual motion of Drebbel, and he was quite amazed, and even more so when he read Drebbel's own description of the machine in his "little book." Yet he was later informed that Drebbel's machine was a fraud. If there was so much wonder at that deception, imagine how great the fame of his own, true perpetual motion machine would be? Yet despite what he discovered about Drebbel's machine, Mormius suggested that that most noble Philosopher Drebbel should still be admired for his great industry, particularly in the invention of his submarine.⁵⁰⁴

Determining the possibility of such desirable arts as the perpetual motion or the celestial magnet was, to say the least, difficult. For Johann Joachim Becher, drawing the border between possibility and impossibility required a careful balancing act between two necessary forces – wisdom and folly. Becher, a latter day mercantilist, had great respect for the possibilities of *Kunst* in the advancement of knowledge. Yet unlike Bornitz, he envisioned a severely humble social place for the actual mechanics engaged in industry.⁵⁰⁵ To counter the enthusiasm of the *desiderata*, he employed an opposing list of *impossibilia*. Several *desiderata* – a perpetual light, malleable glass, rejuvenation, longitude, hyperbolic glasses- from the list

⁵⁰⁴ "Quia supra diximus, motum perpetuum, ne minimum quidem, ullum hominem (quod constet), excogitare nec dum potuisse, quidquid de Archimede feratur. Nuper amicorum quidam mihi objecit machinam Drebbelij, quam in Angliae Regis gratiam construxit; quae interiori agitata arte, absque extrinseco motore ullo, orbium caelestium motus ostentabat; iam per totam fere Europam decantatum artificium, & libello ab eodem autore edito vulgatum. Audiens stupeo, magisque legens; nam, Sed non me diu detinuit stupor: nam, quid hoc esset diligenter inquirenti, qui viderant, retulerunt, quod globus ille insidebat arcae, in qua ni fraus latebat motoris: lampas scilicet ardens ingeniose applicata. De qua simile quid diximus in motu perpetuo igneo. Quo semel dolo detecto, ab ipsomet autore postmodum spretum fuit inventum; ut non amplius prostet: Laudanda nihilo-minus tanti Philosophi nobilissimique viri industria. De quo etiam audivimus, in vase sub undis ad aliquot milliaria processisse, siccum-que emersisse. Caeterum, si dicti viri fabrica tantae fuit admirationi: quanta, putas, nostra foret, si exstaret, uti potest? Quae non super arca residebit in qua dolus lateat, sed fune pendula repraesentabit omnes coelorum motus, pluvias, tonitrua, ventos & ipsam coelorum musicam, innumerabiles denique mugitus, sibilos, vagitus clangores, latratus, & siquae sint alia, nemine quidem tangente aut juvante."

⁵⁰⁵ For Becher's division of society see Pamela Smith, *The Business of Alchemy: Science and Culture in the Holy Roman Empire* (Princeton, N.J.: Princeton University Press, 2004), 231.

of no less than Robert Boyle doubled as the impossible things listed by Johann Joachim Becher.⁵⁰⁶

Becher's list could be found in his *Wise Folly and Foolish Wisdom*, a work which if heeded, would, he said, render Pancirolli's book of lost arts unnecessary, and which offered a new version of Polydore Vergil's *On Invention* (discussed further in Chapter Four).⁵⁰⁷ By heeding both the lessons of the wise folly and the foolish wisdom, all *desiderata* would be fulfilled. Becher began with fifty-one foolishly wise concepts, which seemed at first foolish, irrational, and impossible, but which succeeded in practice ("Närrische Weissheit Oder Concepten/ welche dem ausserlichen Ansehn nach närrisch/ irraisonnable und ohnmöglich geschienen/ dennoch inpraxi wohl succederit und mit Nutzen reussirt"). These include such wonderful objects as microscopes, telescopes, camerae obscurae, and the thermoscopes which Drebbel used in his perpetuum mobile, and which Becher used in his ovens and his own perpetual motion.⁵⁰⁸

Becher balanced the first half with another fifty-one foolishly wise concepts, which at first seemed reasonable, but did not succeed in practice, and therefore were considered to be foolish by the common man ("welche dem ausserlichen Ansehen nach guten Schau hatten/ von raison waren/ und gute intention demonstrirten/ dennoch aber in praxi nicht

⁵⁰⁶ J.J. Becher, *Weise Narrheit/ oder Concepten/ welche dem ausserlichen Ansehen nach guten Schein hatten/ von Raison waren/ und gute Intention demonstrirten/ dennoch aber in praxi nicht succedirten/ und derentwegen bey dem gemeinen Mann/ für naerrisch und unbedacht angeschrien worden*, (Franckfurt : Zubrod, 1682), 157-8. Acht sachen sind/ wornach die gelahrte und Curiosen streben/ nemlich der Lapis Philosophorum, liquor Alcahest, das Glass weich zu machen/ ein ewiges Licht/ eine Linea Hyperbole in eineim Brennspiegel/ die gradus longitudines zu finden/die Quadratura Circuli, und das mobile perpetuum." See also Becher's list of *Impossibilia* in Leupold's *Theatrum Machinarum Generale* (Leipzig: Christoph Zunkel, 1724), 31.

⁵⁰⁷ *Ibid*, Vorrede. ". . . wan die Curiosi in Teutschland und anderer Orten/ diesem meinen Exempel folgen wolten/ so wurde kein Pancirollus mehr vonnothen seyn/ der de rebus perditis schreiben dorffte/ und der Polydorus Virgilius de rerum inventione wurde mit einer andern Feder geschrieben haben."

⁵⁰⁸ *Ibid*, 84-6. "Wie solche zum ersten erfunden ist auch unbekant/gleichwol wil mans dem Cornelio Drexel von Alkmar zu schreiben/ und es kan wol seyn/ dass er den Gebrauch derselben zu erst entdeckt: erinnere mich etwas darvon in den Mathematischen Erquickstunden gelesen zuhaben/ nemlich von einer Machina die er dem Kayser Rudolpho praesentirt habe/ welche er Perpetuum mobile gekennet habe und lange noch zu Prage in der Kunst-Kammer zusehen gewest. Es wird auch viel geredt von des Corneli Trepels seinem Ring."

succedirten/ und dernt wegen bey dem gemeinen Mann fur nährisch und unbedacht ausgeschrien worden”). Here we find several of Becher’s own projects, as well as Mersenne’s submarine, which did not succeed even though Drebbel had already shown that submarine navigation was possible.⁵⁰⁹

Herbert Breger, in “Becher, Leibniz und die Rationalität” argued that due to the later disagreements between Becher and Leibniz, historians cast Becher in the role of the irrational projector compared to the solid philosopher Leibniz. However, in their early history they displayed similar attitudes towards projecting; Leibniz even based his plan for a “Societas Philadelphica” after Becher’s project for a philosophical society.⁵¹⁰ Indeed, Leibniz may appear the more enthusiastic projector, who in his first project for determining longitude (1668/9), planned to use one of Becher’s impossibilities (the perpetual motion – in this case the chymical arcanum discovered by Drebbel) to discover another impossibility – longitude.⁵¹¹ For his part, Becher included Leibniz’ project for a high speed mail coach among the foolishly wise concepts of the *Nährische Weisheit und Weise Nährheit*.

Becher’s title immediately recalls Erasmus’ *Praise of Folly*, however his wise foolishness had little to do with Christian humanism. The Erasmian fool for Christ rejected worldly reasoning, finding the divine hidden within the Silenus box. Faith might be considered folly by the worldly who cared only for material things, but this folly was in fact wisdom. In comparison, the faith of projectors such as Mormius and Drebbel was a very material, although still Christian, one. According to Drebbel, only through knowledge of

⁵⁰⁹ *Ibid*, 149. “So gelehrt dieser Mann auch gewesen ist/ in eine so grosse Narrethey ist er mit diesem seinem Schiff gefallen/ und noch in einem groessere/ in dem er eine ganze Stadt sampt Buchdruckereyen und alles hat unter dem Wasser bauen wollen/ also dass einer dafuer gehalten Mersennes seyent-weder zum Narren worden/ oder wolle die gantze Welt vor Narren halten: gleichwol ist es moeglich unter dem Wasser zufahren/ und hat Cornelius Trebbel hier in Engelland auf der Tems eine Probe darvon gethan.”

⁵¹⁰ Breger, 71.

⁵¹¹ Leibniz papers, Landesbibliothek Hannover LH035, 15, 06, 46r-47r. See the online edition of Leibniz manuscripts, “Leibniz-Edition, Reihe VIII” published by the Berlin-Brandenburgische Akademie der Wissenschaften, <http://www.leibniz-edition.de/>. Cited July 29, 2008.

what we can feel, touch, and taste, we can reach knowledge, and through knowledge, love of God.⁵¹² Mormius and Drebbel therefore argued for the importance of brotherly love as a motivation to the circulation of knowledge. Christian charity promoted the pursuit of knowledge since knowledge led to faith in God and thus salvation.

For Becher the social importance of affective relationships in knowledge was also important. Becher argued in his *Psychosophia* that reason alone was not sufficient to direction investigation, but knowledge must be “tempered by brotherly love.”⁵¹³ However, Becher’s fools joined in their social exploration of materialism irregardless of morality, sharing their desires for worldly goods, and thereby leading to the improvements of all their lots. The God-given power of invention, said Becher, belonged to all men, “not considering person or profession; King and Farmer, Learned and Unlearned, Pagan and Christian, the Good and the Evil, have been endowed with it, as we see in the examples of Archimedes, Euclid, Vitruvius, Geber, and in our time, Albrecht Dürer, Tycho Brahe, Daniel Neuberger, and many others,” including Becher himself.⁵¹⁴

Johann Rist, alchemist, poet, and pastor at Wedel also explored folly’s links to invention and to the improvement of society. A member of Ludwig of Anhalt’s Fruchtbringende Gesellschaft (the only theologian besides J.V. Andreae who joined before 1650), of G.P. Harsdörffer’s Pegnisches Blumenorden, and founder of his own society, the

⁵¹² Drebbel, cited above, “. . . wie mügen wir kennen das wir nicht sehen schmecken noch fülen? oder lieben das wir nicht kennen? ist dan nicht nötig die natur der Elementen zu erforschen?”

⁵¹³ Breger, 82. “Die Traditionelle Definition des Menschen als animal rationale berücksichtigt die Gesellschaftlichkeit des Menschen nicht genügend; die Wissenschaft müsse durch die Nächstenliebe temperiert werden.”

⁵¹⁴ Becher (1682), Vorrede. “Hier ist Kein Ansehen der Persohn noch Profession: König und Bauren/ Gelehrte und Ungelehrte/ Heyden und Christen/ Fromme und Böse/ seyn damit begabet worden/ welches wir an Archimede, Euclide, Vitruvius, Geber, und zu unserer Zeit/ Albrcht Durren/Tyc. Brache, Dan. Neuberger und viel anderen mer sehen. Die Göttl. Gnade hat mir auch etwas von diesem Dono gegeben. . . .”

Chapter Two: From the Columns of Hermes to the Columns of Hercules

Elbschwanenorden (1656), Rist knew about joining brotherly associations.⁵¹⁵ In 1663, he joined with Philanthon, Strephon, and Chariander to debate whether astrology, perpetual Motion, tulipmania, or the philosopher's stone was the noblest folly (*Aller Edelste Tohrbeit*).

Rist's title emphasized the paradoxical status of folly. As Rist's friend Adam Olearius pointed out in a liminary poem, citing the commonplace, "Quodlibet nobile ingenium habet aliquid dementiae admixtum," *ingenium* (inborn talent) was always mixed with madness. Thus art (*Kunst*) as the product of *ingenium*, often displayed signs of folly, resulting in works simultaneously noble and risible.⁵¹⁶

Drebbel's perpetual motion machine supported Strephon's argument that perpetual motion was the noblest folly. The ancients denied that art could produce such a motion. However, if they could only see the "wondersphere" built by the famous Netherlander Cornelius Drebbel – about which one can read in many learned writings - they would be very amazed, just like King James I, who thanked God that he had been born in such an age. Surely no inventions were known to the ancients to compare with what Drebbel built for King James I in England for Rudolph II in Prague.⁵¹⁷

⁵¹⁵ Indeed, Daniel Neuberger, the wax sculptor described by Becher as evidence of God's liberality in bestowing the gift of invention, joined the Elbschwanenorden as "Ingeniander."

⁵¹⁶ Johann Rist, *Die Aller Edelste Tohrbeit der gantzen Welt* (Hamburg: Naumann, 1664).

Rein Edeles Gemühte (Juxta illud effatum:
Quodlibet nobile ingenium habet aliquid dementiae admixtum)
So hoch es auch von Gühte/
Ist/ das nicht bei den Gaben/
Solt' etwas Tohrheit haben/
Daher bei Kunst in gleichen (Tanquam Ingenii effectus)
Sicht man viel Tohrheits-Zeichen
Die Edel sind zu schätzen/
In dem Sie uns ergetzen/
Das Sternen-Prophezeien
Und die Goldmachereien/
Bewegung ohn' ein Ende
Ein Werk der Künstler Hände/
Sind das nicht Edle Sachen?
Worüber man muss lachen?

⁵¹⁷ *Ibid*, 162-5. "Ich bin aber der gantzlichen Meinung wenn die guhte Leute bei disen unseren Zeiten aufstehen und die ubertrefliche Wunderkuglen welche der hochberuhmete Niderlander Cornelius Drebbel von Alkmar

The discussion of folly, as we find it in Becher and Rist, was no longer a question of faith, but was rather linked to material obsessions. The direction of folly was uncertain – it could lead to the horrific crash in value of exquisitely bred tulips, or it could motivate an invention like Drebbel's perpetual motion which outstripped the past and supported the idea of innovating for the future. The most desirable arts were those liable to move unpredictably from the depths of folly to the heights of invention, and from lists of *desiderata* to those of *impossibilia*. They were in the hazy category of those things coming closest to impossibility, representing the newest and strangest objects in the world. At the furthest frontiers of

fur etlichen Jahren erfunden und dem Glorwürdigstem Könige Jakobo in Engeland zu unterthanigstem Gefallen hat vergartiget und dargestellt solten sehen und betrachten sie wurden über einem so unvergleichlichem Kunststücke ganz bestürztet werden wie denn allerhöchstgedachter König Jakob über diese des fürtrefflichen Drebbels wunderseltzamer Erfindung sich dargestalt erfreuet das Er auch Gott von Herten gedankt der Jhn den Tag erleben lassen das Er solche fast Himmel gleichende und überaus schöne und anmuhtige Dinge mit seinen Augen hat ansehen mügen wie denn von disen sehr schönen und Sinnreichen Erfindungen bei unterschiedlichen gelehrten Leuten sonderlich bei dem Niederländischen Geschichtschreiber Wilhelmo Baudartio kan nachgeschlagen und gelesen werden. Diser hochehrwürdiger Drebbel hat in eben demselben Jahre in welchem Ich auf diese Welt bin kommen, nemlich Anno 1607 ein Buch von der Ewigen Bewegung (wofür Bernhard Peter Schagens eine Vorrede gezezt) zu Alkmar lassen drucken. Diser ist eben derselbe Cornelius Drebbel der bei dem allerunüberwindlichsten Kaiser Rudolff dem Anderem grösseten Libhaber der allerfürtrefflichsten Künste und Wissenschaften eine Zeitlang sich hat aufgehalten wiewol Er einsmahlen auch bei Ihrer Majestät in Ungnade ist gerathen und zwar der Ursachen halber (wie viele vermeinen) das Er Ihrer Majestät alle seine Geheimnisse nicht entdecken wollen. Unterdessen hat Er eben zu derselben Zeit wie Er im Arrest gesessen allerhöchstgedachtem Kaiser ein solches Musikalisches Kunststück welches Er anfänglich für den König in Engeland gemacht der auch dasselbe nebenst vielen tausend andere Personen hat angesehen allerunterthänigst mitgetheilt: Als Erstlich haben die Vorhänge oder Teppich vor den Klavizimbalen so bald die Sonne geschienen sich selber eröffnet und eine libliche Music von sich hören lassen so bald aber die Sonne von einer Wolken bedekket oder überzogen worden hat die Musik auch aufgehört der Teppich sich auch von sich selber widrum zugeschlossen. Ferner ist hebei eine Springbrunne gewesen welcher allezeit von sich selber zwehne Ströhme herfür gegeben wenn aber die Sonne geschienen haben hundert und mehr Röhren gesprungen. Disem nach ist Neptunus aus einer Kluft kommen mit Gesellschaft seiner See Göttinnen und Trompeter welche sich under den Strahlen und Tropfen des Wassers gewaschen so bald aber die Sonne widrum hinter die Wolken kommen haben die Strahlen aufgehört zu lauffen Neptunus hat sich auch widrum under die Kluft verstecket und gleichsahm getrauret das sich der güldene Sonnenglanz verlohren. Ferner ist Phebus aus den Wolken kommen sitzend und spielend auf einem Wagen mit vier Pferden welche durch die Bewegung ihrer Flügel in der Luft geschwebet und den Wagen fohrt gezogen wie sich denn auch die Räder an dem Wagen in der Luft bewegend herüm gedrehet. So bald aber die Sonne aufgehört zu scheinen hat sich Phebus widrum under die Wolken verborgen. Endlich ist ein Glas gestanden auf dem Altar des Neptunus, darin alle 24 Stunden und ungefähr 40 Minuten ein Wasser zweimahl zu rechter Zeit auf und nieder gestiegen also das man die Stunden und Viertheile des Tages durch die Auf- und Niedersteigen vollen kömlich hat sehen können. Alle diese Bewegungen haben sich von sich selbst durch einen Ewigen motum bewegt also das man auch niemahl bedörft hat etwas dazu zu helfen. Wenn aber die Sonne nicht geschienen und man nur das Glas mit der Hand etwas warm gemacht sind alle die vorbesagte Bewegungen geschehen welches mines Bedünkens eine solche hohe Sache über welche man sich billig zum allerhöchsten hat zu verwunderen und solte Ich schier daran zweifeln ob dergleichen Sinnreiche Erfindungen den Alten bekant gewesen.“

discovery, a murky promise might turn out to be either a new world or a shadow pursued by a fool. It was in this instable area that contemporaries sought to investigate change in a world that was always on the move.

For some, deciding between possibility and impossibility involved a prudent calculus of the possible benefits compared to the possible losses in this shadowy region of exploration. Thus Boyle recommended that although it might be impossible, the virtuosi ought still to attempt to invent the celestial magnet. The possible benefits could be compared to other seemingly great discoveries which at first seemed impossible, such as the discovery of the new world. Just as those “adventurous Navigators. . . have often doubted, whether what they had so imperfect a sight of, were a Cloud, or an Island. . . judg’d it advisable to steer towards it. . . for if it were a deluding Meteor, they would not however sustain so great a loss in that of a little labor, as in case it were a Country, they would in the loss of what might prove a rich Discovery.”

While employing such a careful calculus, Boyle acknowledged the central role curiosity, not reason, played in venturing into such dangerously murky yet possibly profitable territory. In the case of the navigators, “if they desisted too soon from their Curiosity, they could not rationally satisfie themselves, whether they slighted a Cloud or neglected a Country.” Therefore, in the case of those searching for a celestial magnet, Boyle “would not discourage Mens Curiosity from venturing even upon slight probabilities, where the Nobleness of the Subjects and Scope may make even small attainments very desirable.”⁵¹⁸

⁵¹⁸ Robert Boyle, *Tracts containing I. suspicions about some hidden qualities of the air: with an appendix touching celestial magnets and some other particulars: II. animadversions upon Mr. Hobbes’s Problemata de vacuo: III. a discourse of the cause of attraction by suction* (London: M. Pitt, 1674), 70-1.

VII: Drebbel among the Desiderata

We certainly find Drebbel among the most traditional sort of *desiderata* – desired written works. Borell included Drebbel in his alchemical bibliography, *Bibliotheca Chimica*, both the editions he had seen, and those titles which had only been communicated to him.⁵¹⁹ Isaac Newton in turn employed Borell’s list to draw up his own *desiderata* of alchemical works, including Drebbel (although Newton in fact did own Drebbel in the 1672 French translation).⁵²⁰

Drebbel also appeared as himself a fulfiller of *desiderata*. Yet even those who recognized the importance of enthusiasm and desire in the pursuit of invention were at times hesitant to credit Drebbel. Francis Bacon hoped to channel desire while carefully controlling it in a hierarchy of social order, and while “desiring” Drebbel’s activities, he would not credit Drebbel for them.

Bacon certainly had a place for mechanics in his efforts to fulfill *desiderata*, but that place was securely at the bottom of a social pyramid. This is where I differ from Rosalie Colie’s perceptive account of the relationship between Bacon and Drebbel. Colie rightly pointed out the many points where Drebbel and Bacon are similar. Yet she placed Drebbel in Bacon’s wake as an example of someone who fulfilled every level of the hierarchy Bacon envisioned for Salomon’s House, from those who collected old experiments out of books,

⁵¹⁹ Pierre Borell, *Bibliotheca chimica; seu, Catalogus librorum philosophicorum hermeticorum* (Hildesheim: Olms, [1654], 1969), 78, “Dreppellii, de lapide Philos. Imaginationes. Cornelius Drebellius, seu Dreppels Belga, de natura Elementorum, & de quinta essentia, liber, cum ejusdem Epistola, de mobilis perpetui inventione, è Belgico Idiome in Latinum versa, a Petro Laurembergio, Hamburg. 1621 in 8.” Among those titles communicated to Borell, we find (246) Burggrav’s edition, “C. Drebel ab Ernesto publicatus, Francof. 1628 in 8. Et Genevae cum Pace Med. Vegae. In 8. 1628.”

⁵²⁰ See K. Figala, J. Harrison and U. Petzold, “Newton’s Alchemical Library,” *The Investigation of Difficult Things: Essays on Newton and the History of Exact Sciences* (New York: Cambridge University Press, 1992) 53. Newton cited from Borell in his “De scriptoribus chemicis,” “Cornellius drepbelius seu Dreppels Belga de natura Elementorum liber cum Epist de mobilis perpetui inventione e Belgico in Lat. Versa a Petro Laurembergio Hamburg 1621 in 8 & Francofu. 1628. Reperiuntur et ejus opera in 12 cum Cosmopolita et Augurello, Genevae impressa.”

performed new experiments, to those who collated them, and to the highest ranks, the Interpreters of Nature.⁵²¹ Colie argued that in Drebbel's "little book, *A Short Treatise on the Nature of the Elements*, like a good Interpreter of Nature, Drebbel wrote down the 'observations, axioms, and aphorisms of his experiments in heat and cold so that posterity might profit from them.'"

Yet placing Drebbel at every level of a hierarchy violates that hierarchy. In Bacon's vision, artisans such as Drebbel stayed at the bottom. They were not meant to compose philosophy on their own, but, like "an agent or merchant" to gather raw material for others such as Bacon. This was not a position Drebbel, who believed in his ability to discover universal truths about nature through the work of his own hands, would ever have accepted.

Deborah Harkness has shown that Bacon was not setting a program of future research in Salomon's House, but describing large scale scientific pursuits which were already taking place in London. Thus, when we note similarities between Salomon's House and the activities of Bacon's contemporaries we need not assume that the latter were fulfilling Bacon's program. That Bacon may have owed much to Drebbel does not mean he considered Drebbel as an ally rather than a competitor; the fact that he never once cited Drebbel's writings, would indicate that he would prefer not to acknowledge Drebbel's philosophical authority. Furthermore, even when Bacon did evince Drebbel's "material" he did so without crediting Drebbel, and in very qualified terms, although this "material" often fulfilled his fondest desires. By contrast, John Evelyn cited Drebbel as an author even while indicating that perpetual motions machines probably belonged among the "Impossibils."⁵²²

⁵²¹ Colie (1956), 94-5.

⁵²² See John Evelyn, *Elysium Britannicum, Or the Royal Gardens*, John Ingram, Ed., (Philadelphia: University of Pennsylvania Press, 2001), 252. ". . . being not fully convinced of the possibility of the Thing, we leave it to the profounder Artists, & to those who shall square the Circle having (for our owne part) promised our Gardiner, to deliver (as neere as may be) none but solid, and unsophisticated experiments: whilst {yet to saitiare the thirst

For example, as discussed above, Bacon recommended emphasizing the most fruitful experiments that not only led to further experiments, but revealed the most about the hidden causes of nature. In the 1605 edition of the *Advancement of Knowledge*, Bacon used the commonplace example of the compass. In the expanded 1623 edition, he changed his example to one of Drebbel's demonstrations – the artificial production of cold – although as usual he did not credit Drebbel.⁵²³

Drebbel's demonstrations appeared again within a *desiderata* list to be found in one of Bacon's model experimental histories. In his history of dense and rare, Bacon listed the various phenomena he would like to see (using now the term *optativa* rather than *desiderata*), along with the closest approximation to them currently existing. We find Drebbel's two instruments among those approximating motions driven by the dilation and contraction of the air. Bacon never referred to Drebbel by name, and merely listed, after the thermoscope and the altar of Hero, the “musical organ through the sun's shining streams. The imposture of the flux & reflux of the seas.”⁵²⁴

While Bacon included these Drebbelian instruments in his wish list, he suggested, by calling Drebbel's machine an imposture, that it was in danger of being a tale of Amadis

of those {more} curious persons, we recommend them the Writings of Bettingus, Grungergius, Mattinus, Kirker, Finugius, Drebell, Boeckler, Harstorffer, Schott, not forgetting our Countriman *Flud*, and for the present silence any father Arguments why we thinke it amongst the Impossibils, till we come to see & to know more of that *Soul & Body* . . . which Becker pretends to. . . .”

Evelyn refers to Becher's claim to have invented a perpetual motion moving not by a thermoscope, but by an actual soul. A text describing this machine, “De Anima Perpetui Mobilis” found in the Boyle papers (previously ascribed to Jan Amos Comenius), is also found, ascribed to Becher, in the Evelyn Papers. See Boyle Papers, Volume 29, 0523 F 106-9, “De Anima Perpetui Mobilis, seu Explicatio Causae moventis naturalis in Mobili Perpetuo,” and Sloane 427, 100-101 b, “De Anima Perpetui Mobilis.”

⁵²³ See Chapter Five for a discussion of Drebbel's production of cold. Bacon (1623), 176. “Exempli gratiâ, *Experimentum Artificialis Conglaciationis Aqua*, per Glaciem cum Sale nigro. . . .”

⁵²⁴ Francis Bacon, “Historia Densi et Rari” *Opera* (London: Haviland, 1623), 107. “varii usus motus dilatantis & contrahentis in aëre per calorem. Prox. Vitrum calendare. Altare Heronis. Organum musicum splendentibus radiis solis. Impostura de imitatione fluxus & refluxus maris & amnium.”

Elsewhere, Bacon refers to Drebbel extremely obliquely as “certain Dutchmen.” See *Phaenomena universi*, Oxford Francis Bacon, VI, *Philosophical Studies*, Ed. Graham Rees (Oxford: Clarendon Press, 1996) 60. “Erant etiam Batavi quidam nuper apud nos, qui organum quoddam Musicum confecerant, quod radiis solis percussum symphoniam quandam edebat.”

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rather than a deed of Caesar. The difference between fable and “storie” becomes clear when we look at an earlier list, the “historia” within the *History of Dense of Rare*. This was a catalog of approved facts, and here we find both Hero’s altar and the thermoscope but not Drebbel’s instruments.⁵²⁵

We do find Drebbel’s instruments in Boyle’s *History of the Air*. This work exemplified “knowledge broken.”⁵²⁶ It was published in an unfinished state, with chapter titles adorning blank pages. Referring to the mnemonic technique of organizing notes under headings, or commonplaces, Boyle called these chapterless chapter titles “a kind of Common Places.”⁵²⁷ Boyle justified leaving his work incomplete since “when a Work of this Nature has been once begun and taken notice of, in such an inquisitive and active Age as this of ours, it selddom fails to excite the Curiosity and Industry of others, whom, if the Design be any thing well laid, the Utility that it promises will invite to carry it on.”⁵²⁸ Boyle oriented the work toward the future and communication, inviting others to complete his work.

In that spirit, Boyle included excerpts from others, such as a letter by Benjamin Worsley containing a *desiderata* list for the improvement of the thermometer. Worsley

⁵²⁵ Francis Bacon, “History of Dense and Rare,” *Instauratio Magna, Part 3*, Oxford Francis Bacon 12, Graham Rees and Maria Wakely, eds. (New York: Oxford University Press, 2007), 89.

⁵²⁶ Francis Bacon, *Of the proficience and advancement of learning, diuine and humane* (London: Henrie Tomes, 1605), 63. “. . . *Aphorismes*, representing a knowledge broken, doe inuite men to enquire further; whereas *Methodes* carrying the shewe of a Totall, doe secure men; as if they were at furthest.”

⁵²⁷ Robert Boyle, *The General History of the Air* (London: John Churchill, 1692), x-xi. “Thinking it might be a very useful thing, in reference both to Philosophy and Physick, that that a Natural History of the Air (thought at first it should prove but a very imperfect one) were faithfully compiled, I propounded the Design to some *Virtuosi* that seem’d to relish it, and undertook to be Assistant in it. . . . I drew up a Set of Heads and Inquiries of that sort, which in another Paper I call Titles of the first Classis or Order; who, tho purposely set down without any anxious Method were comprehensive enough to have a good Number and Variety of Particulars conveniently referr’d to them . . . those scattered Notes lay many Years in loose neglected Papers, till at length the Curiosity and Desires of some *Virtuosi*, that knew I had gathered some Remarks, though few and incoherent, touching some Qualities of the Air, obliged me to draw together those that without a troublesome Search I could retrieve, offering themselves to promote the Design that others had abandon’d . . . I have not the leisure to methodize my incoherent Notes, and much less to weave them into continued Discourses; yet rather than let them perish, and disappoint those that will have them such as they are, I am content to refer to some of the Titles prefixed to this Treatise, as to a kind of Common Places, what my Memory, or some old Notes about divers things relating to the Air, and especially to the Causes and Effects of its Changes, supply me with in reference to that Body.”

⁵²⁸ *Ibid*, xiii.

complained “that no Improvement considerable hath, as I can learn, been made by any Man, of these Glasses, either in our own Country, or any where else, since their first Invention, (but only to hang them in a Room for Ornament sake) there being many things yet wanting, that were much to be desired for the perfecting of them [a numbered list followed].⁵²⁹

Worsley concluded his list of what should be done with this instrument with the inspiring example of Drebbel, that “great, singular, learned Mechanick.” Worsley listed Drebbel’s perpetual motion machine, the self-playing clavier, and the self-regulating oven, whose secret he had purchased from Drebbel’s son-in-law in 1656.⁵³⁰

Yet it is certaine that Drebbel that greate singular Learned Mechanicke did by the helpe of this Instrument make a dyall continually to moue of itselſe Regularly ſhewing both the tyme of the day & other Motions of the Heauens, Did alſoe make an Automatous Instrument of Muſick: & found out a furnace which he could gouerne to any degree of heate, But whether thoſe haue dyed with him or how farr the Meditations of others haue wrought vpon them I ſhall humbly referr to a more Leasurable Inquiry.

Worsley continued with a request for more communication upon the subject of the thermometer, saying “If you cann inform me among any of your acquaintance or Correspondents I should be glad to heare & to Learne any thing of this Nature or relating to the further vse experiment or improvement of this rare Little Instrument, or to the further clearing ventilating or discussing the Theory or Doctrine of the Planetts or the Physicall vse & power of these bodyes that wee haue thus breifly made an Assay of.” Both the essay and the desiderata list were open-ended genres Worsley used for the communication and “ventilation” of knowledge. He did not present his information as firmly established or perfected, but as “knowledge broken,” the pieces of which Boyle included in his own open-ended and communicative publication.

⁵²⁹ *Ibid*, 78.

⁵³⁰ Hartlib, *Ephemerides*, 29/5/100B.

Boyle himself developed his own method of desiderata, or optatives, as he called them in his *Some considerations touching the usefulness of experimental naturall philosophy*. In that work, he argued that informed experimental natural philosophy could serve commerce by improving trades. The philosopher, from a vantage point outside the trade, could survey it and note how it might be improved. He could do this by listing “Optatives,” by which Boyle meant “all those Perfections, that being desirable, are rather very difficult, than absolutely impossible, to be obtain’d Of which Optatives, there may sometimes belong several to one Craft or Profession.”⁵³¹

Boyle suggested several optatives for different trades, several of which were *deperdita*. For instance, an optative “in the Glasse-mens Trade, and the looking-Glasse-makers, may be the making of Glasse malleable or flexible.” He also recommended “in the Shipwrights Art, the making of Boats and other Vessels to go under water.” He acknowledged that “such Optatives may be thought but a civill name for Chymical Projects; but I shall hereafter more fully declare to you, why I think it not altogether unuseful, that such Optatives should be propos’d provided, as I hinted above, that they be very difficult & not impossible.”

In determining whether a project was merely “very difficult” rather than impossible, the natural philosopher must weigh, as Boyle had suggested previously, what the possible benefits of the project would be. He could also refer to the history of invention, and determine whether a particular art was a *deperditum*, and therefore possible. Several of Drebbel’s inventions fulfilled *desiderata* by replacing lost ancient arts. Boyle celebrated Drebbel’s replacement of the lost ancient purple with the new scarlet dye in *Usefulness*.⁵³² In

⁵³¹ Robert Boyle, “Usefulness of Natural Philosophy, II ,2,” *Works of Boyle*, Vol. 6, 1668-71, ed. Michael Hunter (London: Pickering & Chatto, 2000), 480.

⁵³² Boyle, *Usefulness*, 480.

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1690 Leibniz praised this chemical scarlet dye of Drebbel's as far more elegant than the ancient purple ("usu aquarum fortium multo elegantioris, quam quod apud Antiquos haberetur").⁵³³ As late as 1741 Johann Seip, in his dissertation *de Purpura Morbo Antiquo* cited Pancirolli on the *deperditum* of the ancient purple, and described how dyers had regained this lost color through Drebbel.⁵³⁴

By contrast, Drebbel's invention of the submarine was a new discovery, which itself quickly became a *deperditum*. Thus, though it seemed impossible, it had indeed been achieved. Tales of this discovery furthered the idea that recovery was possible

Submarine Navigation, at least for a short space, has bin successively attempted by the excellent Cornelius Drebell, as Mersennus assures us, and as I have bin inform'd, both by Drebell's son-in-Law, and by other judicious Persons, that have had the account of the Tryals from the very men, that went in the Vessel under water for a good while together; who affirm'd that though there were many in the Boat, yet they breath'd very freely, and complain'd not of any inconvenience for want of fresh aire. And here also give me leave to take notice, that this Inventive *Drebell* was no profess'd shipwright, nor so much as bred a Sea-man.⁵³⁵

VIII: Drebbel's Desiderata

Besides for fulfilling the *desiderata* of others, Drebbel himself kept a *desiderata* list which became a matter of exchange. As Hartlib recorded two years after Drebbel's death, the manuscripts Drebbel left included a list of experiences, or as we would say today, experiments, mostly optical in nature, some of which he had performed, and some of which were *desiderata*. The list included the design of a perpetual motion, "perspectives"

⁵³³ Leibniz to Ramazzini, *Sämtliche Schriften und Briefe*, Third Series, Vol. 4, Paul Ritter et. al., eds. (Berlin: Akademie, 1995), 454.

⁵³⁴ Johann Christoph Ludwig Seip, *Dissertationem Inauguralem Medicam De Purpura Morbo Antiquo* (Göttingen: Vandenhoeck, 1741), 5, "Perditum hodie colorem [Vid. Pancirollus libr. De rebus perditis et novis inventis] tinctores Cornelio Drebbelio auctore aliunde dedicerunt conficere."

⁵³⁵ *Ibid*, 481-2.

(telescopes) of all sorts, mirrors of all sorts, the design of a solar instrument and of a solar clock Drebbel began to build under King James but never finished, another one for the moon, incubators, large optical glasses, iron furnaces for the drying of malt, refrigeratory instruments, submarines, the camera obscura, and “glasses of thunder and lightning.”⁵³⁶

The description of this list as containing “*desiderata*” was Hartlib’s. Hartlib thought in terms of *desiderata* lists; his *Ephemerides* was full of them. Drebbel himself may have well considered such a list as one of secrets, some of which he had fulfilled and some which he planned to do. He did not intend to communicate these secrets, as one would a *desiderata* list, to be fulfilled by others. He planned to fulfill the list himself. To someone who believed aggressively in his ability to discover universal truths about nature with his own hands, the keeping of a list of secrets may have been as important to him as the *desiderata* list was for someone with a communicative and socially diverse research program such as Hartlib and Bacon. As his son-in-law told Peiresc, Drebbel believed all of philosophy to lie in the secrets of nature.⁵³⁷

While Drebbel planned on fulfilling his “*desiderata*” personally, this did not mean the Drebbel’s list had no affect on the research of others. In 1649 Hartlib circulated some

⁵³⁶ Hartlib, *Ephemerides*, 29/3/55B, Nov. 1635-Feb. 1636. “Illa quae reliquit concessus vt imprimis Optica in qua habet insignia Experientia partim jam perfecta partim adhuc perficienda. Possunt apud illum videri. 1. Forma perpetui Mobilis. 2. Perspectiva omnis generis. 3. Specula omnis generis. 4. Forma Instrumenti solaris. 5. Horologi solaris quod inceptum sub Rege Iacobo sed ob defectum [sumptuum?] nondum finitum. 6. Laborat jam in Novo quodam genere pro Luna. 7. distillatoria vbi etiam Gallinas excludit ex ovis. 8. Magna quadam vitra optica. 9. Fornaces ferrei pro hypocaustis, drying of Malt. 10. Refrigeratoria Instrumenta pro aestate et imprimis in locis calidioribus vt India etc. 11. Naves sub aquis natantes. 12. Conclave Opticum. 13. Vitra Tonitrium et fulgurum. etc.

Desiderata

Physica.

MS. Physica.

Cuffler.

Inventiones”

⁵³⁷ Carpentras Ms. 1776 fol. 408v. “. . . en croissant d’age il aloit tousiours croissant en inventions, qui procedoient de la vivacite d son esprit, sans ayde ny lecture de livres qu’il a tousiours mesprisé, tenant pour maxime que la verite et l’excellence des sciences consiste en la cognoissance des secrets de la nature dans laquelle elles sont tout comp[osées].”

Drebbelian optical manuscript, which appears to have been the same desiderata list, to William Petty. Petty responded enthusiastically, approving “highly of the Optical Ms. of Drebbels, being the true and only way to write Opticks which course himself intends to observe.”⁵³⁸ In fact, the only optical work to be found amid the Petty papers is a list of forty-one numbered points.⁵³⁹ I cannot demonstrate that this was a copy of Drebbel’s optical manuscripts; it most likely dated to the mid 1680’s. Yet many of the items recalled optical projects Drebbel was pursuing late in life.⁵⁴⁰

This was far from the only desiderata list to be found among the Petty papers.⁵⁴¹ Petty often balanced his many lists of *desiderata* with lists of “Essayes” and completed “Workes.” He thereby reduced the advancement of knowledge to the transference of items from the list of *desiderata* to the list of works. Petty further argued that all of philosophy should be trimmed down to the list form. The same year Petty praised Drebbel’s method of writing Optics to Hartlib, he told Henry More that he preferred Drebbel to Descartes

Till Monsieur des Cartes hath approved himself a philosopher in this Sense [producing technical advances and material benefits], I shall preferre Cornelius Drebbel before him, though he understood no Latin as one that hath done more though said less. . . .

Petty envisioned the ultimate philosophy as a mere list, as far from verbiage and as close to works as possible.

⁵³⁸ Hartlib, *Ephemerides*, 1649 [28/1/5A].

⁵³⁹ BL Add. 72892, Petty Papers # 61, 26-7.

⁵⁴⁰ As the Küfflers informed Peiresc, Drebbel was experimenting not only with microscopes and telescopes of various numbers and combinations of convexes and concaves, but in grinding single lenses with multiple convexes and concaves, and with making a telescope for seeing the sun and for seeing in the dark. This recalls Petty’s “Helioscope,” “seeing in the Dark,” “Of convexes for spectacles,” “Of Telescopes & microscopes of one convex,” “Of microscopes of one small convex,” “Of Telescopes of 2 convexes,” “of 4 convexes” “Of a convex & concave,” “Microscopes of 2 convexes,” not to mention Drebbel’s camera obscura and magic lantern, and Petty’s “Of casting figures on a wall without colours,” “And with colours,” “Of making figures encrease & diminish,” “Apparition in the Ayre,” and “Drawing pictures by a dark roome.”

⁵⁴¹ ADD 72866, 1-2 “Desiderata Considerata, 1685”; Add. Ms. 72898, 132-8, “Desiderata,” “Essayes,” “Catalogus Scriptorum,” “Workes”; Sloane 2903, 13, “The desiderata in a shipp.”

If men tooke this Course, there would not bee so many bookes extant, for to write out a sheet of paper in describing often tryed experiments would prove a more tough piece of work than to scribble whole Realmes about frivolous conjectures & imaginations with controversies for and against them.⁵⁴²

IX: Conclusion

The white pages of Boyle's future *Desiderata* and Experiments in his *General History of the Air* [Fig. 4] flag what contemporaries considered a novel and concerted envisioning of the future. Boyle's book lay half-finished "as a kind of Common Places" (cited above) waiting to be filled in by others, returning the *desiderata* back to the scribal culture where it began. In its ancient beginnings, the wish list was always intended to be communicated, yet only in order to fulfill the wishes of its inscriber. A new program of associative invention directed toward the future seized upon this genre as a way to organize and inspire collaborative ventures. As we have seen, *desiderata* entered print, as authoritative individuals from economic advisors to natural philosophers attempted to direct desire for the benefit of many.

The *desiderata* list also resembled commonplacing in that it was a practice which became a philosophy.⁵⁴³ As a widespread mechanics of change, the *desiderata* offer a contemporary, contextual, and grounded way to explore the relationship between a newly imagined future and the lost ancient world. Furthermore, the *desiderata* help us avoid an old modernist equation between reason and the idea of progress.⁵⁴⁴

⁵⁴² See Charles Webster, "Henry More and Descartes: Some New Sources," *The British Journal for the History of Science*, 4:4:16 (1969), 368 and Stephen Clucas, "Samuel Hartlib's Ephemerides, 1635-59, and the Pursuit of Scientific and Philosophical Manuscripts: The Religious Ethos of an Intelligencer," *Seventeenth Century* 6:1 (1991), 11-31.

⁵⁴³ Ann Blair, *The Theater of Nature: Jean Bodin and Renaissance Science* (Princeton, NJ: Princeton University Press, 1997).

⁵⁴⁴ On the need for a revised history of the idea of progress, see H. F. Cohen, *The Scientific Revolution: A Historiographic Inquiry* (Chicago: University of Chicago Press, 1994), 158-9.

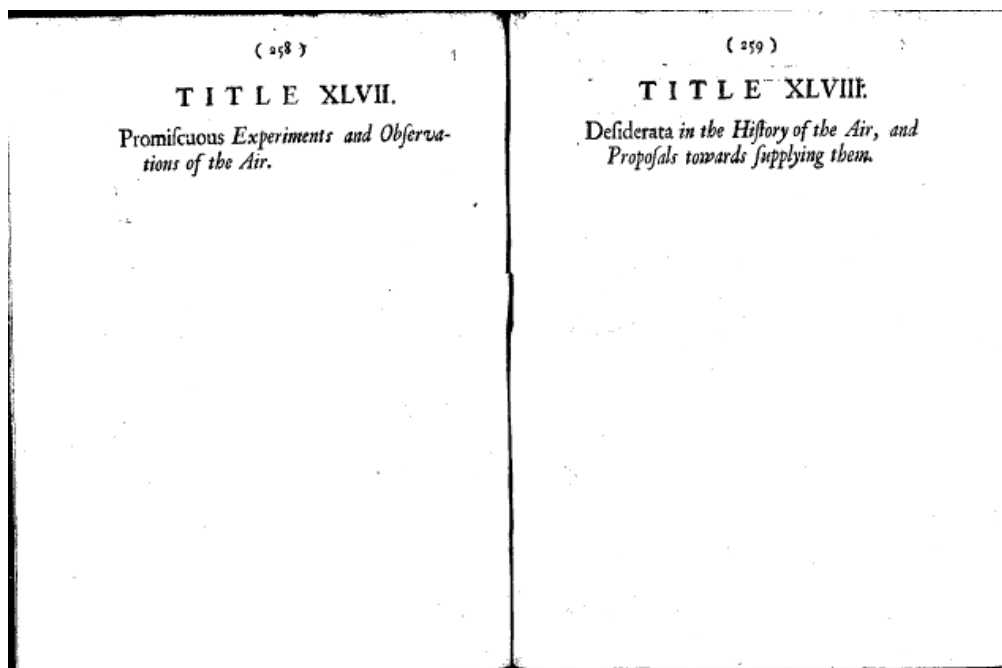


Fig. 4. Robert Boyle, *General History of the Air*

Within early modern *desiderata* lists, we find progress directed not by reason, but by contingent history, communication, enthusiasm, and desire. The fame of modern inventors showed what might be possible for the future. As Elias Ashmole wrote in the preface to his translation of Arthur Dee's *Fasciculus Chemicus* in 1650, works of art (just like the wonderful hidden powers of nature) can counter-act our prejudicial assumptions about what might be possible.

What famous and accurate Works, industrious Artists have furnished these latter Ages with and by Weights, Wheels, Springs or Strings, have imitated lively Motion, as Regiomontanus his Eagle, and Fly, Drebler's perpetual Motion, the Spring in a Watch, and such like Self-Movers. . . . From which few particulars, I might infer many other wonders possible to be wrought, which yet to appearance or probability, are beyond the power of accomplishment: and where the various productions of Nature, Art, or both, have given the levity and infidelity of many mens Judgments, the lie; whose prejudicate thoughts would never believe

a thing could be done, till found (beyond evasion or denial) it was done.⁵⁴⁵

Reading early modern collections of desires, we may be struck by the juxtaposition of objects now commonplace (flying machines, boats for going underwater or overland) and those deemed today inescapably foolish (the philosopher's stone or the universal panacea). Such lists show us the landscape of seventeenth century discovery as a quicksand of shifting knowledge blanketed with a haze of possible promise. Within that hazy plan for the future, we might distantly discern the present we inhabit today.

⁵⁴⁵ *Fasciculus Chemicus*. Elias Ashmole, trans. (London: Flesher, 1650), unpaginated "Prolegomena."

Chapter Three: Conversing with *Liefhebbers*

- I: Introduction: Conversations
- II: Gallery Paintings
- III: Conversing across Europe
- IV: Epigrams
- V: Album Amicorum
- VI: Conclusion

I: Introduction

Drebbel's biographer F. M. Jaeger bemoaned the inflated nature of the second-hand reports circulating about Drebbel, dismissing them as myths which could not offer reliable evidence. Yet, these sources exist in great quantity and in wonderful forms – poems, drawings, paintings, recreations of Drebbelian machines, and tales of Drebbel's exploits. Some of the individuals producing these sources are little known today, others are famous historical characters such as Hugo Grotius, Peter Paul Rubens, Claude Fabri de Peiresc, Jan Amos Comenius, Isaac Beeckman, Constantijn Huygens, Jacob Revius, and Quirinus Kuhlmann, to name a few. Why did so many of Drebbel's contemporaries seize on him as a subject for portraiture, poetry, narration, and conversation? What purpose did this important, extensive and enthusiastic circulation serve?

Those circulating Drebbel used him as a means to deepen and extend networks within a newly broadened horizon of exchange. Drebbel's persona served particularly well for those seeking to expand traditional boundaries, since he himself knew no bounds. As discussed in Chapter One, Drebbel personified enthusiasm in its precise meaning of a claim to authority far above that permitted by one's place in the world. That claim was accepted, augmented, and put back into circulation through the sociability of Drebbel's *liefhebbers*.

The *liefhebber* identity encompassed both producer and consumer. In a market based on supply and demand, both producer and consumer shared responsibility for a cultural product. The consumer confirmed the value of the object he wanted through his desire

alone. Thus the amateur invested his own authority in society, raising the status of those who could supply his wants. This was a period in which individual vices such as desire, curiosity, and private interest emerged as the buttress of public good, knitting together mutually dependent producers and consumers.

The investment of the amateur in his social inferiors and the marketplace distinguished the Northern European *liefhebber* or *liebhaber* from the courtly Italianate ideal of the *virtuoso*. As discussed in Chapter One, the *virtuoso*'s *virtu* was located in heroic self-sufficiency, and did not depend upon fellow *virtuosi* and certainly not upon professionals. He ought not to display passion, but rather the seemingly carefree ability of *sprezzatura*. He was defined by his nobility and not by a sordid, financial interest in his activities which he could take up or cast off at will. Thus the *virtuoso* in fact worked hard to seem idle, while the *liefhebber* displayed his effort on behalf of others since his was a "labor of love."

Of course, these two ideals interacted in the period, especially in England.⁵⁴⁶ There, as Lawrence Stone has described, in "the period from 1560 to 1640" gentlemanly education reached an abnormal high level "of exceptionally intensive intellectual and artistic training, squeezed between centuries of ignorance on the one hand and centuries of dilettantism on the other."⁵⁴⁷ In the early seventeenth century, Englishmen gentlemen began to undertake the learned, methodical travel that had characterized the Central European *ars apodemica*.⁵⁴⁸ Stone related the new ideal of the *virtuoso* to the crisis of the aristocracy, arguing that the "shortage of posts in royal service" created a "compelling need to find an emotionally satisfying alternative."⁵⁴⁹

⁵⁴⁶ Brian Cowan, "An Open Elite: the Peculiarities of Connoisseurship in Early Modern England," *Modern Intellectual History* 1:2 (2004), 151-183.

⁵⁴⁷ Lawrence Stone, *Crisis of the Aristocracy, 1558-1641* (Oxford: Clarendon Press, 1965), 722.

⁵⁴⁸ *Ibid*, 694.

⁵⁴⁹ *Ibid*, 715.

Yet even those most active in the government, such as Charles I and the Duke of Buckingham, assembled massive art collections and involved themselves in projects (as described in the Introduction). The overwhelmed Lieutenant General of the Ordinance Office Sir John Heydon was also an alchemist in his spare time. Charles granted William Drummond of Hawthornden, who already led a celebrated career as a poet, a patent for sixteen military machines, including a perpetual motion.⁵⁵⁰ Drummond deserved the patent for the time, labor, and money he had invested in perfecting older machines, inventing new machines, or recovering lost machines.⁵⁵¹

Rather than finding the cause of their activity in a lack of positions at court, we might look instead to the newly attractive position of the *liefhebber* developed in Central and Northern Europe. Stephen Greenblatt, in *Renaissance Self-Fashioning*, related the courtly ideal of the virtuoso to the individual's need to draw inventively from available cultural bric-a-brac in order to fashion a self which could survive the competitive atmosphere of the Renaissance court. Such self-fashioning entailed the development of an authorial self seemingly set apart from political entanglements and dependencies, although, Greenblatt argued, this was never entirely possible. *Liefhebbers*, by contrast, worked to entangle themselves by splitting the authority of authorship among many. The language of love saturated print, as books were

⁵⁵⁰ See the "Littera Magistri Gulielmi Drummond de fabrica Machinarum Militarium, Anno 1627" printed in William Drummond, *Works* (Edinburgh: James Watson, 1711), 235-6. The perpetual motion, like Drebbel's, was itself a "natural" motion but could power mechanical motions. In the patent the machine was described as a "machina organica ex causa naturali & indefessa motum perpetuum producens, cujus beneficio infinita operationum mechanicarum varietas principium habere potest."

⁵⁵¹ *Ibid.* "Sciatis quandoquidem, ex multorum testimoniois omni exceptione majoribus, liquido nobis innotuit, fidelem nostrum subditum Magistrum Willielmum Drummond ab Hawthornden, plurimum temporis, laboris & pecuniarum insumpsisse in excogitandis & fabricandis machinis multivariis, quae & in pacis & militiae negotiis reipublicae usui & emolumento esse possint, eundemque ex matheseos & naturae principiis & nova quaedam arma invenisse, & vetera nonnulla vel imperfecta perfecisse, vel obsoleta ab oblivione vindicasse, praesertim vero machinas bellicas quibus ut armis uti liceat, cum ad ossensionem tum ad defensionem, sive marina sive terrestri pugna fuerit confligendum."

printed by and for amateurs, who assumed the labor of fashioning the works of others and bringing them to the press.

In his essay, “Des Boiteux,” Montaigne reflected on the way a cycle of expanding rumors knit together the public and the particular. He compared the passion driving man to circulate and increase rumor to the growth of capital through usury. An error began with an individual, who puts it in public circulation. Just as we generally add to anything we have been lent, each individual who encountered the error expanded it, passing it back into public circulation, and into the hands of further individuals. As this cycle continued, the error grew ever larger and more persuasive as it gained “interest” within circulation.⁵⁵²

Each individual who dilated upon Drebbel borrowed him, invested in him, and returned him to public circulation for a reason. To brand their accounts simple errors and lies is to do little credit to the gifted artists, poets, and writers who chose Drebbel as their subject. In their culture, the persuasion of rhetorical currency held great sway, even though, as Montaigne warned, “*Ogni medaglia ha il suo reverso*” (“Every coin has two sides”).⁵⁵³

Conversation notoriously eludes the historian. By tracing the representations, tools, and traces of conversation, I hope to offer some account of who discussed Drebbel, and why they did so. In this chapter, I track the circulation of Drebbel within four genres - gallery paintings, letters, poetry, and the *album amicorum*, or books of friends. All four were important tools of sociability, serving to excite and encourage conversation.

In manuscript, the *album amicorum* was a new genre marking the age of the *liefhebber*. The *album amicorum* evolved from a collection of individual heraldry or quotations to a highly

⁵⁵² Michel Montaigne, *Essais de Michel de Montaigne* (Paris : Firmin-Didot frères, 1854), Livre II, Chapitre XI, “Des Boiteux,” 537. “. . . *insita hominibus libidine alendi de industria rumores*, nous faisons naturellement conscience de rendre ce qu’on nous a presté, sans quelque usure et accession de nostre creu. L’erreur particuliere fait premierement l’erreur publicque ; et à son tour aprez, l’erreur publicque fait l’erreur publicque fait l’erreur particuliere. Ainsi va tout ce bastiment, s’estoffant et formant de main en main; de manière que le plus esloigné tesmoing en est mieulx instruit que le plus voysin; et le dernier informé mieulx persuadé que le premier.”

⁵⁵³ *Ibid*, 541.

inventive genre interacting between script and print, word and image, and circles of inscribers. The *album* functioned as an intertext mediating between individuals and between both texts which preceded the album, and those which grew from it. Within the pages of the album, inscribers entangled their identities, engaging in epigrammatic duels and claiming quotations or images associated with third or fourth parties as their own “heraldry.”

The commodification of art in the Netherlands also had important consequences for the rise of amateurship. *Liefhebbers*, rather than individual patrons or professional artists, could now claim an interest in debates over art as such. In this period, the role of “liefhebber” became an official status within artists’ guilds, at the same time as the invention of the new genre of the gallery painting genre in Antwerp.⁵⁵⁴ These works showed often fictional spaces filled to the brim with luxury commodities of art and nature and *liefhebbers* engaged in passionate debate and connoisseurship. The gallery painting thus offered the ideal of a virtual space for debate over natural and artificial particulars.

And then there was the Republic of Letters. This network for epistolary conversation was of course far from new. Yet, the insistent interest of one *amateur*, Peiresc, in the artisan Drebbel merits attention. Peiresc drew upon his vast correspondence and credit in the world of letters to further the exchange of information and goods concerning Drebbel. He even served as a sort of middleman in the international enterprise of selling Drebbel’s microscopes run by the Küffler brothers in Cologne.

Enthusiasm for what could be achieved in society by the *liefhebbers* gave rise to an era of associations, fraternities, and other fora for amateur interactions, from the linguistic to the philosophical to the Utopian. As Donald Dickson argued in the *Tessera of Antilia*, even pure Utopias – or “no-places” – such as the fictional brotherhood of the Rosicrucians could serve

⁵⁵⁴ Svetlana Alpers, *Rembrandt’s Enterprise: the Studio and the Market* (Chicago: University of Chicago Press, 1988). Z. Z. Filipczak, *Picturing Art in Antwerp, 1550-1700* (Princeton, N.J.: Princeton University Press, 1987).

transformative roles, offering a virtual place in which to re-imagine a social order not yet thinkable in reality.

There were those who policed the borders of actual locales. Elizabeth Goldsmith has argued that “the verb ‘converser’ retained its Latin sense of ‘to frequent’ or ‘live with,’ and the noun ‘conversation’ conveyed a sense of place that it no longer has today.” As a result, “conversation created its own social space with carefully marked boundaries; to ‘be somebody’ one had to be “in the best conversations.”⁵⁵⁵ Goldsmith compared such elite conversations to Mauss’ study of the potlatch, or system of gift exchange completely opposed to the commodification of market systems. Yet in our period, altruistic ideals such as the public good were transformed by the market. In a system far different from the potlatch, private curiosity motivated both circulation and accumulation in ventures for the public good.

II: Gallery Paintings

In seventeenth-century Antwerp, a new genre of the gallery painting performed as an imaginary space for the collection of the most desirable objects - the painted equivalent of the *desiderata* list, as it were. Although executed occasionally for a particular patron, the gallery painting was more often produced generically for the new art market. In some ways, as a virtual space of ultimate desires, it was an image of that market. It was in this imagined space of wonderful goods oriented towards an anonymous consumer that Drebbel’s perpetual motion machine figured as one of the ultimate objects of desire. In painting after

⁵⁵⁵ Elizabeth Goldsmith, *Exclusive Conversations: The Art of Interaction in Seventeenth-Century France* (Philadelphia: University of Pennsylvania Press, 1988), 2. See also Antoine Lilti, *Le monde des salons* (Paris: Fayard, 2005).

painting, we find Drebbel's perpetual motion, often as the subject of excited conversation by circles of *liefhebbers*.⁵⁵⁶

In a *Kunst*-loving world patronized by a court full of *liefhebbers*, the gallery painting put consumption on display. Such works are full of dozens of objects from famous paintings and drawings to statuary, clockwork and instruments. However, as Elizabeth Honig has described, these objects do not overwhelm the viewer. They do not press upon the spectator, overflowing across the picture plane with an unrelenting materialism. The objects, although numerous and executed with great mastery – especially those quoted masterworks showing the “hands” of different masters – do not insist on their reality. They invite the viewer not to reach forward and touch, but to look closely and identify.

Honig, in *Painting and the Market in Antwerp*, contrasted this new seventeenth-century aesthetic with the forceful realism of sixteenth-century market scenes. She argued that as the commodification of culture developed, this new aesthetic corresponded to new social formations of consumption, and new ways of finding value within cultural products. Unlike the sixteenth-century market scenes, whose value was found in the painting as an object of exchange between the artist and the beholder, the value of the gallery painting must be located in a more complicated circulation between numerous producers and consumers.

⁵⁵⁶ Henri Michel first identified Drebbel's machine within the gallery paintings. See Henri Michel “Le mouvement perpetuel de Drebbel,” *Physis* 13 (1971), 289 - 294.



Fig. 1. Willem van Haecht, *The Cabinet of Corneille van der Geest during the Visit of the Archdukes* (New York, Collection of Mary van Berg). The perpetual motion is against the left wall, under the window.



Fig. 2. Hieronymus Francken II. *The Archdukes in a Collector's Cabinet* (Baltimore, Walters Art Gallery).



Cliché number : B126529
Object number : 20025425
Institution : Koninklijke Musea voor Schone Kunsten van België
City : Brussel[deelgemeente]
Object : schilderij[schilderstuk]

Fig. 3. Hieronymus Francken II. *Collector's Cabinet* (Brussels, Gaston Kleefeld Collection). (c) IRPA, Brussels.

Honig underlined the anomalous nature of the gallery painting as the product of collaborators. This multiple authorship extended beyond the “virtual” authorship of the many masters whose paintings are quoted within the works. By collaboration Honig referred to the frequent partnering of masters of equal status in the production of these works. Such collaboration conflicted with the tradition of authorship “as lying in the tight interconnection between the single genius, the ‘idea’ of the work of art and the final product – a notion that came to fruition in the Renaissance and remained broadly operative for centuries thereafter.”⁵⁵⁷ Honig related this phenomenon to the social function of these works. They served as objects of conversation among connoisseurs who could identify the various hands within the works. “On the one hand, the picture “contains” value in the form of the canonical artists’ hands whose traces are inscribed upon its surface; on the other, a much greater value is generated by and for its beholder, who enacts a certain performance before it.”⁵⁵⁸

The luxurious, enclosed interiors depicted within the gallery paintings seem locales for exclusive conversations, which we would hardly relate to the new social configuration of the emerging public. Yet the conversations shown are fictive ones, even when involving historical figures such as the Archdukes Albert and Isabella in Willem van Haecht’s *The Cabinet of Cornelis van der Geest*.⁵⁵⁹ Entrance to this conversation could be obtained on the market, by purchasing a generic gallery painting and appearing before it in the role of the connoisseur. In this period, merchants, for whom Cornelis van der Geest stands as a representative, became major collectors of art. Van der Geest combined his mercantile and

⁵⁵⁷ Elizabeth Honig, *Painting & the Market in Early Modern Antwerp* (New Haven: Yale University Press, 1998), 178.

⁵⁵⁸ *Ibid.*, 210.

⁵⁵⁹ Barbara Welzel, “Galerien und Kunstkabinette als Orte des Gesprächs,” *Geselligkeit und Gesellschaft im Barockzeitalter*, W. Adam, ed. (Wiesbaden: Harrassowitz, 1997), 496.

aesthetic knowledge as deacon of the Mercenier's guild and member of the Guild of St. Luke in the status of "*liefhebber*."⁵⁶⁰

The status of "liefhebber" was an old one found in the chambers of rhetoric. The Violeren chamber merged with the Guild of St. Luke in 1480, so one could join the Guild as a *liefhebber* or *beminnaer* of poetry for some time, but only recently as a lover of painting. The status of *liefhebber* thus originated within an exclusive, closed, and competitive institution closely tied to guild structures and not the wider market.⁵⁶¹

In the seventeenth century, we find the old idea of the *liefhebber* reconceived as part of a broader conception of cultural consumption. In his *Schilderboeck* Van Mander fulminated against the closed nature of artist's guilds, complaining that it lowered them to the status of competitive illiberal crafts, rather than the generous, liberal art which painting should be.⁵⁶² An anonymous "*liefhebber*" of rhetoric also complained about the competition between chambers of rhetoric in his 1618 "Reden over de oneenicheyt der rymers onses tidts en vaderlants."⁵⁶³ He argued that the *liefhebbers* should ally themselves in a much more inclusive formation of all those loving the arts.

As Peter Miller has argued, in an emerging public older relationships from the private sphere such as friend or brother were not neglected, but renegotiated in a new social, political and economic order to "redefine a public identity, that of the 'citizen,' in the name of a private one, the 'friend,' and by so doing to create a third domain that came to be called

⁵⁶⁰ Briels, "Amator Pictoriae Artis. De Antwerpse Kunstverzamelaar Peeter Stevens (1590-1688) en zijn Constkamer," *Jaarboek van het Koninklijk Museum voor Schone Kunsten Antwerpen* (1980), 140-4.

⁵⁶¹ Honig, 20.

⁵⁶² Honig, 14.

⁵⁶³ Ghestelt by een liefhebber derselver hoochloffelijcker konste. 't Amsterdam. In 't jaer ons Heeren 1618. Reprinted in F. V. Van Boheemen and Th. C. J. Van der Heijden, *Retoricaal Memoriaal: Bronnen voor de Geschiedenis van de Hollandse rederijderskamers van de middeleeuwen tot het begin van de achttiende eeuw* (Delft: Eburon, 1999).

‘civil society.’”⁵⁶⁴ It was the “market mechanism” which “served to create one public out of many private desires,” as opposed to the “popular neo-Stoic ideal of men pursuing intellectual perfection through social life.”

Miller’s account of new social theories of the seventeenth-century contradicts J. Briels’ often cited article on the *liefhebber*, “Amator Pictoriae Artis.” Referring to Gerhard Oestreich’s 1969 *Geist und Gestalt des frühmodernen Staates*, Briels argued that the “spirit” (geest) exemplified in paintings of the cabinets d’amateurs of merchant *liefhebbers* such as Cornelis van der Geest or artists such as Rubens was that of a Neo-Stoic “right reason” disciplining an active life in the world.⁵⁶⁵ Rubens has since often stood as the model of Neo-Stoic friendship.⁵⁶⁶

Yet Miller has drawn attention to the Nazi scholarship upon which influential accounts of Neo-Stoicism and the making of modernity have been based.⁵⁶⁷ Oestreich’s work has been frequently cited in the literature on still life in the Netherlands, as setting a certain “neo-stoic” context for the depiction of material things.⁵⁶⁸ According to the Neo-Stoic interpretation of the *vanitas* theme, man, tossed upon the wheel of fortune, could not control his worldly affairs. He could only master his mental state through the exercise of reason.

⁵⁶⁴ Peter Miller, “Friendship and Conversation in Seventeenth-Century Venice,” *Journal of Modern History* 73:1 (Mar., 2001), 3.

⁵⁶⁵ Briels, 149.

⁵⁶⁶ Mark Morford, *Stoics and Neostoics: Rubens and the Circle of Lipsius* (Princeton: Princeton University Press, 1991).

⁵⁶⁷ Miller, “Nazis and Neo-Stoics: Otto Bruner and Gerhard Oestreich,” *Past and Present* 176 (2002), 148.

⁵⁶⁸ B. A. Heezen-Stoll, “Een vanitasstilleven van Jacques de Gheyn II uit 1621: Afspiegeling van neostoische denkbeelden,” *Oud Holland* 93 (1979), 217-250, and Pamela Smith, “Science and Taste: Painting, Passions, and the New Philosophy in Seventeenth-Century Leiden,” *Isis* 90:3 (Sep., 1999), 437-8.

This interpretation has assumed certain features of Oestreich's scholarship which require re-examination.⁵⁶⁹

What did it mean to “live as a philosopher” in this period? The Küfflers informed Peiresc that Drebbel always “lived as a philosopher” (see Chapter One). P.C. Hooft too famously remarked that, “Nu leeven wij hier als die de werelt gestorven zijn, oft ten minsten leeren sterven, op zijn Philosophs.” Yet, as P. Tuynman has argued, the usual Neo-Stoic interpretation of this phrase does not fit Hooft's rich, mercantile, hospitable, and “news hungry” personality. Hooft was not sufficient in and of himself, “a l'a Horatius' Satiren, ‘in se ipso totus,’” but was very much invested in the world around him.⁵⁷⁰

The knowledge of art dealers such as van der Geest was not philosophical, but aesthetic and mercantile. It was a knowledge in and of the world. Painting, a deceitful luxury object, needed to be defended against the claims of reason. It is difficult to reconcile the Stoic ideal of the mastery of bodily desire by reason with a genre celebrating the mass accumulation of luxuries such as the gallery painting, and it is likewise a challenge to see Rubens, acclaimed for his flesh-painting, as a fulminator against bodily pleasure.

The tension here is also apparent in the close relationship between the genres of the *vanitas* still life, allegories of the senses, and the gallery painting. All three were filled with a multitude of objects, often the same ones. For instance, the same artists who depicted Drebbel's perpetual motion in gallery paintings also included it in allegories on the vanity of the world and the sense of hearing [Figs.5-6]. Ostensibly, the theme of these two paintings

⁵⁶⁹ Martin van Gelderen, “Holland and das Preussentum: Justus Lipsius Zwischen Niederländischem Aufstand,” *Zeitschrift für Historische Forschung* 23 (1996) 29-56.

⁵⁷⁰ P. Tuynman, “Hooft en de filosoof,” *Omnibus Idem: Opstellen Over P.C. Hooft ter Gelegenheid van zijn Driehondertvijftigste sterfdag*, Jeroen Jansen, ed. (Hilversum: Verloren, 1997), 157. See also 171. “Wij moeten niet zo lichtvaardig strooien met epitheta las ‘stoïsch’ en ‘epicureïsch’: dat is een miskening van de antieke filosofen en een misstaande vlag van geleerdheid op het werk van iemand die men eerder, om maar eens wat te noemen, zou kunnen kwalificeren als een verliefde dichter, een gelijkmoedig levensKunstenaar, of een toegewijd en arbeidzaam dienaar van het gemenebest.”

was a hortatory one - all accumulation and enjoyment of sensual things was but a fleeting shadow. The senses of fallen man lead him to error and spiritual perdition. Yet these genres reviled conspicuous consumption even as the closely related genre of the gallery painting celebrated it.⁵⁷¹

How do we reconcile the old themes of *vanitas* and allegories of the senses with a new genre celebrating the desire for, accumulation, and delight in physical objects and a mercantile society increasingly prizing knowledge gained through the senses? In the late sixteenth century, the five senses began to be depicted as luxury wooden reliefs within sumptuous banqueting rooms of merchant houses in Lübeck and Antwerp.⁵⁷² Did the allegories of the five senses put on conspicuous display in urban mercantile centers still mean what they once meant?

The importance of the figure of Seneca and Stoic literature in the culture of the period cannot be denied. Busts of Seneca fill many period paintings including the *Cabinet of Cornelis van der Geest*.⁵⁷³ However, Peter Miller has rightly warned against reliance upon Oestreich's discredited model of the neo-Stoic disciplining state alone for our understanding of what appreciation of the Stoa entailed in the period. Other interpretations can be sought in the literature of the period. R.S. Buys, for instance, has suggested the tolerant spiritualism of the engraver and philosopher D. V. Coornhert (who himself translated Boethius and Seneca) and Antwerp familism as one context for the explosion of Netherlandish neo-Stoic

⁵⁷¹Celeste Brusati asked, "Are these pictures produced *primarily* to offer moral edification and reminders of mortality? Do they not also nurture the cherished fiction that that which is most ephemeral can be possessed and preserved - at least in art - from the ravages of time? There seems little question that both these impulses feed into Dutch still-life painting and register its audience's deeply rooted ambivalence toward possessions and worldly attachments that were both desired and feared." See Brusati, "Stilled Lives: Self-Portraiture and Self-Reflection in Seventeenth-Century Netherlandish Still-Life Painting," *Simiolus: Netherlands Quarterly for the History of Art* 20:2/3 (1990-1991), 175.

⁵⁷² Carl Nordenfalk, "The Five Senses in Late Medieval and Renaissance Art," *Journal of the Warburg and Courtauld Institutes* 48 (1985), 21.

⁵⁷³ Wolfram Prinz, "The Four Philosophers by Rubens and the Pseudo-Seneca in Seventeenth-Century Painting," *The Art Bulletin* 55:3 (Sep., 1973), 410-428.

literature in the mid-sixteenth century.⁵⁷⁴ The Coornhertian tradition emphasized vernacular knowledge, tolerance, liberty of thought, inspired enthusiasm, and an optimistic view of man's abilities against Lipsius' notorious "ure et seca." Lipsius was clearly an important figure among Antwerp *liefhebbers*, but his ideas co-existed with other points of view. Lipsius played the Heraclitus to Coornhert's Democritus. Should one cry at the world and attempt to escape from it through reason, or should one laugh at the world and embrace the knowledge of the senses?

Hendrick Goltzius, who as the student of Coornhert was certainly aware of his ideas, designed several allegories on the senses. Drebbel engraved Goltzius' design for Touch [Fig. 4]. The figure of *Tactus* is flung open to the elements, as the heavens storm and ships scud by on a wind-tossed sea. We cannot help but think of Drebbel's own *On the Nature of the Elements, and how they bring about wind, rain, lightning, and thunder*. Hidden in the shadows, a serpent bites the leg of *Tactus*, giving her the most painful, and thus deepest sense of touch. The verses below call this the "illicit sense of Cyprus," thus indicating that the figure of Touch also represents the goddess of desire who "made her way to sea-washed Cyprus and stepped ashore a modest lovely Goddess, and about her light and slender feet the grass grew and the gods called her Aphrodite, and men too. . . ." ⁵⁷⁵ The turtle crawling at her feet also served in Goltzius' 1595 "Allegory of Touch" as a symbol of sexual desire. Yet reading on, we find an ambivalent attitude to touch, the lowest and most transgressive of the five senses.

Illicito Cypriae sensu moveare caveto;
Serpentis morsu nam magis ille nocet.
Sic tamen haud fines Tactus transcendet honesti,
Si modus in reliquis sensibus aptus erit.

⁵⁷⁴ R. S. Buys, "Te doene tghene datmen verstaet: Lekenwijsheid, stadse Stoa en vrijzinnig christendom tussen Reformatie en Opstand," *Queeste* 12:1 (2005), 18-46.

⁵⁷⁵ R. Lattimore, *Hesiod* (Ann Arbor: University of Michigan Press, 1959) 135.

Beware lest you be stirred by the illicit sense of Cyprus, for that injures much with the bite of the snake. Yet touch will not cross over the limits of what is honorable if the proper limits are kept in the rest of the senses.

Even in a world as wind-swept and unsteady as that shown in Drebbel's engraving, man could still stay in control of his senses, experiencing nature through "honorable Touch." Goltzius celebrated the ability of the senses to inform man about the world in the allegory of the five senses he invented which was engraved by Jacob Matham, saying that "The senses serve the soul and perceive everything . . . whatever the earth, the sea and even the aether has – even the stars, the air, the moon and the sun are known to these five."⁵⁷⁶ As we have seen in the last chapter, Drebbel himself argued that the knowledge of sensual things led directly to knowledge of the divine and thus salvation.

The *vanitas* theme was as unstable in the period as the wheel of fortune itself. The very same settings and objects could celebrate sensual appreciation within the gallery painting or ostensibly condemn it within allegories of the senses or allegories of the vanity of the world. Barbara Welzel has argued that gallery paintings not only celebrated conversation, but served as ideal objects of conversation. Thus, compositions included deliberately

⁵⁷⁶ "Omnia percipiunt Sensus animoque ministrant/ Externa externii qualiacunque fient. Quicquid habet tellus, quicquid mare, quicquid et aether,/ Quinque his astra, aer Lunaque, solque patent."



Fig. 4. Drebbel after Goltzius.

provocative themes. For example, the juxtaposition of Quentin Massys, as the founder of Antwerp painting, next to antique sculpture allowed for a debate over ancients and moderns, or the *paragone* of sculpture and painting.⁵⁷⁷ The ambivalence of the senses and wordly vanity in this period might make itself a subject of debate.

As discussed in the next chapter on the rhetorical commonplace, Drebbel's perpetual motion figured frequently in arguments on behalf of the moderns in the ancients versus moderns debate. As a model of the world, the perpetual motion invited the viewers to debate the state of the world. The perpetual motion appeared not only in the ambiguous genre of the gallery painting, but in relatively straight forward *vanitas* compositions.

We find, for instance, Drebbel's perpetual motion in the background of the two versions of Jan Bruegel I and Rubens' *Allegory on the Vanity of the World* (Turin and Brussels). In this work, a distant scene of carnival unfolded in the streets, while a central figure turned away from the world and toward a suspended glass sphere representing the divine.⁵⁷⁸ Drebbel's perpetual motion lurked behind this scene of conversion, almost hidden in the shadows against the back wall. Compared to the "crystalline" sphere of heaven, Drebbel's perpetual motion represented the world.⁵⁷⁹ Directly above the perpetual motion hung a painting of Heraclitus and Democritus. Thus the viewer was offered two possible responses to the world – he could with laugh with Democritus or cry with Heraclitus.⁵⁸⁰

⁵⁷⁷ Barbara Welzel, "Galerien und Kunstkabinette als Orte des Gesprächs, 500.

⁵⁷⁸ Vermeer employed this motif in *Allegory of the Faith* where the central figure turned from the world and gazed up towards a glass sphere suspended from the ceiling, representing the crystalline sphere of heaven. See E. de Jongh, *Questions of meaning: Theme and Motif in Dutch Seventeenth-century Painting*, Michael Hoyle, trans. (Leiden: Primavera, 2000), 72.

⁵⁷⁹ The two were juxtaposed again in the gallery painting by Corneille de Bailleur now in the Musée de Dijon.

⁵⁸⁰ On the contemporary debates over these two approaches to the world and manners of knowing it, see Paula Findlen, "Between Carnival and Lent: The Scientific Revolution at the Margins of Culture," *Configurations* 6:2 (1998) 243-267. On this painting, see Michael Jaffé, *Rubens* (Milan: Rizzoli, 1989), # 769, "Questo quadro è descritto in una lettera del 1631 di Jan II al famoso mercante Chrysostoom van Immerseel residente a Siviglia: "Un grande raffigurante la vanità: le figure sono della mano stessa del Cavaliere Rubens, le piccole scene sul fondo del padre [Jan I]; esse rappresentano una sera di carnevale con molti buffoni giullari e centinaia di figure:

Jan Bruegel II followed his father's lead in his and Hendrick van Balen's *Allegory of Hearing*. There the perpetual motion appeared again, this time with the supporting sphinxes changed to songbirds. The viewer might have recognized the change, and related it to the songbirds fluttering throughout the rest of the painting and the birds singing in the Archduke's aviaries and grottos. He might have discussed art and nature, and the competition between natural song and the music Drebbel produced in his solar-powered instruments.⁵⁸¹



Fig. 5. Jan Bruegel and Rubens, *Allegory of Vanity* (Brussels).

fiorini 400. Avendo egli [Jan I] pagato al Signor Rubens 100 fiorini per queste figure, vediamo sul davanti un angioletto che tiene in mano un ritratto del Christo, nel quale si legge *Ego sum lux mundi, via veritas et vita.*”

⁵⁸¹ Bettina Werche, *Hendrick van Balen (1575-1632): Ein Antwerpener Kabinettbildmaler Der Rubenszeit* (Turnhout: Brepols, 2004), 449.

We find the perpetual motion in gallery paintings not only frequently as the subject of animated conversation, but juxtaposed with the Archdukes Albert and Isabella. Albert and Isabella must have been familiar with the device. In 1612, they had been given a version of it by Daniello Antonini.⁵⁸² At the request of Albert, Antonini applied this irregular motion to a regular motion, producing a clock using the motion devised by Drebbel. Indeed, a clock incorporating a glazen tube half-filled with water can be found in Bruegel's *Allegory of Hearing* in the Prado.⁵⁸³ As Antonini told Galileo, such motions were indeed subjects of conversation and debate.⁵⁸⁴ One of the Archduke's many engineers also developed a version before 1619.⁵⁸⁵ And, as we shall see, the Archdukes had at least one version of the machine at Brussels, which would be copied by Jean de Montfort and Rubens for Nicolas-Claude Fabri de Peiresc.

The *liefhebbers* have been frequently discussed in the art historical literature as connoisseurs specifically of the fine arts. The term was certainly used that way, but it also encompassed, as we have already seen, a more expansive notion of the enthusiast. Drebbel's perpetual motion, reproduced by Rubens and depicted in gallery paintings over a dozen times, points to an appreciation for *Kunst* as a broader category.⁵⁸⁶

⁵⁸² Brussels, 4th February 1612, Daniello Antonini to Galileo in Florence, *Le Opere di Galileo Galilei*, Vol. (Florence: G. Barbèra, 1966), Letter # 652, 271. "Lo feci, come dico a V. S. per mio capriccio, ma poi venendo all'orecchie di questo Principe, l'ha voluto vedere, il quale non solo mostrato, ma gliel'ho ancora donato."

⁵⁸³ *Opere di Galileo*, 269. "Ho ritrovato maniera, ad istanza di questa Altezza, d'applicar questo moto irregolare ad un regolare, per far caminar un horologio. Son apunto hora sul cominciar ad porla in opra: sarà machina assai artificiosa, et spero che riuscirà; il che se riesce, io ne mandarò poi il disegno a V.S. Fra tanto mi conservi suo servitore. . . ."

⁵⁸⁴ Brussels, 11th February, 1612, Daniello Antonini to Galileo in Florence, *ibid*, Letter # 655, 275. "Ogni giorno mi bisogna disputar con alcun di questi sotili ingegni per questo moto, che è uno spasso."

⁵⁸⁵ The Archduke's engineer, Ghijsbrecht de Doncker, also displayed a barometric perpetual motion in Gent in 1619. See A. van Werverke, "Gijsbrecht de Doncker, de uitvinder van den waterbarometer," *Bulletin du Cercle Historique et Archéologique de Gand* 16 (1908), 234-6. Philippe Bragard, "The Archducal Engineers," *Albert and Isabella, 1598-1621: Essays*, Werner Thomas and Luc Duerloo, eds. (Turnhout: Brepols, 1998), 213-215.

⁵⁸⁶ I will not offer an exhaustive search for Drebbel's perpetual motion in these works here, nor debate the attributions of the works in which it does appear. See Henri Michel for several examples, and S. Speth-Hoterhoff, *Les peintres flamands de cabinets d'amateurs au XVII. Siècle* (Brussels: Elsevier, 1957).

In his printed travel guide to the town, Abraham Gölnitz described the various palaces of Archduke Albert and Isabella as full of clocks and machines. Their grotto automata at the Coudenberg Palace in Brussels built by Salomon de Caus and others were at the cutting edge of garden technology.⁵⁸⁷ These included automated craftsman working at their various trades, hidden jets of water to spray the unwary, music, and automated singing birds.⁵⁸⁸

Albert, as a prince of the Empire with imperial aspirations himself, competed with other Northern European princes in his patronage and collections.⁵⁸⁹ The grotto designs included imperial themes. Gölnitz described a lion fountain, designed, he said, by Isabella herself, as well as another fountain incorporating a celestial globe, recalling the grotto designs of Jacques de Gheyn and Drebbel.⁵⁹⁰ The presence of versions of Drebbel's

⁵⁸⁷ Luke Morgan, *Nature as Model: Salomon de Caus and early Seventeenth-century Landscape Design* (Philadelphia: University of Pennsylvania Press, 2007), 72-98; Birgit Franke, "Salomon de Caus (1576-1626) and the Grotto Phenomenon in Court Art," *Albert and Isabella, 1598-1621: Essays*, Werner Thomas and Luc Duerloo, eds. (Turnhout: Brepols, 1998), 202-3. Piet Lombaerde, "Pietro Sardi, Georg Müller, Salomon de Caus und die Wasserkünste des Coudenberg-Gartens in Brussel," *GartenKunst*, III (1991), 159-171.

⁵⁸⁸ Gölnitz described the interior of the Brussels palace his *Ulysses Belgio-Gallicus* (Leiden: Elzevir, 1631), 122, "Altera porticus, diversa navigia, mensas magnae artis & valoris exhibit; nec non horologia, globos argenteos," and the gardens, 123, "Perge ad cryptas. Altera inferior; ubi Pegasus concentus musici, quasi cantor, metitur numeros; Orpheus psallens, è fidibus delicatam elicit harmoniam; juncti sunt globus coelestis, & Satyrus.

Inde VII graduum ad alteram ascensus est; in quinque partes sive alveos distinctam. Ibi organum suavissimum edit concentum, Satyro rem tibiâ juvante: aves modulantes, opifices operantes, audiuntur, videntur.

Ad descensum hortus forum patet, laybrinthi speciment singulare ostentans; ubi in contemplatione ejus haeres, fistulae benè multae subterraneae, arte positae & directae, te aspergent.

E vivario exeunti fons cum ingenti labro ostenditur; sunt duo leones grandis formae, avem ore perpetuam aquam evomentum medio tentens. Opus natum ipsâ *Isabellâ* inventrice, & in declivi positum."

⁵⁸⁹ Thomas DaCosta Kaufmann, "Archduke Albrecht as an Austrian Habsburg and Prince of the Empire," *Albert and Isabella, 1598-1621: Essays*, Werner Thomas and Luc Duerloo, eds. (Turnhout: Brepols, 1998), 15-25.

⁵⁹⁰ For the Jacques de Gheyn's Grotto of the Gorgon designed for Prince Maurits in the Hague, which included a celestial globe, see J. Q. van Regteren Altena, "Grotten in de Tuinen der Oranjes," *Oud Holland* (1970), 33-44. Drebbel described to King James I a grotto he could build in Harleian Manusc. No 7011, folio 56, "Ubi enim sol prodiisset, cortinae et operculum clavicymbali se primum aperuissent; deinde sonuisset idque durante splendore solis, sole vero recondito vel post nubes latente desiisset; fonticulus huic annexus semper fluxisset, splendente solo centum et amplius latices vomuisset, quo remoto omnes in se recidissent, exceptis duobus aut tribus. Neptunus cum Tritonibus Nymphisque suis eodem sole radiante e monte ad lavandum in hunc fontem se recepisset. Eoque abscondito in cavernam suam rediisset Phoebus quatuorque volantibus equis vectus ac cytharam pulsans e nubibus erupisset, viusque fuisset motu alarum equorum aeri inhaerere." A far more expansive description of this grotto, including Orpheus and the integration of Drebbel's perpetual motion, can be found in a letter described as sent by Drebbel from prison to Rudolf (although as we know,

perpetual motion machine with its glass ring “of the tides,” can thus be placed in the context of other pneumatic machinery at court, and in Albert’s competition with and imitation of his brother Rudolf’s patronage.

In this context, Albert’s gift of a telescope to Drebbel begins to make sense.⁵⁹¹ Drebbel had requested some of Galileo’s lenses from Rudolf, and the Emperor, as Giuliano de Medici complained to Belisario Vinta, personally looked into the matter.⁵⁹² From the Emperor’s attention to the request of a “Dutch alchemist,” one could judge the humor of the monarch (“da questo potrà giudicare l’humore”), said Medici. Albert was able to fulfill a request which Rudolf, it seems, never did.

The juxtaposition between the Archdukes and the perpetual motion is particularly striking in Henri Staben’s *The Archdukes visiting the Atelier of Rubens* (Beloeil, Collection of the Prince de Ligne) and Willem van Haecht’s *The Salon of Archduchess Isabella* (Norton Museum of Art) [Figs. 6-7]. The perpetual motion, as a microcosm, could carry imperial symbolism.⁵⁹³

Rudolf was already dead at this point), copied in Beeckman’s journal, in G. P. Harsdörffer’s *Deliciae Mathematicae*, and in Johann Rist’s *Noblest Folly* (discussed in Chapter Two). Drebbel did in fact build fountains for the Duke of Buckingham’s gardens at New Hall (see Chapter One) and for the city of Middelburg (see the Introduction), although we have no record of what they looked like.

⁵⁹¹ 9th July 1655, Willem Borellus to Petrus Borellus. See Pieter de la Ruë, *Geletterd Zeeland* (Middelburg: Schryver, 1734), 302. “Toen ik in’t jaar 1619 Afgezant in Engeland was, heeft Cornelis Drebbel, Alkmaarder, een man veeler Natuurgeheimen kundig, en toen Koning Jacob foor WisKunstenaar dienende, daar ik gemeenzaamen ommegang mede had, mij vertoond dat zelfde stuk werks, ‘t welk de Aartshertog hem Drebbel zelf geschonken had,” and Borel, *De Vero Telescopi Inventori* (The Hague: Vlacq, 1655), 35.

⁵⁹² Prague, 14th November, 1611, Giuliano de Medici to Belisario Vinta in Florence, *Le Opere di Galileo*, Volume XI, G. Barbèra, ed. (Florence, 1966), Letter # 607, 254. “Doppo essere sigillate le lettere et essere un gran pezzo di notte, è venuto qui un Fiammingo alchimista, molto favorito di Sua Maesta Cesarea, a dirmi per parte sua che io scrivisse al Gran Duca nostro Signore, pregandolo in nome suo a volergli mandare due di quei vetri da fare occhiali del Galileo et veltro appresso, il quale egli farà poi lavorare qui, conforme a due vetri lavorati che desidera, cosa nella quale preme Sua Maestà più che in nessun’altra.”

See also Giuliano de’Medici to Belisario Vinta in Florence from Prague, 21th November, 1611, Letter # 610, 235. “Mi vien di nuovo ricordato di Sua Mesta Cesarea quegli’ occhiali et vetri del Galileo, che scrissi a V.S. la settimana passata; che per sodisfare tanto più a questa voglia di Sua Maesta, se parrà così a V.S. si potranno facilmente mandare per la posta, nella stessa forma che si fa della cassette d’olii. ET V. S. da questo potrà giudicare l’humore dell’Impre, di attendere in questi frangenti a quest cose et stare sul volere impedire i maritagii, come le scriss la settimana passata. Et nuovamente è arrivato dell’Imperio un alchimista, colquale sta tutto il giorno in quel tempo che negli non sta travagliato dal timore d’un successore. . . .”

⁵⁹³ Thomas DaCosta Kaufmann, *Variations on the Imperial Theme in the Age of Maximilian II and Rudolf II* (New York: Garland, 1978).

As a time-telling device, it also fell in the tradition of clockwork within portraiture, which Panofsky has argued served both as a model of temperance and a *vanitas* symbol of transience.⁵⁹⁴

The perpetual motion, as a peculiar sort of clock which would never (ostensibly) run down, certainly suggested permanence more than ephemerality.⁵⁹⁵ The machine thus announced a new age of man who was able to master the supposedly inescapable transience and change of the sublunar realm. While royal personages had frequently been compared to the permanence of the celestial spheres, now they might be celebrated for the same qualities found in a manmade microcosm.⁵⁹⁶

⁵⁹⁴ Erwin Panofsky, *Problems in Titian, Mostly Iconographic* (New York: New York University Press, 1969), 90.

⁵⁹⁵ Otto Mayr, in *Authority, Liberty and Automatic Machinery in Early Modern Europe* (Baltimore: Johns Hopkins Press, 1986), connected Drebbel's related invention of the self-regulating oven to ideas concerning the equilibrium and the achievement of balance within political and economic systems. I discuss Mayr further in Chapter Two.

⁵⁹⁶ See, for example, John Davies, "Hymnes of Astrae," *The Poems of Sir John Davies*, R. Krueger, ed (Oxford: Clarendon Press, 1975), 82, Hymne XIX, "Of the Organs of Her Minde," "By Instruments her powers appeare/ Exceedingly well tun'd and cleare:/ This Lute is still in measure, Holds still in tune, even like a spheare,/ And yeelds the world sweet pleasure."



Cliché number : B123311
Object number : 10154522
Institution : Château des Princes de Ligne[museum]
City : Beloeil[fusionne]
Object : schilderij[schilderstuk]

Fig. 6. Henri Staben. *Archduke Albert and Isabella visiting an Art Gallery*. Beloeil, Collection, Prince de Ligne. (c) IRPA, Brussels.



Fig. 7. Willem van Haecht II, Flemish (Antwerp), 1593–1637. *Interior of the Salon of the Archduchess Isabella of Austria*, after 1621. Oil on wood, 36 3/4 x 48 1/2 in (93.3 x 123.2 cm). Norton Museum of Art, West Palm Beach, Florida. Gift of Mrs. George T. (Valerie) Delacorte in memory of Gabriel Pascal producer of the George Bernard Shaw films, 2002.182

III: Conversing across Europe

Unlike those Neo-stoics, who as Miller puts it, “believed that human reason was strong enough, both to grasp the universal laws of nature and to dominate the particular passions of individuals that threatened always to overturn common bonds in the name of particular ones” in the gallery painting we find an argument in favor of individual passions for particulars.⁵⁹⁷ It is clear that in *The Four Philosophers* Rubens did indeed celebrate an old ideal of close philosophical *amicitia*. Yet Rubens also partook in conversations across Europe

⁵⁹⁷ “Nazis and Neosotics,” 145.

about the latest way to observe and master nature through such wonderful machines as the perpetual motion, which he himself reconstructed.

Rubens participated in the international exchange of Peiresc and the intimate conversations of the Du Puy circle in Paris. The Du Puy circle has frequently been contrasted with larger and more accessible locales for debate in Paris, such as the Theophraste Renaudot's Bureau d'Adresse.⁵⁹⁸ Yet within the Du Puy circle, we will find conversations surprisingly similar to those occurring in the *Bureau d'Adresse*, in whose first meetings such questions as perpetual motion, the spirit of the world, the sea tides, and the four elements were debated.⁵⁹⁹

Simone Mazauric, in her study of the *Bureau D'Adresse* noted that the model of the *savant* in seventeenth-century France exhibited a great deal more passion and intensity than the Italianate model of the *virtuoso* should support. Mazauric attributed the change to the values of the *bourgeoisie* who formed a new public for discussion and exchange in which the aristocracy also participated.⁶⁰⁰ By contrast Kathleen Wellman has argued that the Bureau d'Adresse offered an example of the Habermasian restrained and rational public.⁶⁰¹ Yet Wellman herself pointed to the fact that more often than not, the participants in the conferences supported the passions over the Stoic ideals of apathy and reason.⁶⁰²

⁵⁹⁸ Kathleen Wellman, *Making Science Social: The Conferences of Théophraste Renaudot 1633-1642* (Norman: University of Oklahoma Press, 2003), 29-30. On the Du Puy circle, see Harcourt Brown, *Scientific Organizations in Seventeenth Century France (1620-1680)* (Baltimore: Williams & Wilkins, 1934).

⁵⁹⁹ *Première Centurie des Questions* (Paris: 1635), "Du mouvement perpetüel, De l'Esprit universel, De le flux & reflux de la mer, Du feu, De l'air, De l'eau, and De la Terre."

⁶⁰⁰ As a result, "c'est dès lors un public beaucoup plus large et beaucoup plus passioné qui a manifesté un fort besoin d'échanges et de rencontres autour des choses de l'esprit et qui a par là même favorisé la multiplication des lieux de cet échange et de ces rencontres." Mazauric, *Savoirs et Philosophie à Paris dans la Première moitié du XVIIe siècle: Les conférences du bureau d'Adresse de Théophraste Renaudot (1633-1642)* (Paris: Publications de La Sorbonne, 1997), 32.

⁶⁰¹ *Making Science Social: The Conferences of Théophraste Renaudot 1633-1642* (Norman: University of Oklahoma Press, 2003), 7,

⁶⁰² *Ibid*, 229.

Renaudot compared the public space of his Bureau to a telescope, which, bringing the different parts of society closer, offered material for our spirit, memory, and will.⁶⁰³ As we shall see, in the Du Puy circle we will find the metaphor of the microscope (the *lunette de Drebel* as they called it), deployed to describe the practice of discovery through intense scrutiny. While the exclusive Du Puy circle appears to tighten rather than expand association, the microscope was itself an object exchanged across the vast network of the Republic of Letters.

Peiresc displayed an interest bordering on obsession in Drebbel, pestering his famous correspondents across Europe with requests for information concerning Drebbel.⁶⁰⁴ Hugo Grotius, for instance, wrote to his brother Willem on the 10th of June, 1622, that a friend of his, Peiresc, had asked him to investigate the history of dioptric inventions. There were said to be two inventors, both from Alkmaar, whom he believed might be Anabaptists. Hugo asked his brother to ask around for him.⁶⁰⁵ He repeated his request on Nov. 4, 1622, since Peiresc was still asking for the history of Drebbel.⁶⁰⁶ On Nov. 12, 1622, he sent thanks on behalf of Peiresc for Willem's account of Drebbel, but asked him if perhaps he could

⁶⁰³ Justin Stagl, *History of Curiosity*, 136, Renaudot described the Bureau as a “. . . lieu public qui soit comme une lunette d'approche, l'abregé & le ralliement. . . fournissant des notices generales à nostre esprit, d'especes à la mémoire, & d'objets à la volonté. ”

⁶⁰⁴ On Peiresc as an observer, see Peter Miller, “Description Terminable and Interminable: Looking at the Past, Nature, and People's in Peiresc's Archive,” *Historia: Empiricism and Erudition in Early Modern Europe*, G. Pomata and N. Siraisi, Eds. (Cambridge: MIT, 2005), 355-398.

⁶⁰⁵ Hugo Grotius, *Briefwisseling*, Vol. II, 223. “Amicus quidam meus me rogavit ut diligenter explorarem historiam de repertis apud nos dioptris. Repertores dicuntur duo fuisse sub idem tempus Alcmariani, ambo, ni fallor Anabaptistae. Poterit hac in re adiumento tibi esse Forestius, aut si quem alium habes indidem domo. Is qui me hoc rogavit est Peiresius, qui valde scire velit et nomina illorum et fortunam et qua occasione in id cogitationis devenerint. ”

⁶⁰⁶ *Ibid*, 253. “De Drubbeltio quaeso inquiras quantum potes. Nam Peiresius noster accuratam eius rei historiam nosse expetit.”

develop a fuller account (“numquid propius”).⁶⁰⁷ He was still asking for a better account from his brother on Jan. 6th, 1623.⁶⁰⁸

Peiresc also wrote to the brother-in-law of Grotius, asking him “if Cornelius Drubelsius of the same city of Alkmaar (as Metius, about whom he had also inquired), inventor of a different type of *lunettes* which achieves other wonderful effects, spent a long time in Holland and of what quality and condition he is. And whether one knows exactly when he invented his *lunette* for showing the smallest insects as large as he does. If there is anyone who has seen his instrument of the flux and and reflux of the sea. It would be a great pleasure to see a precise description of it.”⁶⁰⁹

Meanwhile, Peiresc was advertising the wonders of Drebbel’s telescope. He wrote to Robert van Scheilder, a canon of the cathedral at Cambrai, on the 1st of October 1622 to tell him of Drebbel’s wonderful discovery, which was no less wonderful than that of the new world, since through these glasses, one sees wonderful things in small animals, such as fleas and lice that we despise with our ordinary sight. This “discovery of wonders in these little animals makes one wonder at divine Providence no less than the greatest rarities which nature produces in the Indies (“dans ces petits animaux ce découvre des merveilles, qui ne font pas moins admirer la Providence divine que les plus rares choses que produise la nature dans les Indes”).⁶¹⁰

⁶⁰⁷ *Ibid*, 254. “De Drubbeltii historia gratias tibi agit Peirezius. Vide numquid propius possis resciscere. Ipse ait dipotram ab eo inventum alterius esse generis a Metiana.”

⁶⁰⁸ *Ibid*, 267. “Si quid propius de Drubbeltio cognoscere potes rogo perscribas.”

⁶⁰⁹ R. Lebègue, *Les Correspondants de Peiresc dans Les Anciens Pays Bas* (Brussels: Lebègue, 1943), 64. “Si Cornélius Drubelsius de la même ville d’Alkmaar inventeur d’une différente sorte de lunettes qui font d’autres merveilleux effets, a fait grand séjour en Holland et de quelle qualité et condition il est. Et si on ne sait point en quel temps il a inventé sa lunette pour faire voir les moindres animaux insectes si gros comme il les montres. S’il y a personne qui ait vu son instrument du flux et reflux de la mer monté. Ce seroit un grand plaisir d’en voir un peu de description exactement faite.” Peiresc also wrote to William Camden for information about Drebbel’s submarine, perpetual motion, telescope, and microscope.

⁶¹⁰ R. Lebègue, *Les Correspondants de Peiresc dans Les Anciens Pays Bas* (Brussels: Lebègue, 1943), 20.

We find the same intensity of epistolary exchange over Drebbel between Peiresc and Rubens as between Peiresc and Grotius. On June 29, 1623, Peiresc asked Rubens to pass by Brussels and to take a look at the model of Drebbel's perpetual machine. He should note its exact measurements and ask its guardian whether the movement differed depending on the humidity of the air.⁶¹¹

This guardian was Jean de Montfort, *garde-dames* of Archduchess Isabella, Master of the Mint, medallist, sculptor, and friend and intermediary of artists such as Otto van Veen, Rubens (who called him his "compadre"), Balthasar Gherbier (the English agent at Brussels), van Dyck, and Jan "Velvet" Breugel. The world he inhabited was that celebrated in the genre of the gallery paintings. De Montfort appeared in van Haecht's *The Cabinet of Corneille van der Geest during the Visit of the Archdukes* (discussed above) alongside van Dyck. As Luc Smolderen has pointed out, this was a period in European history when a considerable portion of diplomacy involved the international sale of art. De Montfort was responsible for negotiating and paying for such sales at the court of the Archduchess. He thus played intertwined roles as courtier, artist, art lover, assayer, and, as it transpired, builder of perpetual motion machines.⁶¹²

On the 14th of July, 1623, Peiresc thanked Rubens for his very exact measurements of the machine, for the details about it Rubens had gleaned from Montfort ("il suo compadre guardiano dallo stromento di moto perpetuo"), and for Rubens' promise to send him not just a drawing, but an actual version of the perpetual motion.⁶¹³ Peiresc was at the

⁶¹¹ P. P. Rubens, *Correspondance de Rubens et documents épistolaires concernant sa vie*, Max Rooses and Ch. Ruelens, eds. Vol. III (Antwerp: Maes, 1900), 184. On Peiresc's interest in the machine, see David Jaffé, "Peiresc-Wissenschaftlicher Betrieb in einem Raritäten-Kabinett," *Macrocosmos in Microcosmo: Die Welt in der Stube. zur Geschichte des Sammelns, 1450 bis 1800* (Opladen: Leske & Budrich, 1994), 303.

⁶¹² Luc Smolderen, "Jean de Montfort, médailleur et maître général des monnaies," *Revue Belge de Numismatique et de Sigillographie* 142 (1996), 125-238. For a study of the state-driven collection and international transport of art, see Hugh Trevor-Roper, *The Plunder of the Arts in the Seventeenth Century* (London: Thames & Hudson, 1970).

⁶¹³ Rubens, 199.

time in Paris, and he wrote again to Rubens thanking him for the promise of the instrument on the 20th July, 1623, which Rubens said would arrive the next Wednesday. Peiresc said he looked forward to it with great impatience, and that he was planning to leave Paris on Thursday.⁶¹⁴

That Wednesday Rubens sent him only a drawing of the perpetual motion. Peiresc thanked him for it politely on the 27th of July 1623, saying it was remarkable, but he thought that it would be quite difficult to build, especially the glass parts. They would have to wait until he returned to Provence to the “areas in the forest” where they blow glass. Meanwhile, he urged the utmost secrecy upon Rubens, since he did not want anybody else discovering the secret of the motion.⁶¹⁵ On the 3rd of August, 1623, Rubens replied that he had made the drawing with every intention of keeping the machine’s secret safe. Meanwhile, he promised to resolve any difficulties there might be in building the machine, and he was still going to try to get it built there in the Netherlands complete with its case. He might be able to send it to Marseilles with some merchants, but he couldn’t promise anything for certain. Peiresc nevertheless eagerly noted on this letter “mouvement perpetuel promis.”⁶¹⁶ On the 10th of August 1623, Peiresc replied that he was grateful for the hope of getting the perpetual motion from Rubens and de Montfort, because he never really would be able to do it at home. The forest glass-blowers did not have that kind of skill.⁶¹⁷

At last Rubens sent the promised machine to Peiresc’s brother in Paris on the 12th of December, 1624, who would send it on to Aix. Rubens included yet another drawing of the machine with detailed instructions, and he also gave Peiresc’s brother advice on how to

⁶¹⁴ *Ibid*, 204.

⁶¹⁵ *Ibid*, 211.

⁶¹⁶ *Ibid*, 218-9.

⁶¹⁷ *Ibid*, 237.

pack the glass tubes so that they would not break.⁶¹⁸ Rubens wrote to Peiresc's brother again on the 10th of January 1625, saying that he was very happy to hear that the machine had arrived without the glass tube having been broken. He hoped that Peiresc also has the recipe for setting it in motion that Rubens had given Peiresc's brother long before. Failing that, Rubens promises to see to it himself at the first opportunity.⁶¹⁹ Peiresc thanked Rubens for it in on the 11th of February 1624.⁶²⁰ As Peiresc informed Mersenne, the perpetual motion worked beautifully for about five years, moving back and forth twice a day (although not at all connected with the movement of the tides as far as he could see).⁶²¹

In 1624 Peiresc was in Paris himself, where Abraham and Gilles Küffler were demonstrating microscopes to the Queen. Finally Peiresc not only had his own model of the machine, but also a font of information concerning Drebbel. His record of his conversation with the Küfflers survives in the collection of "*Elogia et epitaphia*" in the Peiresc papers in Carpentras and in the Du Puy papers at the *Bibliothèque Nationale*.⁶²²

Meanwhile Peiresc began to seek out the natural philosophical writings of Drebbel, writing to his brother in Paris on April 26, 1625, that he had received *On the Elements* by Drebbel, but he couldn't understand the language at all. He awaited the translation, "hoping

⁶¹⁸ *Ibid*, 309.

⁶¹⁹ *Ibid*, 319.

⁶²⁰ *Ibid*, 286.

⁶²¹ After about five years, when Peiresc had the machine moved to a different location, its motion never moved as strongly again. See *Correspondance du P. Marin Mersenne*, Vol. 4, C. d. Waard, ed (Paris: P.U.F., 1955), Peiresc to Mersenne, August 13, 1634, 288. "Pour l'anneau du mouvement perpetuel de Cornelio Drebbels, il y a plus de dix ans que je l'ay. Et tant qu'il estoit demeuré en lieu immobile, il avoit fait fort constamment, deux fois le jour, son mouvement de flux et reflux fort apparant et fort sensible; mais d'avoir alucune proportion ou relation au flux ou reflux de la mer, c'est ce que je n'y ay jamais peu discerner. Depuis quature ou cinq ans qu'on le remua de lieu à autre, il a perdue la moitié de son effet, qui y persiste pourtant ancore, bein que peu sensible.

⁶²² See the Carpentras Papers at the Bibliothèque Municipale Inguimbertaine, *Elogia et epitaphia*, MS. No 1776, 407-413, "Lettre de Girard Pietersoon Schagen" and "Relation de ce que j'ai appris de la vie et des inventions de Corneille Drebbel."

that since the work is so small, it will easily find a translator there (in Paris).”⁶²³ At this time, Peiresc also got involved in the international traffic in Drebbel’s microscopes which Drebbel’s sons-in-laws the Küfflers were organizing from Cologne. Peiresc wrote to the Du Puy brothers, complaining about the quality of a microscope he had received from Rome, and saying that one had to get them from Cologne, where the Papal Nuncio would serve as a useful agent in exchange for news.⁶²⁴ Peiresc also got his brother involved in circulating Drebbel’s microscope, writing to him on the 23rd of February 1625 about the loss of a “lunette de Drebbels.”⁶²⁵

Peiresc also wrote to the natural philosophers he knew, describing the wonders of this instrument to the likes of Gassendi, who was familiar with Peiresc’s version of Drebbel’s perpetual motion.⁶²⁶ Marin Mersenne asked Peiresc for his opinion on Drebbel’s perpetual motion in August of 1634, and wondered whether one could test it by putting some sea water in a glass tube and seeing whether it moved.⁶²⁷ Mersenne thereafter addressed the

⁶²³ *Lettres de Peiresc a Sa Famille*, Vol. 6, 117, 156. “J’ay receu le livre des Elements de Corn. Drebbels, mais je n’y cognois rien en ce langage. Nos attendrons la version, esperant que l’ouvrage estant si petit, il se trouvera facilement quelque traducteur de par delà.”

⁶²⁴ *Lettres de Peiresc Aux Frères Dupuy*, Philippe Tamizey de Larroque, ed. Vol. 1 (Paris: Imprimerie Nationale, 1888), 485 -6. “On m’a envoyé de Rome une lunette, mais c’est de celles qui ne sont bonnes que pour des pulces, qui sont assez communes, et ay apprins qu’il ne s’y en fait point de ces grandes propres à regarder des mouches à mile. Il fault en avoir du costé de Cologne, où resident les parents de Corn. Drebbels, qui en font profession. Mr le Nonce fera bien volontiers celà, si on le luy met en teste, et desja il m’en avoit demandé des nouvelles.”

⁶²⁵ *Lettres de Peiresc a Sa Famille*, Vol. 6, 117. “Je regrette infiniment la perte de la lunette de Drebbels pour Mr. de Lomenie.”

⁶²⁶ *Lettres de Peiresc*, Vol. 4, 435-6. 1634. To Gassendi. “ Puisqu’avec ces lunette de Cornelio Drebbels, on distingue en un ciron (qui ne paroît pas à l’oeuil plus gros qu’un point) tout aultant de membres qu’en un bien gros taon, un des plus gros mouchérons, tant pour les yeux mesme et les entrailles que pour les jambes et aultres parties de son corps. Voire il me souvient d’y avoir veu des yeulx d’abeille don’t la prunelle nous paroissoit aussi grosse quasi qu’un poids, et y distinguoit-on le blanc de l’oeuil d’avec les aultres tuniques fort distinctes, nonobstant que à plien oeuil le tout ensemble ne fust pas si gros que la teste d’une petite espingle, et encore moins, y ayant une infinité de choses que ne nous sont incomprehensibles qu’à faulte d’instruments assez propre à les nous faire discerner. Ce fut en presense du bon pere Denys de Sailly, à present prieur de la Chartreuse de la Verne, que nous fimes cette preuve à Boisgency. ” See Gassendi’s, *The Life of Peirescius*, 18. “He had gotten many years before [1635], the Engine of Drebbel; In the glassy and arched Pipe whereof, the water would passe and repass, twice very day, seeming in a manner to follow the ebbing and flowing of the Sea.”

⁶²⁷ Mersenne, *Correspondence*, Vol. 4, August 2, 1634, 282. “Si vous n’avez jamais vu d’anneau ou d’autre chose semblable, ou l’on tint quelque esprit enfermé, et si vous n’avez point eu de certaine relation de ce mouvement

question in his *Questions Physico-mathématiques* (Paris: Guenon, 1635), Question XV, where he suggested the sea-water test again. Mersenne also corresponded with John Pell concerning Drebbel's submarine in 1640,⁶²⁸ which he then discussed in his "Phaenomena Hydraulica, Prop. 49. Corol. 2," *Cogitata Physico-mathematica* (Paris: Antoine Bertier, 1644).

Meanwhile, Drebbel's *On the Nature of the Elements* had found a translator in Paris. On the 8th of January, 1628, Peiresc wrote to the Dupuy brothers to thank them for the copy he had received.⁶²⁹ This too still survives in a copy at Carpentras, in section LIII, "Observations de diverses merveilles de la nature/ Inventions curieuses/ Instructions pour curiosités" and in the *Bibliothèque Nationale*.⁶³⁰ The translation of the Du Puy circle also served as the basis for the 1672 French edition of Drebbel's works, whose editor claimed that "Everyone who presumes to know who the good Authors are in this science, esteem this great personnage as very enlightened in the secrets of nature, and exceptional in his writings."⁶³¹ Mersenne was less impressed, writing to Theodore Haak on the 20th of March, 1640 that, "I have seen the Compendium of Physics of Cornelius Drebbel, but it does not deserve the reputation it has, being exceedingly simple."⁶³²

perpetuel dans un anneau avec de l'eau bleüe ou de celle de la mer de Cornelius De Rebel. J'avoys pensé qu'en mettant de l'eau de la mer dans un anneau creux de verre, qu'elle auroit peut-estre son flux et reflux de * 6 heures en * 6 heures comme celle de l'ocean, mais je suis trop éloigné pour en faire l'experience et ne croy pas qu'elle se meuve separee de son tout, non plus que le sang hors de sa veine."

⁶²⁸ Hartlib, *Ephemerides*, 18/2/33a-34B, to John Pelle 20 January [1640]. See *Correspondance du P. Marin Mersenne*, Vol. IX, 49-54.

⁶²⁹ Peiresc, *Lettres de Peiresc Aux Frères Dupuy*, Vol. II (Paris: Imprimerie Nationale, 1890), 68.

⁶³⁰ "Petit traité de la nature des éléments, et comme ils causent le vent, la pluye, l'esclair, le tonnerre, et à quoy ils servent; par Corneille Drebbel, d'Alkmaer" and *Bibliothèque Nationale*, Ms. 24717, 44-51 "Petit traité de la nature des éléments, par Corneille Drebbel d'Alcmar."

⁶³¹ "Tous ceux qui presument connoistre les bons Autheurs en cette science, font beaucoup d'estat de ce grand personnage, comme tres-éclairé dans les secrets de la nature, & tout à fait singulier en ses écrits."

⁶³² Hartlib *Ephemerides*, Mersenne to Theodore Haack, 18/2/21A-22B, 20 MARCH 1640. I'ay veu le Compendium de Physique de Cornele Drebel, mais cela ne merite pas la reputation, qu'il avoit, estant fort plat." In a later letter, Haak writing to Mersenne informed him of the current prices of the *lunettes* of "notre Drebbel." See Harcourt Brown, *Scientific Organizations in Seventeenth-Century France*, (Baltimore: Wilkins & Wilkins, 1934), 270.

At the turn of the seventeenth century, the idea of invention and discovery was just beginning to be tied to specific moments of innovation within the mechanical arts (discussed further in Chapter Four). Peiresc appeared as a very determined establisher of priority in discovery. He trained his antiquarian, historical, and philological skills upon Drebbel, constantly seeking better evidence and a more accurate history of Drebbel's inventions.

In turn, Peiresc speculated about adapting Drebbel's inventions for the more accurate study of his philology and archaeology. Thus, writing to Lucas Holstein, on the 27th April, 1629, Peiresc said he has sent him the "lunettes of Drebbel" to use in his study of an inscription upon an ancient Roman triumphal arch (probably the *lunettes d'approche* or telescope).⁶³³ In Peiresc's circle, the use of optical devices also served as a metaphor for a new manner of inquiry employing art to look beneath the surface of things. Peiresc wrote to Claude Salmasius about the many words that do not seem to be at all related, but in fact share almost invisible roots. Bartholomew appears in different languages as "Bortolamio, Bortolome, Bortolo, Bartelemi, Bartoieu, Bartolin, Bartocnin, Bartoccio, Baccio, Boccio, Bouction, Bachot, and others." Such words are like the little grains of wheat, which not only contain the whole plant within it essentially, but in fact it [the whole plant] can be seen if we look with the help of the *lunettes* of Drebbel.⁶³⁴

IV: Epigrams

Peiresc's intense antiquarian focus upon material fragments was shared by epigrammatists. The genre is notoriously difficult to define. Yet, as R.K. Angress has argued, "it is always correct to think of the epigram as an unusually concrete poem elucidating the

⁶³³ Peiresc, *Lettres de Peiresc à Holsteinius* (Paris, Impr. Nationale, 1894), From Aix, 27 avril 1629, 321.

⁶³⁴ Peiresc, *Lettres à Claude Saumaise et à son Entourage* (1620-1637) (Florence: Olschki, 1992), 104.

fragment of reality on which it is ‘engraved.’”⁶³⁵ Such fragments were ideal objects of exchange. Unlike longer genres which facilitated an author’s self-fashioning, the epigram bound together networks. The ambiguity built into this elliptical form sustained dialogue, debate, or duelling.⁶³⁶ A rapier rather than a blunderbuss, the epigram encouraged engagement.

Defining the genre of the epigram is notoriously difficult as epigrams served a variety of rhetorical functions from praise to blame. The satirical epigram was a carnivalesque form which overturned authority and disrespected hierarchy. As Ben Jonson wrote in his *Epigrams*, “May none, whose scattered names honour my book,/ For strict degrees of rank or title look:/ ‘Tis ‘gainst the manners of an epigram:/ And, I a poet here, no herald am.”⁶³⁷ Epigrams were thus an ideal medium through which to broach social status and its overturning.

One specific category of the German baroque epigram, according to Angress, was the use of the epigram to celebrate the “speculative intellect of man and the scientific achievements of the seventeenth century.”⁶³⁸ These were often associated with specific objects which testified to the inventive powers of man. Angress gave the example of Gryphius’ epigrams on the celestial and terrestrial globes. Drebbel’s boundary-transgressing, all-inclusive perpetual motion similarly furnished ideal material for exchange within this object-oriented, microcosmic genre.

Marcel Vranckheim, long before his conversion to Catholicism and his social transformation into a knight of the Eperon De l’Or, a count palatine, and a counsellor of

⁶³⁵ R. K. Angress, *The Early German Epigram: A Study in Baroque Poetry* (Lexington: University Press of Kentucky, 1971), 26.

⁶³⁶ James Doelman, “Epigrams and Political Satire in Early Stuart England,” *Huntington Library Quarterly*, 69: 1 (2006), 32, argues that “two essential formal qualities of epigrams, brevity and sharpness . . . facilitated public circulation and reception.”

⁶³⁷ Ben Jonson, *Epigrams* (Carcanet: Fyfield, 1984), 34.

⁶³⁸ Angress, 116.

Archduchess Isabella, emphasized the social levelling achieved by art through a version of Claudian's poem on Archimedes' perpetual motion.⁶³⁹ Archimedes was himself both a king and the builder of the machine; the case of Drebbel presented an inventor of the perpetual motion from a different social order. Vranckheim claimed that James I and the "second Archimedes," Drebbel, were worthy of each other ("*Dignus rex Archimede isto altero; Dignus Archimedes Batavus magno illo rege*"). Royalty had always moved in higher spheres; now a mere artisan had conquered the heavens.

Hugo Grotius' epigram on Drebbel's perpetual motion, also compared the perpetual motion to King James, but employed a conceit to hide the toppling of the social order this entailed.

In organum motus perpetui quod est penes Maximum
Britanniacum Regem Jacobum.
Perpetui motus indelassata potestas
Absque quiete quies, absque labore labor,
Contigerant coelo, tunc cùm Natura caducis,
Et solidis unum noluit esse locum.
Et geminas partes Lunae dispescuit orbe,
In varias damnans inferiora vices.
Sed quod nunc Natura suis è legibus exit
Dans terris semper quod moveatur opus?
Mira quidem res est sed non nova (maxime Regum)
Hoc fieri docuit mens tua posse prius.
Mens tua quae semper tranquilla & torpida nunquam,
Tramite constanti per sua regna meat.
Ut tua mens ergò motûs caelestis Imago:
Machina sic haec est mentis Imago tuae.

⁶³⁹For Vranckheim's early career as tutor and rector of the school at Zutphen, see Peter T. Van Rooden's *Theology, Biblical Scholarship and Rabbinical Studies in the Seventeenth Century*, 21, and Friedrich Nettesheim's *Geschichte der Schulen im alten Herzogthum Geldern* (Düsseldorf: Bagel, 1881), 331. See de Vegiano, *Nobiliaire des Pays-Bas, et du comté de Bourgogne* (Louvain: J. Jacobs, 1760), 117. "Marcel Franckheim, Docteur en Droit Civil & en Droit Canon de l'Université de Bâle, Chevalier de l'Eperon d'Or, & Comte du Sacré Palais-Latran par Bref du Pape Paul V. du 6 Fév. 1619, & Conseiller de l'Amirauté Suprême par Patentes de l'Infante Isabelle-Claire-Eugenie du 4 Déc. 1631, mort le 7- Mai 1644, à 60 ans, & de Marie van den Eede, mariée le 10 Juin 1626." Vranckheim's correspondence (1612-6) with the Dutch statesman David le Leu de Wilhelm, the brother-in-law of Huygens and friend of Descartes, survives in Leiden, Ms.BPL 293. After his conversion, Vranckheim wrote a defence of the Jesuit Adam Contzen, *Asinus Palmatus* (Mainz: Balthasar Lippius, 1620).

Translated thus.
The untired strength of never-ceasing motion,
A restless rest a toyl-less operation,
Heaven then had given it, when wise Nature did
To frail & solid things one place forbid;
And parting both, made the Moons Orb their bound.
Damning to various change this lower ground.
But now what Nature hath those Laws transgrest,
Giving to earth a work that ne're will rest?
Though 'tis most strange, yet (great King 'tis not new;
This Work was seen and found before in You.
In You, whose minde (though still calm) never sleeps,
But through your Realms one constant motion keeps:
As your minde (then) was Heavens type first, so this
But the taught *Anti-type* of your mind is.⁶⁴⁰

The artisan has “transgressed” the laws of nature, by bringing permanence into an impermanent world. Grotius recouped this apparent overthrow of all order by pinning the artisan’s ability in royal authority; since the mind of the monarch was the type of heaven, the perpetual motion, as the anti-type of the king’s mind, served to fulfill a prophecy already announced in the royal personage.

Like his ideological enemy Grotius, the conservative Calvinist poet and cleric Jacob Revius successfully concealed the conquest of natural and social order performed by Drebbel in his poem “On the wonderful works of C. Drebbel.”

Op de wonderbare wercken van C. Drebbels.

Eens rademakers kint maeckt wagentgens en reepkens,
T' kint van een timmerman bout huyskens ende scheepkens,
Aart wil van aarde niet. gelijk de oude song
(Dit spreekwoort is gewis) pijpt int gemeyn het jong.

O Drebbels, uwen geest sijn afcomst nooyt versaecte.
Wie twijfelt, of de geen die dese werelt maeckte
U vader is, dewijl ghy als een cluchtich kint

⁶⁴⁰ Originally published in Hugo Grotius, *Poemata* (Leiden: Cloquius, 1617), 371. Reprinted and translated in Thomas Powell, *Humane Industrie or, A history of most manual arts deducing the original, progress, and improvement of them: furnished with variety of instances and examples, shewing forth the excellency of humane wit* (London: Henry Herringman, 1661), 22.

Oock cleyne werelden te timmeren begint?⁶⁴¹

Children do just as their fathers do – a wheelmaker’s child makes little wagens, a carpenter’s son builds little houses and boats. It is clear that Drebbel is God’s son, since like a clever child copying his father, Drebbel also began to frame small worlds. Revius thus placed Drebbel’s wonderful machine within a traditional structure of society, in which every child followed the trade of his father.

Drebbel, of course had a father of his own at home in Alkmaar. As discussed in the Introduction, Jan Jacobszoon Dremmel, was a farmer and citizen of Alkmaar. Drebbel could have stayed at home like his brothers Pieter and Jan, and farmed like his father. Instead, he deserted his hometown to take up a career as an international projector and builder of perpetual motion machines.

Quirinus Kuhlmann chose Drebbel’s hubris for his theme in his collection of epitaphs, *Immortal Mortality*. Kuhlmann was a reader of Drebbel, whom he considered a writer of universal method.⁶⁴² In the preface to his work, he developed the celestial sphere as a vanitas theme, referring to the famous glass planetarium of the Persian King Sapor (discussed further in the next chapter), in which Sapor sat on top of the world and watched the course of the stars around him. Through his manmade sphere, Sapor felt that he ruled all. Other monarchs built new heavens and new earths, and confused land and sea for their staged naval battles. Likewise in the art of optics, we make wonderful shows, but they are in

⁶⁴¹ Jacob Revius, *Over-Ysselsche Sangen en Dichten* (Amsterdam: Maatschappij Holland, 1935).

⁶⁴² Kuhlmann entered into a correspondance with Athanasius Kircher regarding combinatorics, and in a letter of January 4, 1674, he listed the writers on universal method whom he had read. See Quirinus Kuhlmann, *Kircheriana de Arte Magna Sciendi sive Combinatoria* (London: William Cooper, 1681), 10-11. “Legimus & omnes, qui ad manus nostras venerere, Universalium methodorum Scriptorum, Cornel. Gemmam, Henric. Mylphortium, Thomam Campanellam, Sorellum, Cornel. Drebbelium, Wolfgang Dienheimium, Erhard. Weigelium, & Chimiae Hermeticae Defensores, Aurel. Theoph. Paracelsum, J. B. Helmontium, Henric. Khunrathum, Jo. Joachim Becherum, aliosque, quorum scripta in hoc genere partim laudantur, partim culpantur.

reality all shadows.⁶⁴³ Only death is immortal. Kuhlmann played upon this theme in his “epitaph” for Drebbel. Alluding, it seems, to Drebbel’s wonderful optical display, Kuhlmann referred to Drebbel who could always make himself invisible.⁶⁴⁴

Unlike Jonson, Kuhlmann did play the herald, giving each name a title for his tombstone. Yet his titles mixed the ancient and the modern from Martin Opitz, “the Silesian Homer,” Andreas Gryphius, “the German Sophocles,” and Friedrich von Logau, “the Silesian Martial” to Cornelius Drebbel “the British Archimedes.” While developing a theme of the vanity of all arts, Kuhlmann did set up a competition between ancient and moderns. Furthermore, the epitaphs of the moderns were interspersed in no particular order among epitaphs for the ancients. By mixing moderns and ancients at random, he allowed the two to compete.

Such mixing was a deliberate stylistic choice. Kuhlmann said in his preface that he would not respect hierarchy in the composition of his epitaphs. This was not only because death distinguished nobody, but because unlike the *album amicorum*, the epigram did not respect the order of persons. In this, Kuhlmann followed the example set by Martial, Owen, and other epigrammatists.⁶⁴⁵ In the next section, we will see how the hierarchical *album amicorum* interacted with the anarchical epigram in building new ways of sharing authority.

⁶⁴³ Quirinus Kuhlmann, *Unsterbliche Sterblichkeit oder Hundert Sil-ersinnliche Witzzeilige Grabe-schriften* (Jena: Samuel Adolph Müller, 1671), 8. “Wie die Optik, durch Mittel des Schattens, allerhand wunderbahre Schauspile fürstellet, welche doch nichts, als ein duckelbahre Schatten, Wider Gold-Sonnen Silber-Schwester, bald hellen Glantz, bald schwere Fünsternüsse zeigt.”

⁶⁴⁴ *Ibid.*, 10.

Grab Cornelius Drebbels/
Des Britannischen Archimeds.
Der sich unsichtbar oft durch hohe Kunst gemacht/
Hat sichtbar bis der Tod zu seiner Ruh gebracht:
Er ruff wo ich dich bin noch ferner sein auf Erden/
So machst du dass ich selbst unsichtbar muste werden.

⁶⁴⁵ *Ibid.*, 8. “Was hierinnen die Ordnung betrifft/ so hab ich solche nicht nach Würden der Personen gesetzt: auch unterschiedliche Schert-Gräber, eingemischet, und bin dem Exempel des Martials, Owenens, Mureten, Taubmanns, u.v.a. gefolget.”

V: Album Amicorum

We have a record of an actual conversation concerning Drebbel in the notes G. L. Seidenbecher kept on the series of meetings he had with Abraham Franckenberg, from the 13th July to the 31st of August, 1649 in Danzig (Gdańsk).⁶⁴⁶ Franckenberg, the correspondent of Jakob Böhme and Joachim Morsius, was described by contemporaries as a “*Liebhoper*” of both divine as well as natural philosophy.⁶⁴⁷ In the course of his conversation, we can follow the practices of *liebhoper* sociability.

On the third of August, at 5 in the afternoon, Seidenbecher and Franckenberg began to discuss the various amateur societies for the advancement of knowledge, from the *Lincei* in Italy, the Rosicrucians in Delft (advertised by Petrus Mormius), and the *Fruchtbringende Gesellschaft* in Germany. They commented upon the fact that Giordano Bruno was executed unjustly, even though he was a magician and an atheist. They then turned to Drebbel “the Englishman,” after which Franckenberg composed epigrams, and gave Seidenbecher a book by the self-proclaimed Rosicrucian Julius Sperber to read, which Seidenbecher returned four days later. Finally, they parted tearfully at the end of the month, and Seidenbecher signed Franckenberg’s *album amicorum*.⁶⁴⁸

The album served as the culmination of and memorial to a series of exchanges – epigrams, books, and ideas – celebrating the role of enthusiastic associations. Just as the

⁶⁴⁶ “Conversatio: Ein Protokoll von Gesprächen A. von Franckenbergs mit G. L. Seidenbecher vom 13 juli bis 31 August 1649 in Danzig” (Gotha, Forschungsbibliothek Chart. a291, 87-91) in Joachim Telle, *Abraham von Franckenberg: Briefwechsel* (Stuttgart: Frommann-Holzboog, 1995).

⁶⁴⁷ Telle, 50.

⁶⁴⁸ *Ibid.*, 356. “D. 3. [Augusti] hor[a] 5. pom[eridiana] discursus de Colleg. Lynceorum in Italia, Roseo in Delphin[atu], Carpophororum in Germania. Brunus Italus in patria immerito exustus, tanquam Magus et αθεος. Corneli[us] Drebbel Anglus. Donabata epigrammata. Legendum dabat Sperberi rubricas. Ratio meretricula. Hoewelken nimis singularis.

D[ie] 7 hor[a] mat[utina] 7. literas offerebam. Sperb[eri] rubric[as] reddebam. Huius se m[anu]s s[cri]pta quaedam habere. Orationes Cabalisticas haberi typis excusas germanice. Legendum dabat libellum de fr[atribus] R[oseae] C[ruce] etc. . . . Mox ego redii et valedixi non sine lachrymis. Ille abitum precans faustum et optima quaeque, obtulit simul album, cui inscripsi αφωρον εργον. Sic abii. Offendi autem iterum in aedibus M[agistri] Rauhenii, ubi prandebat. Hic ultimum vale Gedanense dixi. Deus fortunet omnia.”

practices of amateur sociability marked a period of anomalous collaborative authorship in Antwerp artworks, within the genre of the *album amicorum* we find an unusual triangulation of identity in this period. A genre which began as one very much devoted to the delineation of clear social hierarchies and the fashioning of the self within those hierarchies became an interactive medium blurring hierarchy and linking identities.

Particularly in reformed lands of Central Europe, the emphasis upon the affective ties in the Republic of Letters gave rise to the medium of the *album amicorum* in the mid-sixteenth century. These were originally of two types – the humanist *album* and the noble *Stammbuch*. In the humanist *album* the young student in the midst of his academic travels visited famous scholars and collected their signatures. These typically included professions of friendship and restrained quotations from classical, sacred, or patristic authors. Interleaved editions of Melanchthon's *Theological Commonplaces* frequently served as early albums, tying the collection of commonplaces to the collection of inscriptions by well-known men.⁶⁴⁹

This genre of inscription was closely related to the humanist interest in epigraphy and was often executed in the book with all the elegance to be found on a classical tombstone. The noble *Stammbuch*, by contrast, featured flamboyant heraldry drawn by professional artists. The inscriptions in the *Stammbuch* were generally the nobleman's device, linking word and image closely to the identity of a particular member of a particular family.

Both types of books were arranged hierarchically, starting with the most famous inscriber. Each individual commemorated himself within the book in a clearly demarcated position in society. The owner of the *album* also had to have a very lucid idea of his own social place in order to judge how many famous people he could wangle into signing his book and on what page in that book he should ask them to sign. Each signing of the album,

⁶⁴⁹ Max Rosenheim, "The Album Amicorum," *Archaeologia* 62 (1910), 253.

therefore, was a negotiation for one's status in society, and the inscription was carefully fashioned to reflect the self that the individual wished to display. *Album amicorum* inscriptions were frequently available for hundreds of notables to view and could become public events, as famously was the case for Sir Henry Wotton when his inscription "*H.W. Legatus, vir bonus, missus ad mentiendum rei publicae causa*" in an Augsburg *album amicorum* in 1604 became an international incident.⁶⁵⁰

The encounter with people of diverse ranks and the practice of album inscription helped to clarify social order in a culturally, politically, and geographically complex region of Europe. Those who claimed an unacceptable status in the social hierarchy could stand accused of a social gaffe or worse. For instance, Martin Zeiller commented on the strange customs of Englishmen in his travel book, *Itinerarium magnae Britanniae*, "Englishmen are hospital to all strangers," yet "they don't think much of *Stammbücher*, and they refuse to sign them, or when they do so, they take care to put themselves well to the front, even before people of high Status."⁶⁵¹ Although Englishmen did not generally keep albums themselves (a few Scottish volumes survive), they were very alive to the importance of the volumes

⁶⁵⁰ *The Chamberlain Letters*, Elizabeth McClure Thomson, ed. (London: John Murray, 1965), 94. Cf. Gilbert Hess, who said that "Die Interaktion zwischen Textproduzent und Publikum erscheint im Spezialfall 'Stammbucheintrag' weniger komplex als in den meisten anderen Systemen, da der Autor stets speziell für einen Leser (bzw. für einen exklusiven Leserkreis) schreibt" in "Literatur im Lebenszusammenhang: Text- und Bedeutungskonstituierung im Stammbuch Herzog Augusts des Jüngeren von Braunschweig-Lüneberg (1579-1666)." *Mikrokosmos*, Vol. 67 (Frankfurt: Peter Lang, 2002), 74. Hess does provide a very useful discussion of the album and intertextuality. For more on album as intertext between script and print, see Christiane Schwartz, *Studien zur Stammbuchpraxis der Frühen Neuzeit: Gestaltung und Nutzung des Album amicorum am Beispiel eines Hofbeamten und Dichters, eines Politikers und eines Goldschmieds, etwa 1550 bis 1650* (Frankfurt am Main: Lang, 2002).

⁶⁵¹ Martin Zeiller, *Itinerarium magnae Britanniae, das ist Reyszbeschreibung durch Engelland, Schott- und Irreland, mit fleiß colligirt und Verfertiget* (Strassburg: Simon Paulli, 1674), 61. "Sie seyn bered/gastfrey/ und prächtig in der Haushaltung; befeissen sich dem Frembden grosse Ehr zu erzeugen; halten aber nichts von den Stammbüchern/ verweigern sich entweder darein zuschreiben/ oder wann sie es thun/ so pflegen sie sich wol fornen an/ auch über hoh Stands-Personen zu setzen." Zeiller discussed foreign attitudes to what he called *Standbücher* further in his *606 Episteln oder Send-schreiben von allerhand politischen, historischen und anderen Sachen* (Görlins: Marburg 1656), Vol. I, 467. "Die Auslander zwar achten sich der Standbücher nicht viel: Aber die meisten Teutsche haben es im Brauch/ solche auff ihren Reysen mit ihnen herumb zu fuhren; welchen dann die Italianer Julius Bellus, in seinem Hermete politico, lib. 2. pag. m. 142 an ihnen lobet."

continental visitors asked them to inscribe.⁶⁵² William Camden for instance, recorded in his diary that he inscribed Jakob Fetzer's album on Dec. 2, 1619 (Iacobus Fletzerus Noremburgensis me invisit, meumque nomen in album amicorum inscripsi).⁶⁵³

The position of Drebbel within the *album amicorum* varied wildly. As an artisan, one would normally expect to find him toward the end of the *album*, if included at all. Indeed, he often is found close to the end. The album of the minor nobleman Otto von Herberstein (Bodleian Library Egerton 1239) was an exception.⁶⁵⁴ Drebbel inscribed laconically with his motto "Oefend u gaven regt" on the 7th of June, 1610, in London. Otto Heinrich identified him as the "Autor Perpetui mobilis." Shockingly, we find this inventor of the perpetual motion as the tenth inscription, far ahead of his social superiors such as Isaac Causabon (twenty-second) and Petrus Scriverius (ninety-seventh). Nobility did not determine the order of entries in von Herberstein's album, as it did in the albums of his exact contemporaries.⁶⁵⁵

⁶⁵² For Scottish albums, see James Fowler Kellas Johnstone, *The Alba amicorum of George Strachan, George Craig, Thomas Cumming* (Aberdeen: University of Aberdeen, 1924) and Jan Papy, "The Scottish doctor William Barclay, his Album amicorum, and his correspondence with Justus Lipsius," *Myrica: Essays on neo-latin literature in memory of Jozef Ijsewijn*, Dirk Sacré and Gilbert Tournoy, eds. (Leuven: Leuven University Press, 2000), 333-396. The album of Thomas Seghetus is now Codex vaticanus latinus 9385. See Baumgarten, "Ein Schottisches Stammbuch," *Zeitschrift für Vergleichende Litteraturgeschichte* (1892), 88-95.

⁶⁵³ William Camden, "G. Camdeni regni Regis Jacobi I Annalium Apparatus," *V. Cl. Gulielmi Camdeni, et illustrium virorum ad G. Camdenum epistola. Cum appendice varii argumenti. Accesserunt annalium regni regis Jacobi I. apparatus, et commentarius de antiquitate, dignitate, & officio comitis marescalli Angliae*. Thomsa Smith, ed. (London: R. Chiswell, 1691), 51. See Camden's inscription in Jakob Fetzer's album, 235 Blankenburg, 217.

Pondero non numero

Jacobe Fetzero Norimbergensi praenobilis indolis, et vividi ingenii adolescenti Britanniam invisenti

Guil. Camdenus Clarenceux

Rex Armorum

Ad Jovis Philii aeram

L.M.

Posuit 1619.

⁶⁵⁴ Rosenheim, 287.

⁶⁵⁵ See Erich Zöllner, "Aus dem Stammbuch des Otto Heinrich von Herberstein," *Probleme und Aufgaben der Österreichischen Geschichtsforschung* (Munich: Oldenbourg, 1984), 314. "Dabei ist, wie bei fast allen anderen Stammbüchern, festzustellen, dass die Beiträge keineswegs in chronologischer Ordnung aufeinanderfolgen, as war vielmehr üblich, in bunter Folge auf irgendeine Seite eine Widmung einzutragen, gelegentlich allerdings wurden die vordersten Blätter hervorragenden Persönlichkeiten, namentlich Angehörigen regierender Häuser vorbehalten. Sehr deutlich ist das in dem Album von Georg Andreas von Herberstein, in dem der Adel überhaupt dominiert. Im album Otto Heinrichs sind aber auch Rang und Geblüt des Intragenden nicht für die Reihung entscheidend gewesen."

The *album* served as a record of social credit. The number and quality of the meetings memorialized within the *album* accredited its bearer for certain positions in life. Thus, album keepers could seek out inscriptions from within a particular disciplinary community as a means to credit themselves within that community. For example, the Bohemian alchemist Daniel Stolcius v. Stolzenberg sought out inscriptions from the alchemical pantheon of his day, including Cornelis Drebbel.⁶⁵⁶

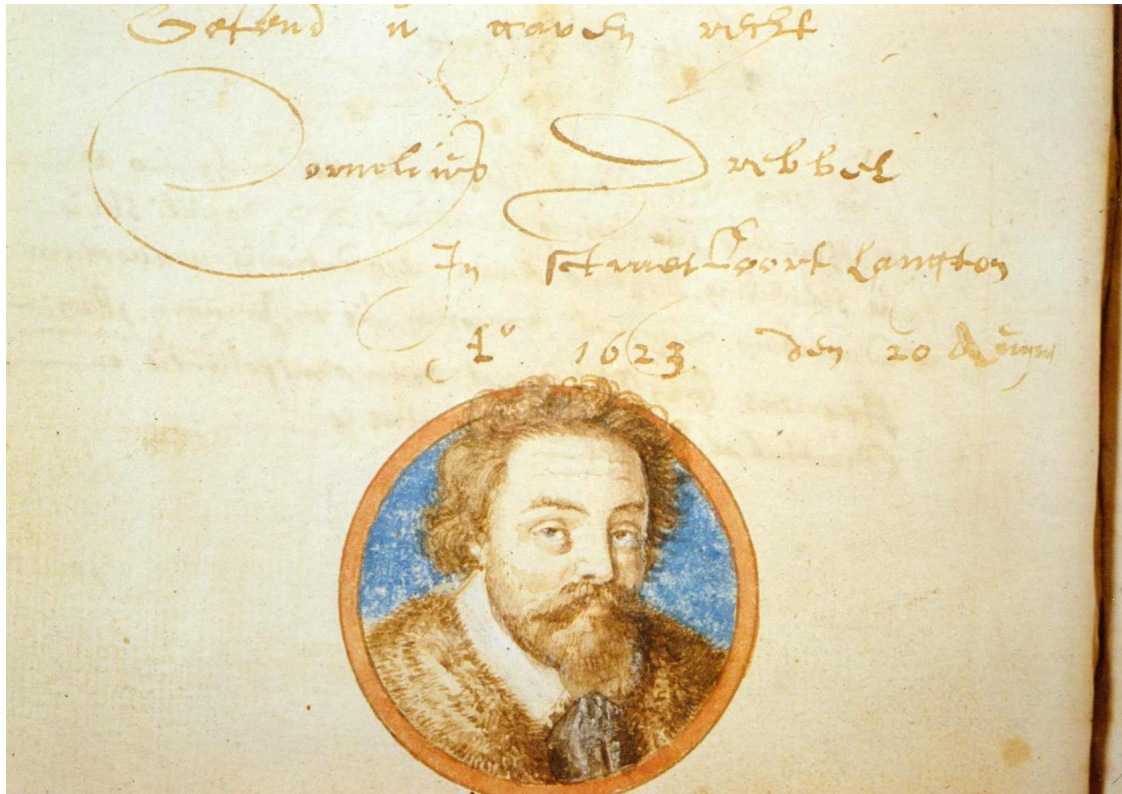


Fig. 8. Drebbel's inscription in Stolcius' album, Uppsala University Library, Y 132d.

Within communities in which printing was also becoming an important means of accreditation, the keeping of the album was closely integrated with the publishing of works. As Christiane Schwartz has remarked in her study *Stammbuchpraxis der Frühen Neuzeit*, the

⁶⁵⁶ For a reproduction of Drebbel's inscription in Daniel Stolcius' album, see Marco Beretta, *A history of non-printed science: a select catalogue of the Waller Collection* (Almqvist & Wiksell International: Uppsala, Sweden, 1993).

album amicorum occupied a middle ground between the cultures of script and print.⁶⁵⁷

Schwartz gave Stolcius' album, now in Uppsala, as an example.⁶⁵⁸ Stolcius' *album* began as a collection of images left over in the workshop of printer Luca Jennis from previous publications of other authors. Jennis gave the images to Stolcius, who made an *album amicorum* out of them, which was subsequently printed as a book, Stolcius' *Chymical Garden* (*Viridarium Chymicum*). The printed book then served as a popular basis for other *album amicorum*. The doctor and translator Johann Elichmann fashioned his album from Jennis' printed edition of Stolcius' book (Wellcome Ms. 257). To complete the cycle, the album included an inscription by Jennis himself.

Stolcius actively worked to tie his book to a network of other *albums*. He dedicated his printed work to the diplomat and *Tausendkünstler* Phillip Hainhofer, recalling the conversations he had with Hainhofer, and Hainhofer's own celebrated album, whose like he had never seen during his travels and did not expect to see ("cui parem in meâ Peregrinatione non vide neque unquam visurus sum)."⁶⁵⁹ Stolcius collected alchemical inscriptions in order to publicize his own alchemical identity. Hainhofer was not an alchemist, but a lover of the art with powerful connections, ("rerum mirabilium et memorabilium Amatori et indagatori solertissimo, Amico et Fautori suo semper honorando"). Hainhofer's celebrated album would enjoy an equally celebrated readership besides its owner. Stolcius used his inscription to make a powerful argument for man's God-given ability to draw on celestial forces in the cure of disease. "With God for us, who will be against us (Pan Buh nami: kdo proti nam)?"⁶⁶⁰

⁶⁵⁷ Schwartz 2002.

⁶⁵⁸ *Ibid*, 235.

⁶⁵⁹ Reprinted in Manget, 895.

⁶⁶⁰ 429, Corpora sunt caeli supera inferioribus aqua, Et superum vires inferiora gerunt.

We've seen Stolcius employ his own album, publications based on his album, and his album inscriptions to fashion an identity of practitioner and promoter of alchemy in a period when alchemy enjoyed a printing boom (discussed further in Chapter Seven). He did so either within a limited community of practicing alchemists, or *liefhebbers* and patrons of alchemists. Stolcius' use of the album can be compared to the discipline formation of the natural historical communities studied by Brian Ogilvie.⁶⁶¹ In the context of Stolcius' practice, Drebbel appeared within Stolcius' album as a member of an international community of alchemists.

Others, however, kept far more eclectic albums. We have already seen the example of Otto von Herberstein's album. How might Drebbel's inscription serve a minor nobleman? In his travel guide, Balthasar Gerbier emphasized the role of the *Stammbuch* and collections of commonplace as the *bona fides* of a nobleman's education and ability to lead in war and government. In Germany, the "Gentry do make it their study to excel in the warlike profession, in all Arts and Sciences, and noble Exercises; where every Gentleman hath his Stam-book, and his Study with Manuscripts concerning the aforesaid Military Art, Fortifications, and all warlike Engines; besides very notable Collections of Proverbs, & Properties belonging to all noble Arts, and most noble parts of the *Mathematicks* and *Metaphysicks*."⁶⁶²

Quicquid in immenso Naturae clauditur Orbe,
Parvus homo parvo corpore cuncta tenet.
Haec bene qui novit, rerum cognoscere vires
Et Medica miseros Arte juvare potest. . . .
Pan Buhe nami: kdo proti nam?

⁶⁶¹ Brian Ogilvie, *The Science of Describing: Natural History in Renaissance Europe* (Chicago: University of Chicago Press, 2006).

⁶⁶² Balthasar Gerbier, *Subsidium peregrinantibus* (Oxford: Robert Gascoigne, 1665), 20-1. Gerbier's own impressive and partially encrypted collection of drawings, chymical recipes, arcana, and military machines can be found in the Wellcome library addressed to the "Amateurs curieux." See Wellcome Library MS. 2505.

Pamela Long has argued that in the fifteenth-century the mechanical arts enjoyed a rise in status due to their increasing importance to the military nobility.⁶⁶³ It is tempting to relate the wild fluctuations of Drebbel's place within the hierarchically organized *alba amicorum* of his day to the still volatile status of the illiberal arts. In the Holy Roman Empire, writers such as Bornitz urged the importance of mechanical knowledge in government. The *Stammbuch* may have served as an important tool in the arsenal of a nobleman seeking credit as a *liebhaber* of *Kunst*. In this context, we can better understand the authority Herberstein invested in Drebbel as the inventor of the perpetual motion.

The uses to which images of Drebbel's perpetual motion were put within the *album* might surprise us even more. I've conjectured that as subjects of conversation, words were applied to depictions of Drebbel's perpetual motion within gallery paintings. The depictions of the machine within that genre were intended to spark debate, and thus the words applied to the image were open to conversation, argument, and exchange. Within the *album amicorum*, we find drawings of the perpetual motion fashioned into devices, in the sense of emblems or heraldry. Heraldry originally appeared in the nobleman's *Stammbuch* as the marker of a particular familial identity, alongside an individual motto.

Strangely, in two *alba amicorum* we find images of Drebbel's perpetual motion appropriated as "heraldry" representing not a single identity, but a collaborative network of exchange. Mottos were applied to the images, yet not in order to serve as markers of identity. These verses rather supply the images with interpretations, transforming them into emblems intended for consumption by an audience who shared an interest in and familiarity with the image.

⁶⁶³ Pamela Long, "Power, Patronage, and the Authorship of Ars: From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age," *Isis* 88:1 (Mar. 1997), 1-41.

The affixing of an interpretative motto to the image of Drebbel's perpetual motion might appear to close off debate in an assumed consensus or authoritative setting of meaning. Yet, the practice of inscribing verses within the *album amicorum* partook of the wider practice of epigram composition and exchange within *amateur* sociability. For example, the Nürnberg patrician Jakob Fetzer had his lavish three volume album filled with many images by professional artists. These images could then be signed by inscribers within his album, allowing them to attach their own meanings to his selected images. Thus one Paul Garpius inscribed the conventional image of a turtle and a couple embracing as "Tactus" with a very biblical "*vanitas*" comparison of man to a passing shadow and a transient flower of the fields [Fig. 9].

Image removed from digital version due to copyright concerns

Fig. 9. Paul Garpius' inscription in Jakob Fetzer's album. Herzog August Bibliothek, Blankenburg 231, 161v.

Similarly, we find an allegorical image of *Terra* inscribed by Joachim Morsius in January, 1620 with a poem on the follies of the world (“Mundus regitur opinionibus/O quam ridiculi sunt mortalium termini!”). Only the hope of the heavenly inheritance awaiting the soul makes birth worthwhile (“Sursum ingentia spatia sunt, in quorum possessionem animus nisi admitteretur/ non fuerat opera pretium nasci”).⁶⁶⁴ Morsius continued with a prayer on the next page, “Lord, Allow me to know you, myself, and Nature, and to be of use to the public good (“Domine/ Da cognoscere te, me Naturam,/ saluti publicae prodesse”).

⁶⁶⁴ The Album of Jakob Fetzer, Herzog August Bibliothek, Blankenburg 231, 96-7.

Morsius involved two entities – Nature, and the public good – in his personal relationship with the Lord. Salvation was a matter to be achieved upon the public stage, and it required knowledge of God, which in turn required knowledge of one’s self and of nature. Morsius tempered a Christian Neo-Stoic message of disregard for all things but the state of one’s own mind by intercalating knowledge of nature and regard for the public into his relationship with the divine.

A few months beforehand, in November, 1619, Morsius had made this message even more explicit in another inscription in Fetzter’s album. On 308v, Morsius quoted from Virgil concerning the staying power of Aeneas in the memory of Dido, “haerent infixi pectore vultus” ([his] looks remain imprinted on [her] heart). “Most noble and famous lord Fetzter, as a reminder of my great love for you take this from me,” he wrote, quoting from the *Aeneid* again (“qui absentem auditque videtque”) “who sees and hears you while you are gone, and in my memory live happily.”⁶⁶⁵ In contrast to the *vanitas* theme of the transience and meaninglessness of all earthly things, Morsius emphasized the permanence of emotion. He transformed one of the most tragically passionate romances of literature into a testament of enduring love.

On the next page, we find a professionally executed image of Drebbel’s perpetual motion machine [Fig. 10]. Morsius identified it below, “Effigies perpetui motus Cornelii Drebellii Amici,” and offers an interpretation above. Reflecting Drebbel’s own belief that sensual knowledge of the elements led to knowledge of the divine, Morsius wrote,

“Knowledge of nature and the separation of the elements is an excellent beginning to the

⁶⁶⁵ “Hoc summi mei in te amoris, Nobilissime et clme dne Fetzere, qualocunque monumentum a me habe, qui absentem auditque videtque meique memore vive FELICITER
Ioachimo Morsius
Scribebam
antiqua fide Londini
Mens. nov. AC.MDCXIX”

Image removed from digital version due to
copyright concerns.

Fig. 10. Drebbel's perpetual motion in Fetzer's album. Wölfenbittel, Blankenburg 231, 309r.

contemplation of divine things” (“contemplationis divinarum rerum eximum principium nosse naturam et separationem elementorum”). Drebbel’s knowledge of the elements allowed him to discover the perpetual motion, the *primum mobile* of the universe, and to build it here in the earthly realm.

On the verso, Morsius continued with a poem on the ability of man to rise above trials. Quoting the Scottish poet Thomas Segetus, Morsius urged Fetzer, that whomever God considered worthy of great ventures, he first strengthened with various labors. Man had the power to raise himself from the depths. “Rouse thee, my soul, from low despondency,/ And hope for better scenes reserv'd on high (Surge anime ex humili, teque ad meliora reserva), he repeated.⁶⁶⁶

Lex prima Deus, si quem melioribus ausis
Dignum habet, huic variis mentem ante laboribus armat.
quem non exercet, non dignum ducit habetque,
molliter, ante tubas nempe hosti terga daturum
Surge anime ex humili, teque ad meliora reserva
Non frustra deus eripuit nos mille periculis
Non frustra casus iuvenem duravit ad omnes:
Non frustra magnos voluit superare labores:
Non frustra verâ voluit virtute teneri.
Surge anime ex humili, teque
ad meliora reserva.

Segetus was a friend and travel companion of Morsius who inscribed Morsius’ own album.⁶⁶⁷ By citing Segetus’ poem, Morsius expressed a standard Neo-Stoic idea, exhorting

⁶⁶⁶ James Boswell cited and translated the couplet by Seghetus, in his essay, “On Thinking.” See *Boswell's column, being his seventy contributions to the London magazine under the pseudonym the Hypochondriack from 1777 to 1783* (London: Kimber, 1951), 153. Seghetus’ much lengthier poem can be found in Arthur Jonston, ed. *Delitiae Poetarum Scotorum* (Amsterdam: Blaeu, 1637), 490. The poem concluded,

Surge anime ex humili, teque ad meliora reserva:
Non frustra Deus eripuit nos mille periculis:
Non frustra casus juvenem duravit ad omnes:
Non frustra magnos voluit superare labores:
Non frustra vera voluit virtute teneri.
Surge anime ex humili, teque ad meliora reserva.

⁶⁶⁷ See Lübeck Ms. 4a 25, 167 for a poem by Segetus in memory of Albert Merton, and another on page 188 about Sir Philip Sidney. On the verso (188v), we find a poem about Segetus by Michael Clenovius. For Segetus’ life, including the early troubles to which Segetus perhaps refers in his poem, see Otakar Odložilík, “Thomas

the mind to rise above earthly troubles. Yet, the way to higher things, as we saw in Morsius' interpretation of Drebbel's machine, followed the path of the senses. Furthermore, this journey was one taken in the company of friends.

Interestingly, Drebbel himself did not inscribe the image of his own machine, although the depiction predated his own inscription in Fetzer's album. The perpetual motion is found in a series of watercolors of remarkable sights in and around London, from London Bridge to the cassowary. The inscription facing the page of the depiction of London Bridge (180v), has transferred ink over the drawing, giving us a *terminus ante quem* of May 15th, 1619 for the series, predating Drebbel's inscription of July, 1619.

Henry Peacham, in a poem prefaced to Coryate's *Crudities* (1611) described both the "heavenly motion at Eltham" and the "Cassawarway" as "toyes" to which the "rude vulgar so hastily post."⁶⁶⁸ The series depicting the perpetual motion, the cassowary, and other sights served as early modern "post cards" showing memorable scenes of distant cities, and were executed en masse. For instance, a watercolor of London Bridge by the same workshop can be found in Michael van Meer's album (Edinburgh, MS.La.III.283, 408).⁶⁶⁹

Like the often repeated depictions of the perpetual motion found in the gallery paintings, the image of the perpetual motion served as the shared subject of conversation, which the viewer could invest with his own authority as he made judgments concerning its value, interpretation, and authorship. If Morsius chose a somewhat Heraclitean view of the machine, we find a rather more Democritean interpretation within his own album. A depiction of Drebbel's perpetual motion appeared again there, this time not as part of a

Seget, a Scottish Friend of Szymon Szymonowicz," *Polish Review* 11:1 (1966), 1-37. In 1619 Morsius re-issued Segetus' 1608 edition of the odes of Szymon Szymonowicz.

⁶⁶⁸ Coryate's *Crudities* (London: W.S., 1611).

⁶⁶⁹ See June Schlueter, "Michael van Meer's *Album Amicorum*, with Illustrations of London, 1614-15," *Huntington Library Quarterly* 69:2 (2006), 301-313.

series, but on the page of the undated inscription of the Kurlander Daniel Rohrman [Fig. 11]. It seems that Rohrman himself drew the image or commissioned it from a professional artist, as a tribute to Joachim Morsius.⁶⁷⁰ Rohrman signed the album from Rostock; all of Morsius' other Rostock inscriptions dated to his student days there in 1617, immediately before his departure for his academic peregrination. As many of the inscriptions show, he had originally intended to travel to France and Italy, but at some point decided to head instead for the Netherlands and England, where he sought out the manuscripts of Cornelis Drebbel as his first venture into alchemical publishing (discussed further in Chapter Seven).

In his inscription for Joachim Morsius, Rohrman identified the machine as “Corneli Drebbels Perpetuum Mobile,” and quoted above it from the end of Book One of Lucretius' *De Rerum Natura*, “Semper in assiduo motu res quaeque feruntur.” For Rohrman, the image served as a representation of how the world worked through constant movement (perhaps he and Morsius studied the theory of atoms with their professor Eilhard Lubinus at Rostock).⁶⁷¹

Earthly change, according to this view, was not something to be regretted, despised, or controlled by heavenly regularity, but to be admired as the cause of all things in nature.⁶⁷² Lucretius began Book One with an invocation to Venus Genetrix, who gave life and form to all. In his view of the world, the senses were the way to know the world, and desire, not reason, the way to master it.

⁶⁷⁰ It is not the only perpetual motion in the volume. See page 893 for the “motus perpetuus” contributed by Johann Cavenius of Hamburg. Rohrman's other album inscriptions were rather reserved. See the album of Johan van Heemskerck, Den Haag, Koninklijke Bibliotheek, Ms. 131 H 7, 117).

⁶⁷¹ On Lubinus' atomism, see Christoph Lüthy, “The Fourfold Democritus on the Stage of Early Modern Science,” *Isis* 91:3 (2000), 463.

⁶⁷² On Lucretius as “a means of legitimating an interest in the domain of materiality and the sensory, including art, natural curiosities, as well as the body and its passions” see Stephen John Campbell, *The Cabinet of Eros: Renaissance Mythological Painting and the Studiolo* (New Haven: Yale University Press, 2004).

In using Drebbel's machine as the image to express his own friendship for Morsius, Rohrman triangulated identities and relationships. Word and image did not serve as an individual coat-of-arms to celebrate a single person's identity, or even a single relationship between inscriber and owner of the album. Rather, Rohrman's inscription had a much wider public, encompassing not only Drebbel himself, but all those who recognize the perpetual motion and the Lucretian citation, and who could participate in the *liefhebber* game of debating their meaning.



Fig. 11. Rohrman's inscription. Stadtbibliothek Lübeck Ms. 4a 25, 850.

Drebbel himself did not play this game. His inscriptions varied little. They were all versions of his motto “Oefend uw gavens recht” (Practice your gifts rightly). His motto expressed the identity he has forged for himself by departing from his socially established

position in life as a Dutch farmer. He practiced his gifts wherever he thought best, as a *Tausendkünstler* ignoring the traditional boundaries of the guild system and taking up and abandoning endeavours in a wide variety of crafts. Yet although his motto appeared to suggest the very model of self-sufficiency, Drebbel in fact required a wider public of *liefhebbers* in order to put his motto into practice.

Drebbel was only able to leave his community and the security of the guild system and operate as an international projector due to the support of the cultural consumer. That many of the activities he decided to pursue could be found in lists of contemporary *desiderata* was no accident. In a new economy where private passions, lacks, and insufficiencies tied together society in a fabric of supply and demand, the right practice (“*recht*”) was determined by the desires of the marketplace.

In Morsius’ album, we not only find the depiction of Drebbel’s perpetual motion implicated in a wider network of *liefhebbers*, but Drebbel’s motto too served as an object of exchange. Joachim Olearius, a pastor in the tiny village of Petschow outside Rostock inscribed a tripartite poem in both German and Latin on the “symbol” “Ofend u gaven recht” of the “philosopher, alchemist, and mechanic” Master Cornelius Drebbel of Alkmaar.

I.

Dona quidem in sanctis varia & distincta videmus
queis sunt ornati pro bonitate Dei
Hanc vult à quovis conferri in munere iusso
ut rudis & simplex erudiatus homo,
Adque alios extendat se delectio vera,
Virtutum officiiis, queis operosa hiet.

II.

Nobilitat Christum virtus ortusque sacratus,
est clarus vitrà & moribus innocus.
Ipsius bona sunt vastus quam continet orbis
atque suum tradit, cuique talentum homini.
Quod benè præbendo vigilem se, conferat omnis,
officii iussi pro rationi sui

III.

Immensus Jehovah, Regum Rex dives in omnes,
Donat omni bonum pro bonitate suâ,
Sed genus humanum malè confert dona tributa,
Divitiis mirâ calliditate studet.
Interea virtuti dedita turba fidelis,
Succurrat miseris non remente manu.⁶⁷³

As was the case in Jacob Revius' "On the Wonderful Works of Cornelis Drebbel," Olearius attempted to depict a new social identity according to traditional mores. God, the sources of all riches, gives riches to every one. Mankind however "assigns his allotted goods badly,/ Striving for riches with amazing cunning,/ Meanwhile the faithful crowd given over to virtue,/ Without holding back their hand rushes to succour the unfortunate." Olearius did not concede that the collective effects of the marketplace might redeem the fallen passions of individual members of the human genus, to form public good out of private passions. The mass pursuit of wealth could never be justified; only the pure charity of the few saves. However, Olearius' poem was still radical in his decision to compose a lengthy poem on the Dutch motto of a mechanic, in his acceptance of that mechanic's identity as a philosopher and an alchemist, and finally in his belief that God granted gifts to all members of society, even to a "rude & simply educated man."

VI: Conclusion

In his study of Peiresc, Peter Miller attempted to understand how somebody so famous as Peiresc in the seventeenth century fell into obscurity so quickly. Peiresc belonged to an anomalous age, an age of intelligencers, literary agents, Utopian fraternities, and amateurs, an age that saw a brief flowering of collaborative authorship in the gallery painting and that witnessed the transformation of *Stammbuch* heraldry into strange junctures of

⁶⁷³ Lübeck Ms. 4a 25, 342v-343v.

multiple identities. This was a time when the relationship of the individual to a society broadened by an impersonal market was renegotiated through older and more intimate associations, such as brother, friend, and lover. In an era when private desires served the public good, the cultural consumer enjoyed an unprecedented authority which he invested in the arts and artisans who were the objects of his passion.

The broader horizons of the *liefhebbers* allowed individuals such as Drebbel to “practice their gifts rightly.” Drebbel ignored disciplinary and social boundaries, claiming the status of philosopher, as well as venturing at will into alchemical, metallurgical, optical, pneumatic, mechanical, nautical, and military arts. His career appealed to an age of *liefhebbers* who denied the limitations of disciplinary and professional divides. With the shared authority invested by the *liefhebbers*, the arts enjoyed status as never before. Many were optimistic that with the dissolution of old boundaries a pansophic harmony of all arts and sciences would be possible.

Drebbel’s discovery of the *primum mobile* of the universe, his display of that discovery within a microcosm showing the motions of all things, and his brief yet comprehensive work of natural philosophy, made him the paragon of pansophic ability, watched with a keen eye by contemporaries. That is why Drebbel served as a subject of enthusiastic conversation and the symbol of *liefhebber* sociability. That is why his perpetual motion appeared in so many microcosmic collections of the world’s most desirable things, and why amateurs, intelligencers, and pansophists such as Peiresc, Hartlib, and Jan Amos Comenius assiduously followed the course of Drebbel’s career.⁶⁷⁴

⁶⁷⁴ According to his manuscript *De Arte Spontanei Motus quem Perpetuum vocant* (1639), Comenius shifted the course of his own activities over the course of the 1630’s, based on the slightest piece of news concerning Drebbel. Referring to Drebbel’s letter to King James printed in Alsted’s *Encyclopaedia*, Comenius thought that Drebbel had discovered the perpetual motion. Then having read Petrus Mormius’ claim that Drebbel’s perpetual motion was a fake, he once again felt that he had a chance of discovering the perpetual motion first.

As Miller explained, Peiresc's "omnivorous curiosity fell victim to the rising walls of disciplinary borders and the experts who policed them."⁶⁷⁵ The same was true for the object of Peiresc's curiosity, Drebbel. As professional disdain denied the authority of the amateur, the object in which the *liefhebbers* had invested their hopes fell into obscurity along with them. The renegotiation of the traditional bounds of community and guild structure in light of a wider ideal of *liefhebber* sociability offers a perspective on the emerging public sphere. This ideal faded when new ways of organizing society along the lines of national and professional divides emerged. Yet the authority enthusiastically granted to the abilities of the *liefhebbers* acting in concert not only helped conceptualize an idea of the public, but reformulated the epistemological status of the particular.

The empirical turn depended upon a forum for the exchange of particulars and their accreditation as matters of fact. Distrust of the individual mind had extended the longevity of Aristotelian deduction, in which proof depended upon statements so universally true that they did not require the validation of an individual, and which no individual could deny. The antidote to the frailty of individual testimony was the emerging public. Like all claims of the marketplace, particulars could be subjected to the validation of the public in order to achieve credit as matters of fact. Such dependence upon factual particulars could be linked to the eventual development of professional expertise which unaccredited outsiders could not credibly claim, and the consequent decline in the status of the amateur. Yet in the seventeenth century, amateurs from the art-loving *liefhebbers* of Antwerp to Boyle's "new virtuosi" enjoyed acclaim as the central promoters of the object of their affections.

⁶⁷⁵ Peter Miller, *Peiresc's Europe: Learning and Virtue in the Seventeenth Century* (New Haven: Yale University Press, 2000), 5.

Chapter Four: Drebbel and the Commonplace

I: The Commonplace between *Publica Fama* and Celebrity

II: Humanism, Science, and the Idea of Progress

III: Collecting Inventors

IV: The Archimedean Sphere in Early Modern Europe

V: Artifactual: Drebbel among the Commonplaces of Invention

VI: Setting New Standards

I: The Commonplace between *Publica Fama* and Celebrity

We have seen Drebbel from the “eye witness” viewpoint of portraitists, travelers, theatre-goers, and others who encountered the charisma and human dimension of his persona. We have also traversed the dangerous and exhilarating territory Drebbel occupied between lost arts, new inventions, possibilities and foolish impossibilities. We have experienced the aesthetic delight and social activity of the *liefebber*, picking out Drebbel’s alluring perpetual motion from a mass of desirable objects, debating its meaning, and exchanging epigrams upon this fascinating subject.

Now we turn to another genre related in some way to all these forms of circulation, but distinct in style, purpose, and practice – the commonplace. Although one does not normally think of people (rather than citations or objects) packaged as commonplaces, we will find Drebbel circulating as the inventor of the perpetual machine in this form time and time again.⁶⁷⁶ Thus the commonplace relates to the persona discussed in Chapter One. Yet, as we shall see, this genre was not intended to supply an “eye witness” view of a person, but casts of interacting *imagines agentes* playing on a stage of the mind somewhat removed from the world of sense.

⁶⁷⁶ Other scholars have pointed to the circulation of personalities as *loci*. For Gabriel Harvey’s fashioning of the Milanese artisan Joannes Antonius de Rubeis into a *locus* in 1590, see Nicholas Popper, “The English Polydaedali: How Gabriel Harvey Read Late Tudor London,” *Journal of the History of Ideas* 66:3 (July 2005), 357-8. Harvey’s desire for modern *Polydaedali*, described by Popper, clearly set a type to which Drebbel responded in his London career. Alexandar Marr, “*Gentile Curiosité*: Wonder-working and The Culture of Automata in the Late Renaissance,” *Curisoty and Wonder from the Renaissance to the Enlightenment*, R. J. W. Evans and Alexandar Marr, eds. (Aldershot: Ashgate, 2006), 167 n. 80 suggested Drebbel as “an early example of curiosity attaching to ‘selves.’”

Similarly, in its repetition and rhetorical appeal, the commonplace of Drebbel could be compared to the *liefhebber's* gallery painting. Both were virtual collections which increased the appeal of Drebbel's machine by including it among a mass of other desirables. We have also already encountered the ancients versus moderns debate, in the gallery painting and in the *desiderata* list, which was the major arena in which this commonplace circulated.

There was another significant difference between Drebbel the commonplace and the Drebbel the persona, the desideratum, and the object of the *liefhebber's* desire. As a commonplace, Drebbel was banal. The other genres we have traced so far have emphasized and augmented the charisma of Drebbel's persona. Commonplaces transformed even the most thrilling material into a unit on a list repeated mechanically time and time again. Commonplaces were becoming related to the increasingly important matter of fact, but they were not facts. They were not only banal, they were also often mythical. For example, we find in an Appendix to a 1686 translation of Polydore Vergil's *History of Inventors*, the following statement.

Watches, were the Invention of a German, and the Invention brought into England Anno, 1580. The Famous Inventers and Improvers were Cornelius Van Dreble, and Janus Torrianelus, the first Clocks were brought into England, much about the same time.⁶⁷⁷

If there was one device Drebbel did not improve, it was the watch. Yet, as Montaigne pointed out in "Des Boiteux" (cited in Chapter Three), the circulation of myth built on the

⁶⁷⁷ *Appendix to Polydore Vergil's A pleasant and compendious history of the first inventers and instituters of the most famous arts, misteries, laws, customs and manners in the whole world together with many other rarities and remarkable things rarely known, and never before made publick : to which is added, several curious inventions, peculiarly attributed to England & English-men, the whole work alphabetically digested and very helpful to the readers of history* (London: Printed for John Harris, 1686), 156. Gianello Torriano of Cremona, the clockmaker of Emperor Charles V, gained fame for designing a clock based on Dondi's Astrarium. For that reason, he was included by Pierleone Casella in a canon of great artists. E. H. Gombrich, "An Early Seventeenth-Century Canon of Artistic Excellence: Pierleone Casella's Elogia Illustrium Artificum of 1606," *Journal of the Warburg and Courtauld Institutes* 50 (1987), 231 See Ladislao Reti, "The Codex of Juanelo Turriano (1500-1585)," *Technology and Culture* 8:1 (1967), 53-66, and Silvio A. Bedini and Francis Maddison, "The Mechanical Universe: The Astrarium of Giovanni de' Dondi" *Transactions of the American Philosophical Society* 56:5 (1966), 1-69. However, Torriano was not Drebbel's contemporary, and he never, it seems, worked in England.

relationship between particular individuals and society at large. Through the evolving practices of commonplacing, we can trace that relationship, and the changing authority of common knowledge variously conceived.

Gabriel Naudé in his *History of Magick* condemned three causes for the continued circulation of false reputations. The first cause was an old one – the belief that the more something is known, the truer it must be. Writers who shared this belief did not turn to Nature for proof, but rather groped “after things by hear-saies and conjectures, without ever sifting or examining them as they ought, especially in this Age, which is more fit to refine and sharpen mens judgements, then all the precedent put together were, by reason of the great revolutions that now happen, through the discovery of a new world, the disturbances occasion’d by Religion, the restauration of Letters, the declination of Sects and ancient opinions, and so many stranges inventions and artifices. . . .” The new world order ought to “raise mens minds out of the Lethargy they are in, and enliven them to a retraction and so to a contempt of abundance of false and absurd opinions.” It was time to open the flood-gates of the cultural reservoir and pick out the trout from the draining bilgewater.

Yet the current state of affairs also afforded two other phenomena which continued to promote the circulation of false opinion. The first of these was the idea the a writer gains more in reputation through the quantity rather than the quality of writings, “which they can swell up as they please, without much trouble or difficulty, with the assistance of a *Method*, devoutly observ’d of transcribing word for word, whatever hath been said a hundred and a hundred times over by others.” This belief is “much oblig’d to the *third* and last cause of the propagation of all these falsities, which is a Custome lately introduc’d of making ostentation of *Polymathy* or great reading, speaking on any subject of all things, and upon any occasion of

all subjects. . . .” The polymaths whipped the existing cultural reservoir into a frothy chaos, adding even more confusion, circulation, and repetition.

Those polymaths who “exactly observe such a method, are, like Marchants that take up all, burthen’d with many things of no value, and such as only corrupt and disparage others, which would be much more in request and reputation, were they cull’d out of the Chaos and confusion of those great Volums.”⁶⁷⁸ In the great quantity of items which they have for sale lie hidden many which ought to be worth more than the others were they only sifted out of the general chaos. The merchants of knowledge are not, however, interested in sorting through their wares. They seek only their own credit, which they believe depends upon the quantity and not the quality of wares sold.

For Naudé, the merchant serves perhaps as but a metaphor, yet one which points to a historic commercialization of reputation. *Publica fama* had long been a legal category - what was generally known about a person could be brought to court as a form of proof. If the old world order relayed falsehood through a reliance upon *publica fama*, the new commercialization of reputations introduced celebrity as a consumer good. Those who could profit from selling the public unexamined gossip could not be expected to cull their stock in careful pursuit of truth.⁶⁷⁹

There were those who contemplated the information market with greater relish than Naudé, integrating private vice into a theory of public good. Among them was none other than John Streater – the London printer who offered Naudé’s *History of Magick* for sale in its English translation. For Streater, the advantages to be gained through the circulation of

⁶⁷⁸ Gabriel Naudé, *History of Magick By way of Apology, for all the Wise Men who have unjustly been reputed Magicians, from the Creation, to the present Age* (London: John Streater, 1657), 300-302.

⁶⁷⁹ *Fama: the Politics of Talk and Reputation in Medieval Europe*, Thelma Fenster and Daniel Lord, eds. (Ithaca, N.Y.: Cornell University Press, 2003). Cheryl Wanko, *Roles of authority: Thespian Biography and Celebrity in Eighteenth-century Britain* (Lubbock, Tex.: Texas Tech University Press, 2003). Graeme Turner, *Understanding Celebrity* (London: Sage, 2004).

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information in the market were above all political. He considered government as an art which could be improved by an informed citizenry. Streater co-operated with “Hartlib, Calvert and Mewe” in “producing a new and powerful knowledge of nature, and by exemplifying in the distribution of that knowledge a new politics of circulation.”⁶⁸⁰ The private interests of both the merchant of knowledge and his customers could in the information market work toward the public good.

Between Naudé and his London printer Streater, we find two poles of a debate over the role of commercialized print in civil society which has continued over the centuries.⁶⁸¹ On the one hand, according to Judith Stoddart, we find Habermas’ view of reading as “rationality, the internalization of narratives, a mode of learning to categorize and make hierarchies of knowledge.”⁶⁸² Yet another view of reading celebrated the commerce of consumer goods. Such a view of the circulation of information did “not serve as a catalyst for rational-critical debate.” Nor did “it help its readers to categorize and hierarchize knowledge.” Instead it emphasized “processing and accumulating – not analysing-information. This type of reading fits with a political theory in which the public sphere was not imagined as a space of dialogue- as a simulacrum of face-to-face communications – but as a store of tangible facts to be distributed. The political subject was imagined not as a rational, self-regulating, centred individual, but as a repository of circulating facts and figures.”⁶⁸³

⁶⁸⁰ Adrian Johns, Chapter Four, “John Streater and the Knights of the Galaxy: Republicanism, Natural Knowledge, and the Politics of Printing,” *The Nature of the Book* (Chicago: University of Chicago Press, 1998), 281-9.

⁶⁸¹ Judith Stoddart examines the two views in the nineteenth century in “Cultures of Print: Mass Markets and Theories of the Liberal Public Sphere,” *Authorship, Commerce and the Public: Scenes of Writing, 1750-1850*, E.J. Clery, Caroline Franklin, Peter Garside, eds. (New York: Palgrave Macmillan, 2002), 171-185.

⁶⁸² Stoddart, 172.

⁶⁸³ *Ibid*, 180.

Stoddart was here describing the nineteenth-century *Penny Magazine*, which offered recycled materials rather than original articles. It thus replaced the credit of a particular authorial or editorial persona with that of pre-circulated publicity. Yet the *Penny Magazine's* repository of common knowledge could well be compared to the ancient practice of commonplacing – a practice that in the era of Naudé's lament was changing from “what everyone knew” to the circulation of curious particulars.

Within this circulation, individuals too were collected and circulated as objects of exchange. If we think of the public as a collection of particulars, a particular figure might become a public figure by being collected. Or, as Daniel Boorstin put it, “the celebrity is a person who is well-known for their well-knownness.”⁶⁸⁴

The idea of a celebrity has been associated with the development of mass media.⁶⁸⁵ The rapid international dissemination of the figure of Drebbel as a commonplace in print demonstrates his fame in what was the mass media of his day. To that end, I will focus in this chapter not on manuscript commonplace collections and their use by individual readers, but on copious printed works produced rapidly by using the commonplace method. Usually, such writers do not state explicitly that they are basing their writing on a collection of commonplaces. Yet by tracing the movement of the commonplace of Drebbel from one work to the next, we can uncover the use of commonplacing.

One writer who did reflect upon his use of commonplacing was the prolific author Martin Zeiller. By 1655, Zeiller had already published over thirty (frequently re-printed) titles. As he revealed in his *Handbuch von allerley Nützlichen Erinnerungen*, it was the commonplace which had allowed him to be so productive.

⁶⁸⁴ Daniel Boorstin, *The Image* (New York: Athenaeum, 1962), 57.

⁶⁸⁵ Boorstin, *The Image*, Graeme Turner, *Understanding Celebrity* and Christopher Rojek, *Celebrity* (London: Reaktion, 2001).

Zeiller wrote that to aid his memory he had collected a fair amount of *loci communes*. He had re-assembled his collected commonplaces in diverse forms – stories, letters, travelbooks, speeches, and other writings – which he had had printed. Yet this material was now spread throughout these writings, so he had taken it upon himself to organize them into an alphabetically arranged handbook of commonplaces.⁶⁸⁶

Zeiller's handbook rendered the material turn of the commonplace and its relationship to collecting and the *ars apodemica* very apparent. The handbook began with a lengthy catalogue of *naturalia* and *artificialia* from an Ulm *Kunstammer*.⁶⁸⁷ Yet Zeiller categorized personalities too as collectibles. For example, under the heading “Art, Artists, Artworks, Collections, etc.” (“Kunst/Künstler/ Kunststücke/ KunstCammern/ u.”) Zeiller listed the commonplace of Drebbel. Under the same heading he continued to describe the contents of various *Kunstammern* across Europe.

Zeiller cited Christoph Besold's *Thesaurus*, Hegenitius' *Itinerarium*, and van Meteren's *Histories* as his sources for Drebbel.⁶⁸⁸ While Hegenitius and van Meteren drew upon

⁶⁸⁶ Martin Zeiller, *Handbuch von allerley Nützlichen Erinnerungen* (Ulm: Balthasar Kühn, 1655), preface. “Denselben nunhab ich auch nachfolgen wollen/ und zu Behueff der Gedächtnus/ etliche Theil solcher Locorum communium, ohne Ruhm zu melden/ gesamblet; auss denen ich/ so dann nich wenig in die im Druck verhandene traurige Historien/ Episteln/ Raissbücher/ Gespräch/ und andere Schrifftten/ gebracht habe. Dieweil aber die Materien hin und wider zerstreut/ und nicht eines jeden Gelegenheit es leidet/ alle derselen Bücher Register/ oder Anzaiger/ auffzuchlagen: Als hab ich die Mühe uber mich nehmen/ und gegenwärtiges Handbuch/ dem A/B/C/ nach/ verfertigen wollen.”

⁶⁸⁷ *Verzeichnus Unterschidlicher Thier/ Vögel/ Fesch/ Mergewächs/ Ertz-und Bergarten/ Edlen und anderen Steinen/ ausländischen Holtz und Früchten/ Kunst-und frembden Sachen/ Malereyen/ Muschel und Schneckwerck/ beydnischen und anderen Müntzen/ u. so in Herren Christoph Weicmanns Kunstammer in Ulm zu sehen.*

⁶⁸⁸ *Ibid*, 473. “Cornelius Tribbel/ oder von Trebbel zu Alckmar/ der/ noch vor wenig Jahr/ in Holland gelebt/ war ein berühmter Naturkündiger/ der die stätswärende Bewegung/ oder den ewigen Lauff/ erfunden; aus einem Kleid viel andere/ von mancherley Farben/ machen/ in einen Baum sich verwandlen/ allerhand Thier Form annhemen/ und anders mehr wunderlichs durch die Fernebildung/ oder SehKunst/ zuwegen bringen können. C. Besold in *Thes. Pract. Voc. Ewiger Lauff/ Lit. O. Pag. 591*, & Hegenitius, in *Itin. Frisio-Hollandico* pag. 73. seqq.

Meteranus lib. 29. hist. belg. im Jahr 1610 schreibt also von ihm: Cornelius Tribbel/ zu Alckmar in Holland/ hat jetzt underhanden ein Instrument/ oder ClaviCimbel/ welches von sich selbstn spielen soll/ durch Krafft der Sonnen-Stralen/ welcher Krafft/ und wann es schon in einem Keller stünde/ er darein zuführen und zuleiten/ weisst.”

Zeiller also noted in his *606 Episteln* (Marburg: Görllins, 1656), Vol. II, 840 Drebbel's ship which could sail underwater and search for pearls. “Cornelius Trebel von Alckmar/ dessen ich auch anderswo/ und seiner

(presumably in van Meteren's case) firsthand material, Besold's work was itself a treasury of material drawn from printed works (Besold had cited Morsius, Burggrav, and Staricius as his sources). Zeiller intended his handbook, taken in part from Besold's thesaurus, to serve in turn as a storehouse from which other writers would continue to draw in a continual flow of *loci communes* from one massive printed work to the next.

Zeiller wrote dozens of travel guidebooks and topographies based on his commonplaces without ever travelling himself. He fabricated print-based worlds populated by personalities who had achieved a certain citability. While such a use of print culture disembodied individuals from their particular contexts, it did not perforce create rational, internalized readers.⁶⁸⁹ Instead, we note, as Naudé may well have done, the rote repetition of commonplaces.

That such repetition was irrational did not make it ineffectual. The rhetorical commonplace depended upon affect, not reason, to persuade readers. That is why I refer to the commonplacing, rather than merely the citation of Drebbel. The commonplace was a highly theorized genre, attached to its origins in oratory and to the idea that a shared cultural reservoir could be persuasive. The citation of fact implied a truth value that the commonplace did not.

Stylistically, the matter of fact appeared "objective" and shorn of context, although based in a concrete reality. The commonplace, gathered together under heads and in arguments, associated particulars. While commonplaces were supposed to offer discrete

Sinnreichen Erfindungen/ gedacht/ hat eine Arth Schiffe auffgebracht/ welche under dem Strom gehen/ auch die Muscheln/ und Perlen/ suchen können."

⁶⁸⁹ This dynamic may well differ for manuscript commonplace collections, or those whose keepers manage to follow Montaigne's advice in the *De L'Institution De L'Enfant* to cannibalize on the authors one reads and digest their material into one's self. However, Montaigne himself claims to draw from Plutarch and Seneca like the Danaïdes, "remplissant et versant sans cesse." He may attach something of theirs to the paper of the *Essais*, but none of it sticks to him (J'en attache quelque chose à ce paier; à moy, si peu que rien"). Montaigne, *Essais*, Pierre Villey, ed. (Paris: PUF, 1999), 147.

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units which could be employed in any situation, as we will see in the case of Drebbel, commonplaces lodged within arguments. They accrued fellow-travelers and vestiges of rhetorical contexts which they then carried with them into the general circulation of information.

II: Humanism, Science, and the Idea of Progress

This emphasis upon a mainstay of classical rhetoric and dialectic might seem misplaced in a study of an artisan who prided himself on his ignorance of literature. Likewise, it might seem counter-intuitive to call upon the commonplace, whose force lies in its banality, to dissect the fame of a figure celebrated for his novelty.⁶⁹⁰ Yet the fame of Drebbel's innovations depended upon their integration into this time-honored technique of composition. Drebbel's celebrity was fashioned via the classical *locus communis*, and the fortunes of this unlettered artisan rose and fell with the practice of the commonplacing. Conversely, the integration of new, artisanal activities, for which we take the commonplacing of Drebbel as an example, into an ancient literary form revolutionized not only the rhetorical commonplace, but its relation, the dialectical *locus*, and even the philosophical axiom.

A study of Drebbel, a proponent of a new, empirical generation which prided itself on its "freedom" from old authorities, circulating as a rhetorical commonplace stresses the relationship between humanism and science. Until recently, while medieval philosophies were related to the advances of the Scientific Revolution, the bookish learning of humanists was seen merely as an obstruction in the face of progress. Such a dim view of humanism and science has been untenable for the last two decades.⁶⁹¹ However, given that the

⁶⁹⁰ For the benefits of banality, see the example provided by Grafton and Jardine in *From Humanism to the Humanities* (Cambridge, Mass: Harvard University Press, 1986), 133.

⁶⁹¹ Since the publication of Grafton's *Defenders of the Text: Traditions of Scholarship in an Age of Science, 1450-1800* (Cambridge, Mass: Harvard University Press, 1991).

commonplace was equally a scholastic as a humanist technique, a study of the philosophical or “scientific” *locus* also shows how *Späthumanismus* and Neo-Scholasticism can be newly linked with the emerging empirical culture of the seventeenth-century.⁶⁹²

The context in which Drebbel first started circulating as a commonplace was the battle of the ancients and the moderns. The debate between ancient and moderns had itself been a commonplace of rhetoric since antiquity.⁶⁹³ The particular competition between ancients and moderns in the seventeenth century has long been well-trodden ground in historiography.⁶⁹⁴ Yet, despite much critique, the standard reference is still R.F. Jones’ modernist *Ancients and Moderns* of 1936. Jones committed himself to the side of the moderns and equated progress with another admirable cause, the defense of reason.⁶⁹⁵

Attention to the goals of the commonplace genre allows us to substantially revise the modernist literature on the idea of progress and its relationship to reason. Jones treated some of the same primary texts I do here, such as George Hakewill’s 1627 *Apologie*. Yet Jones assumed a causal link between the idea of progress in the seventeenth century and the approaching Age of Reason. This assumption neglected the contemporary aim of the rhetorical commonplace employed by Hakewill and others not to prove, but to persuade. Jones also turned a blind eye to the numerous occult and magical inventions adduced as

⁶⁹² Cf. Charles Nauert, “Humanism as Method: Roots of Conflict with the Scholastics,” in *Sixteenth Century Journal*, 29, No. 2 (Summer, 1998), 427-438.

⁶⁹³ On the use of commonplacing within the commonplace debate of ancients and moderns from antiquity to the eighteenth century, with special attention to the Renaissance, see Robert Black, “Ancients and Moderns in the Renaissance: Rhetoric and History in Accolti’s Dialogue on the Preeminence of Men of his own Time,” *Journal of the History of Ideas* 43:1 (Jan., 1982), 3-32.

⁶⁹⁴ Classic works include J.B. Bury, *The Idea of Progress* (London: Macmillan, 1920) and R.F. Jones, *Ancients and Moderns: A Study of the Rise of the Scientific Movement in 17th Century England* (St. Louis: Washington University Studies, 1936).

⁶⁹⁵ On the need for a revised Jones, see H. F. Cohen, *The Scientific Revolution: A Historiographic Inquiry* (Chicago: University of Chicago Press, 1994), 158-9. For a critique of Bury and Jones, see Joseph M. Levine, “Ancients and Moderns Reconsidered,” *Eighteenth-Century Studies* 15:1 (Autumn, 1981), 77-9. Levine addressed the issue, however, by extending the study of ancients and moderns to literature rather than revising the material upon which previous authors dwelt, such as invention and the arts.

evidence of progress. Finally, as many have pointed out, Jones neglected the history of the debate of the ancients and moderns prior to the seventeenth century. Without ignoring the ancient pedigree of this debate and commonplacing itself, the changing nature of commonplacing and its relationship to philosophy in the sixteenth and seventeenth centuries helps to show how the debate of ancients and moderns did shift in early modern Europe.

We have already seen the contributions of the Hermetic revival, occult empiricism, and the perfective arts to the idea of progress in the early modern period. The Hermetic *Poemandres* offered an account of creation with no original sin, which linked knowledge of nature to knowledge of the divine, and which assumed man's ability to know and master the macrocosm. Within desiderata and related lists, we have seen the complicated understandings of the relationship between desire, folly, and invention in the period. Those arguing for modern invention recognized the dangerous but thrilling possibilities offered by the inventor's folly. Literature on progress in the seventeenth century was not as sober and rational as Jones would have us believe.

For example, Abraham von Franckenberg enthusiastically developed the idea of progress in his *Oculus Sidereus* of 1643. He wrote to support "judgment against prejudice" (*Judicium contra prae-judicium*) and the many new ideas, such as Copernicanism, of his time. Man had too long slumbered within a ravine, wrapped up in an "Imagination-Cloud," as though trapped in the prison of the Babylonian tower and possessed by fantastic dreams. A wake-up call had been sounded by the many new societies, including the college of the Lyncei in Italy, the Delft Rosicrucians, and the fraternities of Philadelphia and Aurora across Europe.⁶⁹⁶ von Franckenberg argued that the discovery of the new world and inventions not

⁶⁹⁶ Abraham von Franckenberg, *Oculus Sidereus* (Dantzig: Rhete, 1644), Preface. "COLLEGIUM Lynceorum . . . in Italien, Solis sive Aquilinum, in Deutschland; und Roseum, im Delphinat, neben anderen freyen Philosophischen Gesell-und Brüderschafftten besonders Philadelphiae und Aurorae, in Europâ.."

known to our forefathers - including guns, printing, organs, compasses, and telescopes - showed that discovery is possible.⁶⁹⁷

Many years before, in an effort to fulfill the desires of the *Liebhavern* of such rarities, he had starting collecting unbiased opinions on this matter from many authors.⁶⁹⁸ These included G.P. Schagen's description of Drebbel's perpetual motion machine as able to prove through living instruments what Copernicus could only do through reason. Rubens' account (found in Gassendi's life of Peiresc) of the fields, woods, buildings, and monuments which Drebbel saw upon the moon through his telescope demonstrated that the universe was full of other creatures.⁶⁹⁹ Such discoveries should prompt us to withhold our prejudice against any new idea, argued Franckenberg.

Occult empiricists also furthered the idea of progress based on empirical discovery rather than reason. Occult empiricists believed in the need for observation precisely because what they sought to discover was not discernable by human reason. Their discoveries

⁶⁹⁷ *Ibid*, IV. "Weldkundigen Exempeln und Schrifften von Erfindung der Newen Weld/ und unseren Vorgahren/ unbekandten Sachen/ als der Buchsenmeistery/ Buchdruckery schlag-und algemeinen Sonnen-Uhren: Item Orgelen/ See-Compass/ Meilenzeiger/ Fergesicht/ und dergleichen beym Cardano, Pancirola, Salmuth, Majero, und anderen Authoribus, als Verulamio de augmentis Scientiarum; Cusano, de Docta Ignorantia. . . ."

⁶⁹⁸ *Ibid*, IX. "Jedoch/ damit ich den Liebhaberen solcher raritäten und Wunderreden/ auf ihr angesuchtes Begehren/ in etwas möge willfahren/ wil ich/ zu mehrerem Anlass/ den Sachen weiter nach zudencken /nur das jehne wenige/ so ich etwa vor Jahren bey unterschiedenen Authoren, hievon/beydes in gemein/und dann auch insonderheit/ doch fast nur obenhin/ un ohn einiges wiederholen/ gelesen/oder auch mir Neulich zu handen gekom men/ kurtzlichen erzählen: und mich beynebenst dersehen/ es werde von gutten und unpartheyischen Gemüthern dahien verstanden und auffgenommen werden/ wie es von mir/ zu dero bedienstwilligung/ ohne einigen Verdurss/ Genuss/ oder Anhang eines oder des anderen theiles/ ja auch ohne einige Kunst-onder Hangst hafte Abtheil und Ausfuhung/ Schlact und Recht ist hiengesetzt und angemeinet worden."

⁶⁹⁹ *Ibid*, XIV. "So schreibet auch Gerhard Peters Schagen in der Vor Rede von der Ewigen Bewegung Cornelii Drebbels, 1607 zu Almar gedruckt: so diese wissenschaftt under den Sternkungigern gemeine whre/ so dürffte man nicht so viel Rechnens und abmessens mit den Planetent, und anderen Sternen, sondern, die SternKunst solte leichte seyne, und Copernicus würde blühten. Denn/ der bewiset mit Reden/ dass dass Erdrich alle 24. Stunden Rond umbgehet: aber dieser Alcmariische Philosophous Cornelius Drebbel, kan dasselbige nicht allein mit Reden/ sondern auch mit lebendigen Instrumenten berechnen."

XXXII: ". . . Telescope durch Cornelium Drebbel, (wie bey Petro Gassendo, in Vita Peireskii, p. 30 3 his fere verbis: Rubenius ante annos aliquod ad Peireskum scripsit, Heymum Pictorem perspexisse apud Drebbelium Opticum Tubum, diametri palmaris: quo liceret in disco Lunae discernere Campos, Sylvas, Aedificia & Munimenta locorum, nostratibus non abismilia &c zufinden)."

depended not upon universal truths accessible to each mind, but upon the accumulation of observations gathered by many practitioners. While grounded in the Hermetic corpus and other ancient sources, occult empiricists also believed they could rival the ancients with their discoveries.

The perfective arts, such as alchemy, was one area promising great possibilities for future progress. As discussed further in Chapter Five, in the perfective arts, man intervened in biological process and completed an imperfect nature. Such an ability assumed man's status as the perfecter of the divine handicraft. The perfective arts were often contrasted to the imitative mechanical arts, through which man could only imitate living nature through the use of weights, measures, and dead materials.⁷⁰⁰ The Fall placed the mechanical artist in the position of imitating what was already an imperfect imitation. The perfective arts offered the possibility of repairing the damage of the Fall.

Man's ability to transform and improve his world through art, to be the builder of his own fortune, was one reason why those disputing the idea of progress debated the possibilities of the arts. In a 1616 sermon, Godfrey Goodman, for example, argued that nature was corrupt and required correction. Yet he denied that the perfective arts granted man a status above nature. Goodman castigated the ugliness and weakness of imitation and the hubris of perfection alike.

. . . nature is to bee taught and instructed by her handmaid, to receiue her last and finall perfection from her vassall and slaue, that ill-fauoured ape, mistrisse Arte, forsooth, the learned gossip, which doth all things by imitation, taking her grounds and principles of action from nature; she must be sent for as a mid-wife to help the deliuerie: and hence issues such numbers and troupes of Artes, together with such infinite inuentions of men; and among others,

⁷⁰⁰ See A.J. Close, "Commonplace Theories of Art and Nature in Classical Antiquity and in the Renaissance," *Journal of the History of Ideas*, 30:4 (1969), 467-486, and "Philosophical Theories of Art and Nature in Classical Antiquity," *Journal of the History of Ideas*, 32: 2 (1971), 163-184, and Dennis Des Chene, *Physiologia: Natural Philosophy in Late Aristotelian and Cartesian Thought* (Ithaca: Cornell University Press, 1996).

the Chemicall Arte, though it deserues high commendation, being rare and wonderfull in her operations, yet with her vaine-glory and ostentation, shee hath greatly wronged and prouock't nature, in so much that if nature were not wholly cast downe and deieted, rather then she would endure the intolerable boasting and bragging of Mountbankes, shee would attempt the vttermost of her power.⁷⁰¹

The enthusiastic claim to authority apparent in the perfective arts perverted the natural order of things. All the “infinite inventions of men” and the “rare and wonderfull” operations of the “Chemicall Arte” provided still more evidence of the world turned upside down. Showing “how Art serues like a cobbler, or tinker, to peece vp the walles, and to repaire the ruines of nature” proved that “she is corrupted.” That nature was powerless to retaliate against the presumption of alchemical “Mountbankes” gave further tokens of her impairments.

Although Goodman claimed in his title that he proved his argument by the “*light of natural reason*,” in fact the same instances he adduced could be and were used to defend the opposite view. This was not a failing of the commonplace, but part of its purpose. Rhetorical commonplaces could be employed to opposite and conflicting ends, since rhetorical arguments persuaded readers not through logic, but through emotional resonance and sheer length. As we shall see, the acceptance of the idea of progress did not depend upon the irrefutability of the better argument, but upon the “uptake and citation” of the idea.

If the *desiderata* list was a compendium of the unknown and to be desired, the already known could be collected within a commonplace book. This technique dated to Ancient Greece. Tracking the history of commonplacing thus entails nothing less than tracing the shape of general knowledge in the western tradition. It is thus with good reason that

⁷⁰¹ Godfrey Goodman, *The fall of man, or the corruption of nature, proued by the light of our naturall reason Which being the first ground and occasion of our Christian faith and religion, may likewise serue for the first step and degree of the naturall mans conuersion* (London: Richard Lee, 1616).

commonplaces have received so much attention in the recent history of ideas.⁷⁰² I can only briefly review the history of the *locus* here before turning to its use in the fashioning of Drebbel's fame.

The notion of the *locus communis* (commonplace) stemmed from the *τοποι* (places) more generally. Places were an important tool for both the ancient rhetorician and dialectician. One could remember ideas by associating each unit idea with a place or object within a landscape which the speaker mentally traversed.⁷⁰³ The rhetor thus easily elicited a flow of examples, set speeches, or arguments. The dialectician used places as means of finding probable arguments.

In scholastic philosophy a distinction was drawn between philosophical and rhetorical *loci*.⁷⁰⁴ Philosophical *loci* were arguments intended for judgment by the faculty of reason in philosophy. Philosophical *loci* carried varying levels of probability, and at the uppermost end of the scale, there was little to distinguish between highly probable *loci* and the philosophical axiom which proved itself and alone offered necessary certainty. Rhetorical *loci*, by contrast, appealed to human emotions and were typically well-recognized sayings by revered authors. The two types of *loci* had similar features, but to different ends.

What was common about the common place? According to one definition common places were such general statements that they could be used in both dialectic and rhetoric, as

⁷⁰² The classic studies are Ann Blair, "Humanist Methods in Natural Philosophy: The Commonplace Book," *Journal of the History of Ideas* 53:4 (Oct. 1992), 541-551, *The Theater of Nature: Jean Bodin and Renaissance Science* (Princeton, NJ: Princeton University Press, 1997), and "Reading Strategies for Coping with Information Overload ca. 1550-1700," *Journal of the History of Ideas* 64:1 (Jan. 2003), 11-28; Sister Joan Marie Lechner's *Renaissance Concepts of the Commonplaces* (New York: Pageant Press, 1962); Ann Moss, *Printed Commonplace-books and the Structuring of Renaissance Thought* (New York: Clarendon Press, 1996); Richard Yeo, "Ephraim Chambers' Cyclopaedia (1728) and the Tradition of Commonplaces," *Journal for the History of Ideas* 57:1 (1996), 157-175.

⁷⁰³ For the arts of memory in medieval and early modern Europe see Mary J. Carruthers, *The Book of Memory: A Study of Memory in Medieval Culture* (New York: Cambridge University Press, 1990) and Frances Yates, *The Art of Memory* (London: Routledge and K. Paul, 1966).

⁷⁰⁴ Gillian Evans reviewed the history of the rhetorical and philosophical commonplaces in *Getting it Wrong: the Medieval Epistemology of Error* (Leiden: Brill, 1998). See especially Part Three, Chapter Two, "The Commonness of Shared Knowledge."

opposed to the specific places used in specific disciplines.⁷⁰⁵ Alternatively, the commonplace could be a general head under which specific places were gathered. However, as the term commonplace was used in the practice of “commonplacing” in early modern Europe, and as I use it here, a place was “common” when it was so well known as to belong to a shared fund of *loci*. The commonplace’s power to persuade or affect lay in its banality; the commonplace was so often repeated and so widespread as to gain the credibility of the familiar.

Just as the *desiderata* list changed over the course of the sixteenth-century from a homogeneous list of desired manuscripts to a miscellaneous hodgepodge of desires for future objects, books, machines, institutions, and ideas, so too did the system of rhetorical places become increasingly eclectic in this period. The early modern rhetorical place departed from the classical model in two important ways. It no longer needed to be either time-worn or literary. Facts about the natural world gained the status of commonplaces, and even exemplary modern artisans could be fashioned into a *locus*.⁷⁰⁶ Not only time-honored quotations, but extremely contemporary artificial and natural particulars were collected as places.⁷⁰⁷ The introduction of print and the increasing speed of communication in an emerging public allowed contemporary *loci* to become common, or shared, through rapid dissemination and repetition. *Loci* no longer needed to be of classical vintage to be persuasive; modern celebrity found a rapt audience, even as commonplacing naturalized in the vernacular.⁷⁰⁸

⁷⁰⁵ Moss (1996), 5.

⁷⁰⁶ As Ann Blair has noted, commonplaces drawn from various disciplines blurred the boundaries of natural history and natural philosophy.

⁷⁰⁷ Yeo (1996), 163.

⁷⁰⁸ Ann Moss, “Locating Knowledge,” *Cognition and the Book: Typologies of Formal Organisation of Knowledge in the Printed Book of the Early Modern Period*, Karl A.E. Enenkel and Wolfgang Neuber, eds. (Leiden: Brill, 2005), 47.

It was the utilitarian humanist ends of the rhetorical place that made such changes acceptable in comparison with the philosophical *locus*. The philosophical topic had to be kept pure of human fallibility; truth could only be found in a philosophy that answered to universal ends, rather than finite human desire. The philosopher thus carefully sifted *loci* in search of those of the highest probability.

By contrast, the rhetorical commonplace was intended above all to be persuasive. A rhetorical commonplace was judged by its success in convincing a human audience, not its claim to truth. Since the commonplace was expressly designed to work upon human emotions and desires, it is no wonder that commonplaces would change in tandem with the *desiderata*.

Indeed, humanists took pride in the flexibility of the rhetorical *locus*. As Evans has written, “In periods when rhetoric was in the ascendancy over logic the freedom and flexibility of argument the orators allowed themselves was a matter of pride in a higher art.”⁷⁰⁹ Therefore “a much looser usage of *locus* began to be common by the late fifteen and sixteenth centuries.”⁷¹⁰ Petrus Ramus dealt the final blow to the purity of the philosophical locus in his blatant disregard for Aristotelian disciplinary divisions and his blending of philosophy and rhetoric through “one method.”⁷¹¹

Ann Blair, in her study of Jean Bodin’s *Theater of Nature*, demonstrated how by the late sixteenth-century, a Ramist bookish lawyer felt free to intrude upon philosophical territory by transforming his very loose and eclectic natural-historical commonplaces back into natural philosophy. As a part of rhetoric, commonplaces ought to supply material for rhetorical composition, not for philosophy. However, as Blair has shown, Bodin made

⁷⁰⁹ Gillian Evans (1998), 143.

⁷¹⁰ *Ibid*, 144.

⁷¹¹ Robert Goulding, “Method and Mathematics: Peter Ramus’s Histories of the Sciences” in *Journal of the History of Ideas* 67:1 (Jan. 2006), 65.

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“natural philosophy out of natural history by offering new causal explanations” drawn from the eclectic *loci* he had gathered.⁷¹² Bodin’s very free use of natural historical *loci* in natural philosophy would never have passed muster in the adversarial climate of the scholastic disputation. As Blair herself pointed out, academic philosophers such as Bartholomew Keckermann who recommended reading the *Theater of Nature* as natural history criticized its author for confusing the proper disciplinary use of places.⁷¹³

As we shall see, in addition to the humanist ends which “the commonplace Drebbel” served, philosophical laymen sought to draw natural philosophical evidence from their commonplacing of Drebbel. This blurring of the roles of rhetorical and philosophical place spilled over even into professional practice. Semi-Ramist natural philosophers introduced the commonplace of Drebbel as philosophical *loci* into their academic disputations and works of natural philosophy.⁷¹⁴

III: Collecting Inventors

As discussed in Chapter One, Drebbel’s persona was not associated with a particular discipline. He was known as a man of universal ability. Even within the field of mechanical arts, he was a “polydaedalus” (a *Tausendkünstler*, or a mechanic of universal abilities). In some ways, this persona of universal ability hearkened back to the very beginnings of the history of invention. Catherine Atkinson, in her study of the influential historian of discovery Polydore Vergil (1470-1555), described how the panegyric celebration of beginnings started with “a clustering of inventions associated with one personality,”

⁷¹² Blair (1992), 544.

⁷¹³ *Ibid*, 549.

⁷¹⁴ By Semi-Ramist I refer to the natural philosophers who integrated some Ramist views with those of other authorities, such as Aristotle.

generally a divine one, such as the goddess Athena.⁷¹⁵ Over time, inventors were assigned to disciplines, leading to a new topos - the *laus artium* - celebrating the first inventor of each art. As Atkinson pointed out, we think today of Leonardo da Vinci as the typical universal man. Yet Polydore Vergil was far more interested in founders of traditions than in innovators, and thus more so in the ancient discoverers than in his contemporary Leonardo. The history of invention did not tip to the “idea of inventor as innovator” until the seventeenth century.⁷¹⁶

Atkinson argued that Vergil’s history was based on the genre of the *ordo artium*. Medieval encyclopaediae, according to Atkinson could be arranged either as an *ordo artium*, with a history of each man-made discipline, or as an *ordo rerum*, tracing the structure of the divinely ordained natural world. Within the *ordo rerum*, man was “the observer rather than the maker.” This “was a view of things which did not usually encompass culture or cultural achievements and even less so such anthropogenic objects and skills as the *artes mechanicae*.”⁷¹⁷ By contrast, the world of the *ordo artium*, was a contingent, completely man-made one, which yet fit together as a hierarchical system of disciplines.

Both the *ordo rerum* and the *ordo artium* would enter into the debate over the ancients versus the moderns. Was the natural order of things in decay? Did all arts originate in the ancient world, and have they only declined since then? Or, could man use art to build his world in a new way? The inventor of a “living” microcosm stood in an unusual position to these two genres, since he himself had invented a universal *ordo rerum*. In other words, he had built a new nature through art. This was one reason why the perpetual motion in particular appeared so frequently in debate in a period questioning the order of both things and arts.

⁷¹⁵ Catherine Atkinson, *Inventing Inventors in Renaissance Europe: Polydore Vergil’s De Inventoribus Rerum* (Tübingen: Mohr Siebeck, 2007), 23.

⁷¹⁶ *Ibid*, 2.

⁷¹⁷ *Ibid*, 127.

While Vergil's *ordo artium* accentuated the ancient founders of the arts, in the seventeenth century we will find greater emphasis upon the competition between ancients and moderns. Drebbel's fame as the inventor of the perpetual motion in particular grew in part from his status as competitor in the position with an ancient, Archimedes. Drebbel's perpetual motion machine was easily fashioned into a commonplace because of its relationship to the deeply alluring commonplace of the Archimedean sphere.⁷¹⁸ This comparison was one which Drebbel himself first made, and which subsequently enjoyed a long history of repetition in print. Christoph Lüthy argued similarly concerning the relative fame of the telescope in the seventeenth century and the lack of renown of the microscope. The search for the telescope had long been guided by tales of ancient inventions that allowed one to see from afar, and thus its discovery fulfilled a widely held fantasy.⁷¹⁹

Drebbel's perpetual motion was far more frequently cited than other inventions for which he is far better known today, such as the submarine. Drebbel's submarine fulfilled a widely held contemporary desire, and it was also an exceedingly public invention; Drebbel demonstrated the submarine in the presence of the King. Furthermore, the submarine enjoyed a literary life after the death of its inventor in philosophical discussions on the nature of air. Yet as a rhetorical commonplace it could not compete with Drebbel's celebrated perpetual motion.

As discussed further in Chapter Six, a particular line of philosophical reception for Drebbel's submarine stemmed from Boyle's citation of it in *New experiments physico-mechanical, touching the air*, where Boyle says he has not "found it mentioned by any Writer." Boyle's

⁷¹⁸ Drake-Brockman in her article "The Perpetuum Mobile of Cornelis Drebbel" in *Learning Language, and Invention: Essays Presented to Francis Maddison*, ed. W.D. Hackmann and A.J. Turner (Paris: Variorum, 1994) mentioned the "Archimedean" nature of the reception of Drebbel's machine, and cited several examples.

⁷¹⁹ Christoph Lüthy, "Atomism, Lynceus, and the Fate of Seventeenth-Century Microscopy," 3-4. For another examination of the importance of legends of lost devices in the process of discovery, see Eileen Reeves, *Galileo's Glassworks: the Telescope and the Mirror* (Cambridge: Harvard University Press, 2008).

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account confirms that the submarine rarely surfaced in writing, although the ship had in fact been mentioned in passing a few times before then. In 1624 the historian Willem Baudartius concluded his lengthy account of Drebbel's perpetual motion by adding as an aside that "the same Cornelis Drebbel also made Ships that travel under water, as well as other wonderful Instruments, such as Glasses through which men can see very far. . . ." ⁷²⁰ The "Rosicrucian" Petrus Mormius praised Drebbel's industry in building the submarine in 1630. John Jonston mentioned the submarine in his *Constancy of Nature* of 1632. ⁷²¹ In Georg Stiernhelm's macaronic play, *Astro-poeticus* of circa 1660, Neptune (standing in for Denmark), asked Argonavis (the Dutch) why they couldn't build a ship to fly in the air or under ice like Drebbel's with which to attack the Swedes. ⁷²² While Drebbel's ship may have been talked about (as Neptune said, "Fama est Drebellium tales reperisse carinas"), it did not, like Drebbel's perpetual motion, join a select pantheon of the most commonplace inventions in the early seventeenth-century.

It was here in the uneven citation of Drebbel's inventions that the power of the commonplace showed itself. The reason for this imbalance did not lie in the appeal of the invention alone; seeing very far and traveling under water evoked levels of desire comparable

⁷²⁰ Boyle, *New Experiments Physico-Mechanicall, Touching the Spring of the Air, and its Effects* (Oxford: H. Hall, 1660), 106; John Wilkins, *Mathematical Magick* (London: Gellibrand, 1648), 179; Willem Baudartius, *Memorien* (Arnhem: Jan Jansz., 1624), Book II, 146. "Noch heeft de selfe Cornelis Drebbel gemaect Schepen die onder het water varen ende noch ander wonderbaerlicken Instrument/ als Brillen daermen heel verde mede sien can Item Brillen daermen snachts door sien can &c."

⁷²¹ The submarine also appeared in mathematical and physico-mathematical works prior to Boyle's such as Mersenne's *Cogitata Physico-mathematica* of 1644 and John Wilkins' *Mathematical Magick* of 1648.

⁷²² Georg Stiernhelm, "Discursus Astropoeticus Mixtus et comicus seu Relationes et Revelationes Sijdereae De Phaenomenis Coelestibus et Consultatione Deorum," *Samlade Skrifter av Georg Stiernhielm*, VIII, Johan Nordström, ed (Lund: Carl Blom, 1973), 230. "Kanstu my dat niet doen, siquidem sat possis in arte, Makt een skeep, volitet levibus super aequora pennies
Aut quae sub bölljis nunc possit simmere diupis [sic];
Fama est Drebellium tales reperisse carinas,
Nun were daet maer fray de dat kont maeken in Holland,
Inde per Oceanum denso seglare sub Jso.
Ich geb ghy min landt, glacies cui litora cingunt." See E.H.G. Wrangel, *De betrekkingen tusschen Zweden en de Nederlanden op het gebied van letteren en wetenschap, voornamelijk gedurende de zeventiende eeuw* (Leiden, Brill, 1901), 393.

to those inspired by the possession of perpetual motion. The deciding factor was the already existing fund of commonplaces.

Contemporary places by no means superseded the classical *loci*. Instead, the new *loci* joined the already common stock of knowledge. The relationship between a new *locus* and the already existing *loci* was important. In practice, *loci* were collected together in commonplace books under general heads. Furthermore, when put to use, they were intended to form a stream of *copia*; just as the ancient rhetor easily moved through the spaces of his memory palace or landscape, citing the *loci* he passed along the way, the early modern writer, once he began to dilate upon his theme, did not stop until he exhausted the fund of *loci* he had collected under that general head. If a particularly attractive stream of commonplaces already existed, it was a simple matter to add new *loci* that fit the same theme. Once these contemporary *loci* were collected alongside their powerful classical predecessors, they were cited together with the more time-worn *loci* in the same knee-jerk reaction.

The early modern *desiderata* list could seem an entirely futuristic practice compared with the hoary custom of commonplacing. Yet, as we have seen, the classical *loci* themselves were one way to organize a *desiderata* list. Tales of the lost wonders of the ancient world, the *deperdita*, filled many a list of desires. Such lost arts, as listed by Jakob Bornitz in his 1625 *Tractatus Politicus de Rerum Sufficientia*, included “malleable glass, the glass sphere of Archimedes, the flying wooden dove, mute music, molded stones and columns, universal medicine and the philosophers’ stone, and clothes of purple.”⁷²³

Of course, Drebbel’s submarine, self-regulating oven, and other novel inventions could also have joined the time-honored commonplace of the three modern inventions, the

⁷²³ Jakob Bornitz, *Tractatus Duo* (Frankfurt: Weiss, 1625), 224. “Amisimus vitrum flexile, seu ductile; sphaeram Archimedis vitream. Columbam ligneam volatilem. Musicam mutam. Lapidem et columnas fusas. Medicinam catholicam et lapidem Philosophorum, vestimenta ex purpura et bysso.”

nova reperta. Gunpowder, printing, and the mariner's compass formed a trio precisely because they had no ancient counterparts.⁷²⁴ Only rarely do we find Drebbel's other inventions joining a list of *nova reperta*. One example we have encountered was Johann Daniel Major's description of Drebbel's torpedo as an extension of the invention of gunpowder.⁷²⁵ Yet the fame of Drebbel's perpetual motion far outstripped that of his other inventions.

The persona of the inventor might be another factor augmenting the fame of the perpetual motion. The comparison of Drebbel's sphere and Archimedes' also entailed a comparison between the personas of Drebbel and Archimedes. In a period inventing the idea of the inventor, Archimedes offered the ultimate ancient example of someone with unlimited abilities to know nature through his art. Drebbel claimed to surpass Archimedes, and those arguing in favor of the moderns versus the ancients seized upon this enthusiastic claim. The comparison of Drebbel and Archimedes was far more useful than that between Drebbel and Gutenberg or Coster, although as we will see, that comparison was made too.

The relationship between Drebbel and Archimedes also joined Drebbel's sphere to a group of other commonplaces, and thus to other pairs of ancient and modern inventors. For example, one of the famous lost arts mentioned by Bornitz was Archytas' flying dove, which bore comparison with the modern Regiomontanus' fly and eagle. We will frequently encounter this cadre of Archimedes, Drebbel, Archytas, and Regiomontanus as a cluster of commonplaces.⁷²⁶

⁷²⁴ Roy S. Wolper, "The Rhetoric of Gunpowder and the Idea of Progress," *Journal of the History of Ideas* 31:4 (1970), 589-598.

⁷²⁵ Cited in the Introduction, *See-Earth nach der Neuen Welt ohne Schiff und Segel* (Hamburg: G. Wolffen, 1683), 7.

⁷²⁶ This cluster also picked up other fellow travellers. The ancient Greek Memnon's pneumatic speaking statues competed with the brass talking head of the modern Roger Bacon and Drebbel's pneumatic self-playing clavier. Minsoo Kang similarly followed a cluster including Daedalus, Hephaestus, Egyptian Idals, Boethius, and speaking heads from Cornelius Agrippa (1533) to Florentius Schuyt (1662) in "Wonders of Mathematical Magic: Lists of Automata in the Transition from Magic to Science, 1533-1662," *Comitatus*, 33 (2002), 113-139.

IV. The Archimedean Sphere in Early Modern Europe

Almost the entire complement of classical sources concerning the Archimedean sphere known to early modern Europe was cited by the reverend Thomas Powell in his *Humane Industry* of 1661, to which we will return.⁷²⁷

ARCHIMEDES of *Syracuse* was the greatest Mathematician and the rarest Engineer that was in his time, or hath been ever since (as 'tis believed) both for the *Rational* and *Chirurgical* part, the *Theory* and the *Practick* of the Mathematicks. *Cicero* calls him *Divinum ingenium*, 2^o *de natura Deorum*. He was not only, *Caeli Syderumque Spectator assiduus* (as *Livy* speaks of him) a diligent Spectator of the heavenly Orbs and their Motions; but also *Cyclorum & Staticorum indagator acerrimus*, as the same *Livy*, a great Experimentator and devisor of Mechanical Motions and Inventions. He was the first, *qui stellarum errantium motus in Sphaeram illigavit*, saith *Cicero*, 1^o *Tusc.* that made a Sphear and an artificial heaven, wherein he did represent the rotations and revolutions of the Planets, and that with as true time and measure as they perform the same above. Of this Sphear *Claudian* hath an Epigram that acquaints us with some thing of the Fabrick of it.

Jupiter in parvo cùm cerneret aether vitro;
Risit, & ad superos talia dicta refert.
Huccine mortalis progressa potentia curae:
Jam meus in Fragili luditur orbe labor.
Jura Poli, Rerumque fidem, Legésque Deorum,
Ecce Syracusius Transtulit arte Senex
Inclusus variis famulatur Spiritus astris,
Et vivum certis motibus urget opus.
Percurrit proprium mentitus signifer annum,
Et simulata nove Cynthia mense redit.

Translated thus by M^r *Nathaniel Carpenter* in his *Geography*.
In a small Glass when *Jove* beheld the skies,
He smil'd, and thus unto the Gods replies;
Could man extend so far his studious care,

⁷²⁷ Thomas Powell, *Humane Industrie or, A history of most manual arts deducing the original, progress, and improvement of them: furnished with variety of instances and examples, shewing forth the excellency of humane wit* (London: Henry Herringman, 1661). Powell was Henry Vaughan's closest friend, and more information on Powell can be found in Francis Hutchinson's *Henry Vaughan: A Life and Interpretation* (Oxford: Clarendon Press, 1947). The classical sources on the Archimedean sphere are cited by Johann Albert Fabricius, *Bibliotheca Graeca*, Lib. III (Hamburg: Christian Liebezeit, 1716), 552-3. "Sphaera vitrea, qua miro artificio, lunae, solis & quinque errantium motus illigavit, teste Cicerone 2. De natura Deor. p. 379. edit. Lescaloperii, & 1 Tusc. quest. p. 193. edit Camerarii. Meminit & Claudianus eleganti epigrammate p. 257. edit Heinsii, & Sextus Empiricus VIII adversus Mathematicos pag. 329. Lactantius II.5. Firmicus lib. V. pag. 77. & Marcianus Cappella lib. 6. pag. 191, Ovidius VI, fastor. v, 277."

To mock my labours in a brittle sphear?
Heavens Laws, Mans Ways, and Natures Sovereign Right
This Sage of *Syracuse* translates to sight.
A soul within on various Stars attends,
And moves the quick Work into certain ends;
A feigned Zodiac runs its proper year,
And a false *Cynthia* makes new months appear.
And now bold Art takes on her to command,
And rule the heavenly Stars with humane hand.
Who can admire *Salmoneus* harmless Thunder,
When a slight hand stirs Nature up to wonder?

This is mentioned also by *Ov. 6. Fast.*

Arte *Syracusia* suspensus in aere clauso
Stat Globus, immensi parva figura poli.

From that description of *Claudian*, we observe first, That this Machin did move of it self, it was an *Automaton*, a selfmoving device; and which moved regularly by certain laws,

Et Vivum certis, motibus urget opus.
As the Poet saith.

2. We learn from him, that these motions were driven and acted by certain *Spirits* pent within.
Inclusus variis famulatur spiritus astris.⁷²⁸

From the classical rhetorical accounts of the Archimedean sphere, Powell drew certain physical particulars about its principles of motion: namely 1. that it was an automaton, and 2. that it was run by spirits (i.e. pneumatically).⁷²⁹ In the *locus classicus*, Claudian's epigram, we also read that the device displayed the workings of all the universe; the Archimedean microcosm was a specialized space for demonstrating the workings of the natural world, or a laboratory *avant la lettre*. The Archimedean microcosm therefore offered an especially rich reservoir of natural knowledge.

⁷²⁸ Powell, 15.

⁷²⁹ Powell continued to cite further the physical conclusions which a natural philosopher, Athanasius Kircher, attempted to draw from these accounts. "About which spirits *Kircher* hath often beaten his brains, what to make of them, that he might know what was the inward principle of motion in that machin: But after all his study and scruting, he could never find it out, but he contends that the Circles of that Sphear were of brass, and the out-side (only) was of glass or specular stone, (which the Poet might call *vitrum*, glass, for the perspicuity of it)."

Yet, beyond the natural philosophical enigma of the machine's workings, other conclusions could be drawn from the classical accounts cited by Powell. The Archimedean sphere represented mankind's greatest challenge to the gods; as Cicero stated, man showed himself to be divine through the construction of his own microcosm. The device was used not only to heighten the general status of man along the chain of being, but of those men with the greatest claim to power. Microcosms had long symbolized imperial power.⁷³⁰ This sphere in particular was associated with royalty from the original King Archimedes of Syracuse onwards. Thus we find it appearing in celebrations not only of man in general, but of imperial rule in particular.

The ready-made arguments provided by these *loci* carried over into the discussion of modern inventions, Drebbel's included, associated with the classical sphere. William Newman, in *Promethean Ambitions*, has shown how perfective alchemy successfully transgressed the art and nature divide and elevated man's abilities through the creation of the artificial *homunculus*. The Archimedean sphere was another clearly defined field supporting the same ambitions in the seventeenth-century as man proved he was divine through the creation of a living microcosm.⁷³¹ Early modern writers brought the classical Archimedean *loci* as witness to the greatness of man, and early modern writers on progress offered modern *loci* competing with Archimedes to show that greatness of man was on the rise.

Drebbel's perpetual motion was not the first microcosm to be considered a modern "Archimedean sphere." A series of other modern globes and planetaria had previously been

⁷³⁰ Percy E. Schramm, *Globus, Sphaira, Reichsapfel* (Stuttgart: A Hiersemann, 1958).

⁷³¹ William Newman, *Promethean Ambitions: Alchemy and the Quest to Perfect Nature* (Chicago: University of Chicago Press, 2004). The chemical creation of the microcosm was compared to the construction of the homunculus by Praetorius in "Von Chymischen Menschen" in *Anthropodemus Plutonicus* (Magdeburg: Lüderwald, 1666), 147. "In ubrigen mercke noch dieses das ich oft gelesen habe, wie die *Chymic* und *Alchymisten* bey ihrer *Medicinã universali*, oder Verfertigung *Lapidis philosophorum*, in denen *distillir* Gläsern die Erde/ den Himmel/Sterne/Vögel/ Blitzen/Regenbogen/Wolcken/das Meer/Fische &c. praesentiren drinnen *vide* obberühmtes *scriptum* Herrn Ristii (referring to the *Alleredelsten Thorheit* of Johann Rist, discussed above)."

commonplaced alongside the Archimedean sphere. Before Drebbel, the most frequently cited “Archimedean spheres” were a glass planetarium allegedly built by Sapor, the Persian King, and a silver globe sent as a gift by the Holy Roman Emperor Ferdinand to the Ottoman Emperor Suleiman. This silver planetarium had previously belonged to Maximilian I and was given to Suleiman in 1541.⁷³² These globes served in the same arguments, alongside the Archimedean sphere, supporting the power of man in general and imperial power in particular.

Above all, the spheres of Sapor and Ferdinand illustrated the divine nature of Kings, and man’s imperial control of nature. The image of an Archimedean microcosm which could be held in the hand like an orb was one way to illustrate a king’s complete control. Sapor’s sphere, however, was actually a planetarium, so large that Sapor could enter it. His majesty was signaled by the position he assumed on top of a central earth within the planetarium, from which he could survey the heavens. As Boaistuau said in his 1558 *Discourse on the Dignity and Excellence of Man*, what better way could the power of a King be illustrated, who seemed to possess not only the world, but the stars, the heavens, and the domicile of God?⁷³³

While the sphere of Sapor typically celebrated the power of the monarch who could marshal such resources, it could also commend the powers of the unnamed artisan who created the sphere. This was the tack taken by Hans Jakob Christoffel von Grimmelshausen in *Der Abenteuerliche Simplicissimus Teutsch*. Grimmelshausen argued in Book 2, Chapter 10 that the nobility of the artist equaled the nobility of the knight. He listed eight examples, ranging

⁷³² Gürlü Necipoğlu, “Süleyman the Magnificent and the Representation of Power in the Context of Ottoman-Hapsburg-Papal Rivalry,” *The Art Bulletin* 71:3 (Sep., 1989), 416.

⁷³³ Pierre Boaistuau, *Bref discours de l'excellence et dignité de l'homme (1558)* (Geneva: Droz, 1982), 16. “*Quel Miracle en nature se peut trouver plus grand que ceste machine de vitre que fist construire Sabor Roy des Persiens? laquelle estoit si grande, qu'il estoit assis au centre d'icelle, comme en la sphere et rondeur de la terre, voyant sous ses pieds les astres, et estoilles, qui se couchoient et levoient: en sorte que combien qu'il fust mortel, il sembloit estre sur toute la haultesse et expectation d'immortalité. Quelle chose plus grande et divine peut tomber au sens des hommes, spécialement à un Roy qui possede tout le monde, qu'après la possession des terres et mers, il semble posseder les astres, le ciel, et le domicile de Dieu.*”

from Apelles to the inventor of moveable type, and among them, the inventor of Sapor's globe.⁷³⁴ Here a recognized commonplace typically used to celebrate the power of the King was turned on its head to comic effect. In Grimmelshausen's use of the *locus*, the anonymous artisan, rather than his royal patron, receives praise for the globe.

This amusing use of the *locus* pointed to a serious tension in the heart of the Archimedean commonplace; Archimedes was both King and artificer, but these roles separated in subsequent "Archimedean" spheres. The commonplacing of modern spheres alongside the Archimedean globe set up a *paragone* or competition between both modern and ancient invention, and modern artisan and the royal Archimedes. Drebbel entered this contest and successfully competed with all modern Archimedean contenders to become the most cited example of a modern Archimedean sphere.

As a sign of the heights of fame it achieved, Drebbel's sphere could even be used to explain the Archimedean sphere, rather than the other way around, as in Nathaniel Carpenter's *Geography*, where Carpenter noted that "this Spheare of *Archimedes* I take to be more then an ordinary Globe commonly vsed amongst vs, as may appeare by the Poëts description; so that it may rather be likened to the Spheare, lately composed by *Cornelius Trebelius*, and presented vnto *King Iames*."⁷³⁵

It is the off-handed nature in which Drebbel's sphere appeared in contexts not particularly related to it that indicated its success as a commonplace. The very banality with which Andrea Rainieri, in his 1693 biography of Saint Anselm, complained that the artisan depicting the saint in a globe of fire, did "not have the ingenious hand of an Archimedes, or

⁷³⁴ Hans Jakob Christoffel Grimmelshausen, [1669] *Der Abenteuerliche Simplicissimus Teutsch* (N.A.: Elibron, 1975) 117. "Wer wollte nicht vor andern Menschen preisen denjenigen, der dem persischen König Sapor ein gläsernes Werk machte, welches so weit und groß war, daß er mitten in demselben auf dessen Centro sitzen und unter seinen Füßen das Gestirn auf- und niedergehen sehen konnte?"

⁷³⁵ Nathaniel Carpenter, *Geography* (Oxford: John Lichfield and William Turner, for Henry Cripps, 1625), 162.

a Drebbel, to represent in miniature the ample orbits of the Heavens” proved that Drebbel had truly arrived as an Archimedean commonplace.⁷³⁶ But how did Drebbel first become “Archimedean”?

Drebbel himself began the process of packaging his invention as Archimedean. In his letter to King James I on his perpetual motion, we find the only citation of any author, ancient or modern, which Drebbel ever made. “Cicero writes that Archimedes made a Sphere which moved perpetually following the orbit of the heavens” said Drebbel.⁷³⁷ The Archimedean sphere, however, was destroyed by war; now this ancient art had been recovered in his own device.⁷³⁸ The magnetic attraction of the Archimedean commonplace was so great that it was able to elicit this very atypical citation from Drebbel.

When Drebbel’s friend the bookseller G. P. Schagen published this letter to King James, he vastly expanded the commonplace context of Drebbel’s perpetual motion. The pamphlet was printed by Jacob de Meester in Drebbel’s hometown of Alkmaar (alongside the first Dutch translation of the Hermetic *Poemandres*) with several Archimedean commonplaces advertised on the title-page.

*Wonder-invention of the perpetual motion/ brought about by the Alkmaarian
Philosopher Cornelis Drebbel through a perpetually moving spirit enclosed in a
Sphere. . . / Here too is also the evidence which Cicero/ Claudian/ and
Lactantius/ gave of the perpetual motion/ which Archimedes is supposed to*

⁷³⁶ Andrea Rainieri, *S. Anselmo Arcivescovo Cantuariense: Istoria Panegirica*, (Modona: Cassiani, 1693), 25. “la mano ingegnosa d’un Archimede, ò d’un Drebelio, per riportare in piccolo gli ampi cerchi de Cieli. . . .” Rainieri footnoted, “Globum primisit perpetuo secundum cursum aetheris singulis vigintiquattuor horis semel circumrutatitem, qui vel mille annis ne semel falleret; ostendentem annos, menses, dies, horas, cursum Solis, Lunae, omnium Planetarum, & Stellarum, quarum motus omnibus notus. Sed & eidem (Jacobo Britonum Monarchae) & Imperatori gloriosissimo II praestiti, tradiditque opus, supra mortalium naturam, &c. Andr. Beyer. in addit. ad Selden, ad Cap. 3. Solin. ap. Simon. Maiol. Dier. Canic. colloq. 22.” In turn, Andreas Beyer, in the notes he appended to John Selden’s *De Diis Syriis* (Lipsiae: Cöernerus, 1668), 48, cited Christoph Peller’s citation of Hegenitius’ *Itinerarium* in Peller’s *Politicus Sceleratus Impugnatus* (Nürnberg: J. A. Endtner, 1663), as well as Drebbel’s own letter to King James I, in Joachim Morsius’ edition of 1621.

⁷³⁷ Cicero discussed Archimedes’ globe in *De re publica*, I, 21-22.

⁷³⁸ Cornelis Drebbel, *Wonder-vondt van de eeuwighe bewegingh* (Alkmaar: Jacob de Meester, 1607), 60. “Cicero schrijft dat Archimedes had een Spheer ghemaect die hem eeuwelyc na den loop des Hemels konde bewegen. . . .”

*have discovered. Also from Bartas about Ferdinand who also sent a perpetual motion to the Turkish Emperor in Constantinople.*⁷³⁹

From the very beginning, Schagen encased the machine in a carapace of citations. In addition to the classical quotations concerning the Archimedean sphere, Schaghen cited another modern “Archimedean sphere,” the globe sent by Emperor Ferdinand to the Sultan and described by the French Huguenot poet du Bartas.

The citation of du Bartas set the literary landscape in which Drebbel’s machine made its first appearance. The poetry of du Bartas was highly popular among poets in Holland, inspiring the literati surrounding Karel van Mander such as Schagen’s own cousins and Drebbel’s good friend Ijsbrandt van Rietwyck.⁷⁴⁰ Du Bartas’ poems on Archimedes, Sapor and Ferdinand would frequently travel in the company of the Drebbelian commonplace, along with Claudian’s epigram on the Archimedean sphere. These poetic precedents ensured that Drebbel’s perpetual motion would be celebrated in verse by poets such as Hugo Grotius, Jacob Revius, and others.

An early example could be found in the letter written by the Dutchman Marcellus Vranckheim to the German alchemist Johann Ernst Burggrav (who later translated and published Drebbel’s *On the Nature of the Elements* in Latin and German). First printed in Franeker in 1611 (re-issued in Frankfurt in 1629 and 1630), Marcellus Vranckheim’s thirty-nine page letter praising modern Dutch inventions featured one of the earliest and most

⁷³⁹ Wonder-vondt van de eeuwighe bewegingh/die den Alckmaersche Philosoph Cornelis Drebbel/ door een eeuwig bewegende gheest/ in een Cloot besloten/ te weghe ghebrocht . . . Hier is oock noch de getuyghnis/ die Cicero/Claudianus/ en Lactantius/ gheven van de eeuwighe bewegingh/ die Archimedes gevonden soude hebben. Oock uyt Bartas van Ferdinand/ die oock mede een eeuwighe bewegingh aen den Turkschen Keyser/ tot Bysants ghesonden heeft.

⁷⁴⁰ L. Strengholt, “Twee Alkmaarse Dichthers uit het Begin van de Gouden Eeuw: Pieter Jansson Schaghen en Cornelis Pietersson Schaghen” in van der Bijl, M. et al, eds., *Van Spaans Beleg tot Bataafse Tijd: Alkmaars Stedelijk leven in de 17de en 18de Eeuw* (Sutphen: De Walburg Pers, 1980), 127. Both P. J. Schagen and van Rietwijck contributed to the *Nederduytschen Helicon*, also printed by Jaacob de Meester. Boukje Thijs, *De hoefslag van Pegasus: een cultuurhistorisch onderzoek naar Den Nederduytschen Helicon (1610)* (Hilversum: Verloren, 2004), 34 and 64.

hyperbolic accounts of Drebbel's perpetual motion.⁷⁴¹ Vranckheim thoroughly reworked the classical Archimedean *locus* to apply it to Drebbel, re-writing Claudian's epigram to fit Drebbel, the "second Archimedes."⁷⁴² Vranckheim's deep engagement with the wildly popular Archimedean *locus* made his account of Drebbel's creation particularly attractive. His even-handed praise of both Drebbel's patron King James I and the artisan, "The king is worthy of that second Archimedes; the Batavian Archimedes is worthy of that great king," would be cited by other authors (as Powell, below, quoted, "*Dignus rex Archimede isto altero; Dignus Archimedes Batavus magno illo rege*").

The English minister Thomas Tymme provided another early and highly influential account in his *A Dialogue Philosophicall* printed in London in 1612. Despite the philosophical themes of Tymme's work, Tymme explained how he believed a citation of Drebbel would "move" his human readership in a rhetorical appeal to the emotions. "And for that rare things moue much," wrote Tymme, "I have thought it pertinent to this Treatise, to set before thee a most strange and wittie inuention of another *Archimedes*, which concerneth Artificiall perpetuall motion, imitating Nature by a liuely patterne of the Instrument itselfe, as it was presented to the Kings most royall hands, by *Cornelius Drebbel* of Alchmar in Holland. .

⁷⁴¹ Vranckheim began his career as Constantijn L'empereur's private tutor until 1608. He then was sent abroad to study at the expense of his patron, and defended in 1609 the theses *ZHITHMATA Quaedam ex V.I. & Politica miscellanea. . . in augustissimo Rauracorum Athenaeo, Pro Doctorali in V.I. Laurea & insignibus. . . Nonis Julian, loco & horis praestitutis*. Basileae: Joan. Jacobi Genathi, 1609, and *MELETEMATA Quaeda Ad L.XIIX.C. De TRANSACT. dirigente clavum Icto Germaniae incomparabili Hermanno Vulteio Inchytae Hujus Mauritianae Procancellario, illustrissimi Principis Mauritii, in augustiss. Ictorum Athenaeo horis solennibus stabe xiv. Kal. Jun. Marpurgi Cattorum: Ex Officina Rodolphi Hutwelckeri*, 1609. He then returned to Zutphen where he was appointed rector of the Latin school. See Peter T. Van Rooden's *Theology, Biblical Scholarship and Rabbinical Studies in the Seventeenth Century*, 21, and Friedrich Nettesheim's *Geschichte der Schulen im alten Herzogthum Geldern* (Düsseldorf: Bagel, 1881), 331. Vranckheim wrote his letter a few month's after earning his degree, signing it Dec. 1609 (IIIX Kal Decem CIC. ICC. IX. Patavii Anten.)

⁷⁴² Marcellus Vranckheim, "Epistola" in Johann Ernst Burggrav, *Biolychnium* (Franeker: Balck, 1611). „Claudiani illud alter ab Archimede noster hic Architectus audiat. Jupiter in parvo cum cerneret Aethera Vitro,/ Risit, & ad Superos talia dicta dedit:/ Huccine mortalis progressa potentis curae?/ Iam meus in fragili luditur orbe labor/ Iura poli, rerumque fidem, legesque deorum./ Ecce tibi Batavus transtulit arte senex. &c.”

. . .”⁷⁴³ Such rhetorical usage of Drebbel’s work did indeed have the anticipated affect upon his audience; both Vranckheim and Tymme’s Drebbelian *loci* would be cited again and again over the course of the seventeenth-century.

V. Artifactual: Drebbel among the Commonplaces of Invention

As in the case of Boaistuau cited above, *loci* concerning the arts had a well-established place in sixteenth-century humanist “progress literature” defending an optimistic conception of man’s abilities.⁷⁴⁴ The writers of several English treatises arguing for the progress of the arts and the ability of man continued this trend in the seventeenth-century. For example, the full title of Nathaniel Wanley’s *The Wonders of the Little World* (1673) was *The wonders of the little world, or, A general history of man in six books: wherein by many thousands of examples is shewed what man hath been from the first ages of the world to these times, in respect of his body, senses, passions, affections, his virtues and perfections, his vices and defects, his quality, vocation and profession, and many other particulars not reducible to any of the former heads: collected from the writings of the most approved historians, philosophers, physicians, philologists and others*. Wanley emphasized the *copia* of his material (*many thousands of examples*), his eclectic and dependable sources (*most approved historians, philosophers, physicians, philologists and others*). He also showed that he had followed a method in his text, but has not allowed it to restrain him to mere generalities; he included “*many. . . particulars not reducible*” to the general heads he had already mentioned.

⁷⁴³ Thomas Tymme, in the unpaginated letter “To the Reader” in his *A Dialogue Philosophicall. . . . Together with the witty invention of an Artificial perpetuall motion, presented to the Kings most excellent Maiestie* (London: Clement Knight, 1612).

⁷⁴⁴ Louis Le Roy cited the classic trio of modern inventions, printing, the compass, and guns, in *InterChangeable Course, or Variety of Things in the Whole World, and the Councurrence of Armes and Learning, thorough the first and famousest Nations, from the beginning of Civility, and Memory of man, to this Present*. trans. R.A (London: Charles Yetsweirt, 1594), 110-112. Cf. E. Zilsel, “The Genesis of the Concept of Scientific Progress,” *Journal of the History of Ideas* 6 (1945), 325-349. See A.C. Keller, “Zilsel, The Artisans, and the Idea of Progress in the Renaissance,” *Journal of the History of Ideas* 11 (1950), 235-40 for a discussion of the absence of humanist treatises in Zilsel’s account of an artisanal progress literature.

Yet Wanley's text was not merely a vast compendium of facts about man. An argument was embedded within it, since Wanley closely followed the 1627 treatise of George Hakewill which defended an idea of progress against the claims of Godfrey Goodman. Picked up by Wanley and others, Hakewill's *An apologie of the pover and providence of God in the gouernment of the world. Or An examination and censure of the common error touching natures perpetuall and vniuersall decay diuided into foure bookes*, continued to serve as a storehouse of *loci* demonstrating the abilities of modern man throughout the century.

Goodman himself had used the enumeration of instances to fill the places of his argument; Hakewill fought back by gathering together what Mordechai Feingold has called an "impressive gallery of contributors" of commonplaces.⁷⁴⁵ Hakewill dedicated the *Apologie* to the University of Oxford, as was appropriate for a work compiled by a cadre of Oxford dons and other learned men.⁷⁴⁶ These pooled together their stores of examples, producing a first edition almost twice the length of Goodman's work, and augmenting each subsequent edition of the *Apologie*. Better arguments would not win this debate.⁷⁴⁷ Longer ones would.

The length of the work testified to the influential individuals who had been won over to its side. The impressive thesaurus of examples appearing in the 1630 and 1635 editions of the *Apologie* lent the argument for progress all the ammunition a battalion of Oxford dons

⁷⁴⁵ For the contributions to Hakewill, as well as the copying from Hakewill into the manuscript commonplace book of Queens College don Thomas Crossfield, see Mordechai Feingold, *The Mathematician's Apprenticeship: Science, Universities and Society in England, 1560-1640* (Cambridge: Cambridge University Press 1984), 66. Contributors included not only Henry Briggs, but also "John Bainbridge, Thomas Clayton (Regius professor of Medicine), Edward Lapworth (Sedleian Professor of Natural Philosophy), Thomas Allen, and Sir Kenelm Digby."

⁷⁴⁶ Drebbel's perpetual motion was already current as a commonplace in Oxford, having been cited by Robert Burton of Christ Church in the *Anatomy of Melancholy*, and by Nathaniel Carpenter of Exeter in his *Geography*.

⁷⁴⁷ Cf. Ronald Hepburn, who argued in "George Hakewill: The Virility of Nature," *Journal of the History of Ideas* 16:2 (1955), 150, that Hakewill "realizes that the controversy is empirically unsetttable; the bandying back and forth of instances could continue indefinitely and inconclusively," and thus sought other means of persuasion. Hepburn does not account for the sheer number of instances Hakewill does adduce, or the contemporary aims of the commonplace. No doubt Hakewill did employ other rhetorical techniques in addition to the commonplace, but the accumulation of instances itself would have been a recognizable, and persuasive, rhetorical technique to contemporary readers.

and other men of letters could muster. Their concerted effort made the *Apologie* a key resource for future works supporting the idea of progress in the seventeenth century.

Hakewill claimed in the title of the chapter devoted to modern inventions that he would be discussing discoveries “at leastwise matchable with those of the ancients, namely & chiefly the invention of Printing, Gunnes, and the Sea-Card or Mariners Compasse.” Yet before he reached the “three inventions,” he began with another section devoted to “some rare inventions and artificiall workes of this latter age, comparable both for vse and skill to the best of the Ancients.” In this chapter he dealt with modern inventions, “comparable,” to ancient masterworks in the way that Drebbel’s perpetual motion recalled Archimedes’ sphere. Only at the end of this section did he move on from what “are in truth but toys & tryfles in regard of those three most vsefull inventions, which these *latter ages* challenge as due & proper to themselues, *Printing, Gunnes, and the Marriners compasse.*”⁷⁴⁸

In the first edition of 1627, Hakewill did not yet include Drebbel among other modern *loci* comparable to the Archimedean sphere. He cited instead Bartas’ poems on the silver sphere of Ferdinand, “matchable with Archimedes, or that of Zapores.”

Neither doth he [Bartas] forget that most exquisite silver *spheare*
(matchable with *Archimedes*, or that of *Zapores* King of *Persia*) which
was sent as a present from the Emperour *Ferdinand* to *Solyman* the
great *Turke*, & is mentioned by *Paulus Iouius* & *Sabellicus*: It was
carried as they write, by twelue men, vnframed & reframed in the
Grand Signiours presence by the maker, who likewise deliuered him a
booke contayning the mystery of vsing it.
Nor may we smoothe o’er nor forget ingratelie
The *Heauen of siluer*, that was sent but lately
From *Ferdinando* as a famous worke
Vnto *Bizantium* to the *greatest Turke*:
Wherein a spirit still mouing too & fro,
Made all the *Engine* orderlie to goe;
And though the one *spheare* did alwayes slowly slide,
And contrary the other swiftly glide;

⁷⁴⁸ Hakewill (1627), 256.

Yet still their stars kept all their courses euen
With the true courses of the stars of heaven.
The Sun there shifting in the *Zodiaque*
His shining houses, neuer did forsake
His pointed path, there in a monthe his sister
Fulfil'd her course & changing oft her lustre
And forme of face, (now larger, lesser soone)
Followed the changes of the other moone.

In the 1635 edition of *An Apologie*, Hakewill expanded this section. After his description of “silver spheare” and citation of Du Bartas, Hakewill continued by citing Hugo Grotius who had written an epigram comparing the perpetual motion machine to King James’ brain.

To these may be added the instrument of perpetuall motion,
invented by Cornelius a German here in England, and the sayling
coach invented by Stevinus in the Netherlands, upon both which
Hugo Grotius hath bestowed these excellent verses.

“In organum motus perpetui, quod est penes maximum
Brittaniarum Regem”⁷⁴⁹

The similarity of a Grotian epigram on both subjects led Hakewill to mention Stevin alongside Drebbel. After Hakewill’s addition of the *loci* of Drebbel and Stevin, the two often traveled in each other’s company. For example, Evelyn, in his *Numismata* of 1697, described a list of famous men whose portraits ought to appear on coins (a numismatic *desiderata* list).

Cornelius Drebbel was Famous for his *perpetual Motion*; the Noble
Hunniades Inventor of the *Scarlet-Bow Die*, since the loss of the
antient *Purple*; *Stevinus*, who (besides several Geometrical
Instruments) framed the *Veliferous Chariot*, celebrated by the
Learned *Grotius*.⁷⁵⁰

⁷⁴⁹ Hakewill (1635), bk. 3, ch. 10, sec. 1, pp. 314.

⁷⁵⁰ 280. For Hunyades see Sherwood Talyor and C.H. Josten, “Johannes Banfi Hunyades,” *Ambix* 5:1-2 (1953), 44-52, John H. Appleby, “Arthur Dee and Johannes Banfi Hunyades,” *Ambix* 24:2 (1977), 96-109, and George Gömöri, “New information on János Bánfihunyadi’s Life,” *Ambix* 24:3 (1977), 170-174. The citation of Hunyades is particularly curious. As Appleby points out (97), Evelyn attributes the same invention of the scarlet dye to Drebbel in his *Diary*. We know that Hunyades and Drebbel communicated, from the fact that Morsius acquired Drebbel’s letter to King James from Hunyades. Perhaps it was Hunyades’ claim to the Scarlet-Bow die which explains the animosity of the Kuffler’s, who took over Drebbel’s scarlet works. Kuffler tells Hartlib (*Ephemerides* 1656, Part 3) “Hans Hunniades a very idiot Laborant and one that knew nothing at all, but only was cryed up by Dr. Mayerne, who was no chymist at all. The chiefe thing that was in him was his Art of enamelling or making of Artificial Stones or Jewels. Dr. Kufler.” The recovery of the ancient purple, (purple

John Jonston (1603-1675), the Silesian alchemist, doctor, and Comenian pansophist of Scottish descent, followed Hakewill's *Apologie* closely in his *Constancy of Nature* of 1632, first printed in Latin in Amsterdam.⁷⁵¹ Jonston typified the methodical traveler discussed in Chapter One. He studied at St. Andrews, Frankfurt, Leipzig, Berlin, Franeker, Leiden, London, and Cambridge, spending over a decade in travel before settling at home in Silesia.⁷⁵² Jonston published the book the *Constancy of Nature* while studying for the M.D. at Leiden. He had recently returned from his trip to England, where he acquired Hakewill's *Apologie*. As he acknowledged, "I having borrowed matter, especially from a large Treatise written in *English*, by that reverend man, *D. George Hackwil, S S T. D.* concerning this Thesis."⁷⁵³

While Jonston's work as a whole was far slimmer than Hakewill's, he expanded the treatment of Drebbel whom he had met personally in London.⁷⁵⁴ Yet it is striking that although Jonston knew Drebbel, he drew the vast majority of his discussion from other works rather than giving an eyewitness account.

As for particular Inventions, many might be instanced in, that surpasse, *Architas* his Pigeon, *Archimedes* his Globe of Glasse, *Homers Iliads* writ in parchment and put into a nutchell, the Ship and the Chariot of Myrmecidas; I beleeeve also that *Cornelius Drebbils* wonderfull Sphere is not unkown, wherein he did by vertue of a perpetuall Motion, represent the constant and most apparent Motions and Laws of the Heavens and the Stars, and the Predestinations of Times and Motions in them. But what shall we

was considered blood red in early modern Europe), was another *locus communis* in the ancients vs. moderns debate, mentioned by Bornitz and Dornau.

⁷⁵¹ Jonston, *Naturae Constantia* (Amsterdam: Blaeu, 1632). Citations below are from Jonston, *Constancy of Nature* (London: Streater, 1657).

⁷⁵² John Ferguson, *Bibliographical Notes on Histories of Inventions and Books of Secrets*. Part IV. (Glasgow: Strathern & Freeman, 1885), 12.

⁷⁵³ *Ibid.*, 3.

⁷⁵⁴ In another work, Jonston recalled observing a multi-colored fly through a microscope with Drebbel in London. See *Historiae Naturalis de Insectis Libri III* (Frankfurt: Merian, 1653), 67. "Variis depingi cancellatim quasi coloribus, pavonis instar, per microscopium apud celebrem illum mechanicum Drebellium Londini observavimus."

think of that Instrument, by means whereof he changeth himself into divers forms of Trees, and living Creatures, and makes an appearance as if the Earth opened, and Spirits came forth of it; First in the form of a Cloud, and then changing themselves into another shape that he commands them, be it of *Alexander* the great, or of some other King or Prince. I will say nothing of his Ship that swam under the Waters, and an Optick Instrument, wherewith in a Starlight night, he could read Letters a quarter of a mile from him. [Marginal note: Vranckheimis in Epist. ad Burggravium. Hegenitius Itin. p. 73].⁷⁵⁵

Two pages later, Jonston continued to expand the list of Drebbel's inventions, citing the Rosicrucian Petrus Mormius.

The same person mentioned before, proceeded to search out with great care and study an Instrument of the like kinde [the telescope], and he hoped to finde it, whereby out of our Horizon in the Opposite Hemisphere, beyond the bounder of the Hemispheres he might observe all the Stars there, as if they were apparent in that part of the world we live in. What shall we say of that Musicall Instrument? that by the perpetuall, moveable or moving vertue of the same (as the Artificer reported) in a clear day, the Sun shining forcibly, only by the Sun beams, that musicall Genius being, roused thereby, without touching the instrumentall parts with your hand; would make most Heavenly Musick. But who is able to reckon up all? If those things be true, that *Mormius* hath set forth in his *Arcanis Rosianis*, lately at Leyden in Holland, (but beleve them that will) his example were enough to oppose against all Antiquity.⁷⁵⁶

Jonston reported on Drebbel's submarine and both the telescope he had and the one he hoped to build without any cited authority. To that he added accounts drawn from authors recently published in the Netherlands, such as Vranckheim, Hegenitius, Mormius, and Drebbel himself.⁷⁵⁷ He cited even sources he considered doubtful, such as Mormius. The point of his work was to compile arguments to oppose against antiquity, not to sift

⁷⁵⁵ Jonston (1657), 110-1.

⁷⁵⁶ *Ibid*, 112.

⁷⁵⁷ Marcellus Vranckheim, *Epistola*, in Johann Ernst Burggrav, *Biolychnium* (Franeker: Balck, 1611); Gottfried Hegenitius, *Itinerarium* (Elsevier: Leiden, 1630); Petrus Mormius, *Arcana Totius Naturae secretissima, nec hactenus unquam detecta, a Collegio Rosiano in lucem produnctur* (Leiden: Joseph Navius, 1630).

evidence. Mormius' account of Drebbel offered a very strong statement of his argument indeed.

Learned repositories of instances drawn from international and current literature such as this in turn served as resources for the compilers of manuscript commonplace books throughout the Republic of Letters. For example, the Danish Nicolaus Steno quoted Jonston on Drebbel in his commonplace book in 1659.⁷⁵⁸ As was not uncommon, Steno entitled his collection "Chaos," taking pride in the mixture and copiousness Naudé had deplored.

Thomas Powell of Jesus College, Oxford followed the same argument as Hakewill and Jonston in his *Humane Industrie or, A history of most manual arts deducing the original, progress, and improvement of them: furnished with variety of instances and examples, shewing forth the excellency of humane wit* of 1661. In this work, Powell compiled one of the most extensive collections of *loci* showing the "progress" of "humane industrie" to date. We find both Stevin and Drebbel among the greatest modern and ancient engineers he listed.

For Engineers, such as were expert in the practical part of the Mathematicques, these were the most renowned in ancient times. *Archimedes* of Syracuse, *Architas* of Tarentum, *Severinus Boetius* of Rome, *Proclus*, *Heron*, and *Ctesibius*, both of *Alexandria*, of later times, *Regiomontanus* of *Norimberg*, *Simon Stevinus* of lower *Germany*, *Cornelius van Drebble* his Countryman, whom we mentioned before, *Athanasius Kircher* by birth a German, but living (of late) in *Rome*, and *Marinus Marsennus*, a Frier of *Paris*. These were *Magi* and *Thaumaturgi Mathematici* wonder-workers, or such as performed marvellous feats by their great skill in Mathematical Sciences.⁷⁵⁹

The cadre of Archimedes, Archytas, Regiomontanus, Stevin, and Drebbel surfaced again in this group.

Powell developed these commonplace artificers in perhaps their most complete redaction, divided into two categories, "ΣΦΑΙΡΟ-ΠΟΙΗΤΙΚΗ or, Some curious Spheares

⁷⁵⁸ Nicolaus Steno, *Chaos: Niels Stensen's Chaos-manuscript* (Copenhagen: Danish National Library of Sciences and Medicine, 1997), 278.

⁷⁵⁹ Powell (1661), 26-7.

and Representations of the World” in Chapter Two, and “ΑΥΤΟΜΑΤΟΠΟΙΗΤΙΚΗ, of Sundry Machins, and Artificial Motions” in Chapter Three. The association between certain commonplace artificers was so tight that Powell repeated the same examples again in order to associate the artificers in the appropriate chapters. In both chapters, Powell closely followed Hakewill’s account. In Chapter Two, Powell moved from Archimedes (quoting Claudian, Cicero, Livy, Ovid, and Kircher, cited above) to Sapor and Ferdinand (quoting du Bartas) and Drebbel, quoting (Kircher, Tymme, Vranckheim, and Grotius).

Yet Authors do make mention of a Sphear of glass which *Sapor* King of *Persia* had, which was so large, that he could enter within it, and sit in the midst of it, and see the Sphears and Planets whirling round about him; which did swell him with such a conceit, that in his Letters he did use this stile, *Rex regum Sapor, Particeps Syderum, Frater Solis & Lunae*.

We read of a silver Heaven sent by the Emperour *Ferdinand* for a Present to *Soliman* the grand Signior, which was carried by twelve men with a book along with it that shewed the use of it, and how to order and keep it in perpetual motion. *Du Bartas* makes mention of both, and concludes his description of them with this Rapture touching humane wit.

O compleat Creature! who the starry Sphears
Canst make to move, who ‘bove the heavenly Bears
Extend’st thy power, who guidest with thy hand
The days bright Chariot, and the heavenly brand.

Kercher doth highly extol and admire the Artificers of this latter age for making Sphears and Globes, and such representations; who can make them (saith he) with such exactness and perfection in all points, that *Jupiter* might have juster cause to complain of them, then he did of *Archimedes* (in *Claudian*) for their presumptuous emulation of his handyworks. Among the Moderns, one *Cornelius van Drebble* a Dutchman of *Alcmar*, may deserve just admiration: This man lived here in *England*, and was *Regi Jacobo à Mechanicis* (as one saith) King *James* his Engineer, he presented the King with a rare Instrument of perpetual motion . . . This *Bezaleel* was sent for to the Emperour of *Germany*, who sent him a chain of gold: A rude Scheme of this Instrument may be seen upon paper in M^r *Tho. Tims* Philosophical Dialogue, *Dignus rex Archimede isto altero; Dignus Archimedes Batarus magno illo rege, as Marcellus Vrankheim*

(another Dutchman) speaks of King *James* and his Engineer, in his Epistle to *Ernestus Burgravius*. Of this Microcosme or Representation of the World which we now mentioned, the excellent *Grotius* hath framed this Epigram following. . . .⁷⁶⁰

Humane Industry purported to demonstrate the “excellency of human wit,” yet the eclectic mix of *loci* Powell had accumulated conveyed mixed messages. The *locus* concerning Sapor, whose globe “swelled” him to style himself “*Rex regum Sapor, Particeps Syderum, Frater Solis & Lunae*” seemed to offer a negative example of pride. Yet, clearly a certain pride for the “presumption” of modern artificers, especially Drebbel, appeared in the citation of Kircher’s citation of Claudian.

Powell employed his *loci en masse* to praise the industry of the artisan, despite the eclectic messages they revealed upon a closer examination. The very accumulation of so many *loci*, particularly from such an approved source as the “excellent” Grotius, was proof enough of Drebbel’s deserved celebrity. Powell did not attempt to build a logical argument; rather, the deluge of *loci* served to persuade.

Powell continued to discuss Drebbel in Chapter Three. There Powell listed Archytas, Regiomontanus, Stevin (citing Grotius’ epigram here too), followed by Daedalus, Albertus Magnus, and Roger Bacon, among a few others, and Drebbel.

Cornelius van Drebbel that rare Artist we spake of made a kinde of an Organ that would make excellent Symphony of its self, being placed in the open Ayr and clear Sun, without any fingering of an Organist; which was (as we conceive) by the means of Ayr inclosed, and the strictures of the beams rarifying the same; for in a shady place it would yeild no Musick but where the Sun-beams could play upon it, as we read of *Memmons* Statue that would make some kinde of Harmony when the Sun did beat upon it; whereof we speak more hereafter.⁷⁶¹

⁷⁶⁰ *ibid*, 22.

⁷⁶¹ *Ibid*, 32-3. Compare Powell’s account to Sir Kenelm Digby’s in *Two treatises in the one of which the nature of bodies* (Paris: Gilles Blaizot, 1644), 46 of “the weatherglasses, and other artificiall musical instruments (as Organs and Virginals that played by themselvs) Cornelius Drebbel (That admirable master of Mechanicks) made to shew the King. All which depends upon the rarefaction and condensation of some subtile body, conserv’d in a cavity

Just as Drebbel's perpetual motion was cast as an Archimedean sphere, his pneumatic Organ was celebrated through the *locus* concerning Memnon's statue.⁷⁶²

No such parallel invention existed for the other Drebbelian devices Powell mentioned. Powell cited Drebbel's invention of the microscope and his telescope in his chapter on the art of glass.⁷⁶³ He also discussed the submarine in his chapter on shipping. However, he was unaware that this too was Drebbel's invention, and cites only Bacon, who had not credited Drebbel.

There have been Boats made here in *England* to go under water, which my Lord of S^t *Albans* seems to touch, *Audimus inventam esse Machinam aliquam Naviculae aut Scaphae, quae subter aquis vehere possit ad spatia non nulla*: We are not now content to sail upon the waters, but we must sail under them too.⁷⁶⁴

In a genre as technical as a progressive history of the arts Powell still relied upon collections of rhetorical *loci*, even when these were originally intended to make quite different points. Where such *loci* were lacking, as in the case of the submarine, Powell's information was sparse. By contrast, when Powell did have a cache of *loci*, he repeated them mechanically wherever they could be fitted to a general heading. Both Archimedes and Drebbel, therefore,

within the bulk of the whole instrument: for, as soon as the Sun shined, they would have motion and play their parts. And, questionless, that grew out of the rarefaction of the subtile liquor he made use of; which was dilated as soon as the air was warmed by the Sun-beams: Of whose operation it was so sensible, that they no sooner left the Horizon, but its motion ceased; And if but a cloud came between the instrument and them, the musick would presently go slower time. And the ancient miracle of Memnon's statue seems to be a juggling of the Ethiopian priests, made by the like invention."

⁷⁶² Powell also listed the Archimedean sphere (citing Claudian) once again in this chapter, *ibid*, 33. "*Archimedes* his Sphear was some *pneumatical* Engine, that moved of it self by means of some inclosed Spirits, as appears by that Verse of *Claudian* in the description of it. *Inclusus variis famulatur spiritus Astris*"

⁷⁶³ *ibid*, 137-138. "*Cornelius van Dreble*, a Citizen of *Alcmar* in *Holland*, and a rare *Engineer*, who lived in King *James* his Court here in *England* (as we mentioned before) invented the *Vitru Microscopia*, the Microscopes or glasses whereby we plainly see and discover the subtilest objects and the smallest, as the distinct colours and members of Flies and Worms and Nits, and the spots and small grains in Gemms, as also in Urine or Blood, w^{ch} the eye could not otherwise discern. With these the *Anatomists* (in dissecting of bodies) discover the smallest veins and strings and fibres in the body of man or beast. . . . *Cornelius Drebbel* before-mentioned had a little glass (but of a hands breadth in Diameter) which he called *Fabus Opticus*, wherewith he could distinctly see all the hills and spacious plains in the *Lunary world*, as also all the forrests, cities and buildings there, as D^r *Gassendi* relates it in *l.* 5. written of the life of *Peyresc*."

⁷⁶⁴ *ibid*, 155.

received mention in the chapters on sphere-building, automata construction, pneumatic machines, and glass.

The mechanical copying of commonplaces meant that sometimes the commonplace of Drebbel was repeated *ad nauseam* and at others it was surprisingly absent, depending upon which collection of commonplaces an author happened to follow. Nathaniel Wanley, in his *Wonders of the Little World, or A General history of Man* of 1673, began Book 3, Chapter XLIV, “Of the admirable Works of some curious Artists” by following the structure of Hakewill’s 1627 *Apologie*. Because Wanley based his account on the 1627 rather than the 1635 edition of Hakewill’s text, he did not include the commonplace of Drebbel’s perpetual motion which Hakewill added in his later edition.

Wanley argued that since the time “When Learning. . . was at a kind of lower ebb in the world” “the times have been more favourable to learning, and thereby Art improved to that height, as some of the following examples will discover. “ He copied his first two examples, Regiomantus and the sphere of Sapor, *verbatim* from Hakewill.⁷⁶⁵ He then proceeded to cite an additional thirty-seven examples. Drebbel’s sphere did not make the list (although the later spheres of Gottorp and Francis Line did). But Drebbel did appear as number ten for his pneumatic organ, where Wanley quoted the locus of Memnon’s statue we encountered in *Humane Industrie*.

10. *Cornelius van Drebbel* that rare Artist, made a kind of Organ, that would make an excellent Symphony of it self, being placed in the open air, and clear Sun, without the fingering o[...] an Organist; which was (as is conceiv’d) by the means of air inclosed: and the strictures of the beams, rarifying the same, for in a shady place it

⁷⁶⁵ Wanley, *The wonders of the little world* (London: Printed for T. Basset, R. Cheswel, J. Wright, and T. Sawbridge, 1673), 225. “The Silver Sphere, (a most exquisite piece of Art, which was sent by the Emperour *Ferdinand* to *Solyman* the Great Turk) is mentioned by *Paulus Iovius* and *Sabellicus*. It was carried (as they write) by twelve men unframed, and reframed in the Grand Seignior’s presence by the maker of it, who likewise delivered him a Book, containing the mystery of using it: of which *Du Bartas* thus . . .”

would yield no Musick, but only where the Sun-beams had the Liberty to play upon it, as we read of *Memmons* Statue.⁷⁶⁶

In turn, John Dunton repeated Wanley's list in slightly condensed form. Dunton extended the virtual world of commonplaces to the extreme in his *Young Student's Library* of 1692. This work was the product of the Athenian Society, which purported to be a real scientific association along the lines of the Royal Society, but was in fact a fiction of the stationers. Like the Rosicrucians, the Athenian Society was a virtual association for the advancement of knowledge existing only in print. Both Rosicrucians and Athenians might appear difficult of access, since there was no way to join the non-existent inner circle. In reality, as print phenomena, anyone could participate by reading. Like "copper tokens," virtual societies had no intrinsic value. Their value lay only in circulation. As Adrian Johns has written, "the Athenians reversed the tactic of the virtuosi, and had *real* witnesses reporting to *virtual* scientists."⁷⁶⁷ The commodification of the matter-of-fact made credit a construction of print. Anyone could contribute to that credit by increasing its circulation.⁷⁶⁸

The *Young Student's Library* included "An Essay upon all sorts of learning" supposedly compiled by the Athenian Society. The essay gave a complete review of the authorities in every discipline that a student should have on his shelf. Perhaps not coincidentally, the Athenian Society recommended a lavish list of books to the student.

The *ordo artium* followed by the Athenian Society was surprisingly conservative. "Mathematics," encompassed an expanded quadrivium including arithmetic, geometry,

⁷⁶⁶*Ibid.*

⁷⁶⁷ Adrian Johns, "The Ambivalence of Authorship in Early Modern Natural Philosophy," in *Scientific Authorship: Credit and Intellectual Property in Science*, Mario Biagioli and Peter Galison, eds (New York: Routledge, 2003), 76. See also G.D. McEwen, *The Oracle of the Coffee House: John Dunton's Athenian Mercury* (San Marino, Calif: Huntington Library, 1972).

⁷⁶⁸ In *The Nature of the Book*, Johns argued that fixity of credit did not arise through the authorial persona and the technology of print alone, but in the use by readers. David McKitterick argued for the instability of print as interactive in *Print, Manuscript and the Search for Order, 1450-1830* (Cambridge: Cambridge University Press, 2003).

astronomy, music, poetry, painting, navigation, dialling, optics, and geography. Yet, Dunton treated this section rather differently than “Divinity” or “Philosophy.” He started with a condensed ancients versus moderns debate, saying, “To speak a little of *Mathematicks* in General before we come to treat of any particular parts of that Subject; we suppose we cannot do better than to give a short account of what has been already perform’d by the assistance of this Art, that we may the better judge of the possibility of future Acquirements.”⁷⁶⁹ He then continued to cite a list of inventions largely taken from Wanley.

This list served an unusual function within the “Essay.” Dunton did not offer a *laus artium* for any of the other disciplines, locating innovation and invention squarely within the mechanical arts. Furthermore, although the category of mathematics extended far beyond the mechanical arts, Dunton understood the mechanical arts to stand for the possibilities of “mathematics in general.” His citation of the famous group of inventors was intended to inspire the young student to pursue any of the “particular parts of that Subject.” It was here in the category of “general inspiration for invention” as it were, rather than as founder of a discipline or as an authority in philosophy or medicine that Drebbel’s name appeared.

Following Wanley, Dunton did not cite Drebbel’s sphere, but he did cite the organ. Dunton claimed to be only interested in those inventions which could be applied to a practical purpose, and not curiosities. However, Dunton’s account was based on commonplaces of curious devices, which were formerly seen to have a serious purpose if only in their demonstration of the powers of man and possibility of progress. Dunton mentioned the curiosities of Tivoli and the Pratolino via a *praeteritio* (mentioning a subject by saying that it should not be mentioned) since, as he said, “they were more design’d for

⁷⁶⁹ John Dunton, *The Young-students-library* (London: Printed for John Dunton, 1692), x.

Pleasure, than real Use.” Yet the inventions which he then continued to list in contrast to such “Curiosities” were themselves “Curious.”

We suppose we cannot do better than to give a short account of what has been already perform'd by the assistance of this Art, that we may the better judge of the possibility of future Acquirements: *Regiomontanus* his *Wooden Eagle*, and *Iron Fly*, mention'd by *Petrus Ramus*, *Hakew*, *Heylin*, &c. must be admirably contriv'd, that there was so much proportion, such Wheels, Springs, &c. as cou'd so exactly Imitate Nature. *The First* was said to fly out of the City of *Noremburg*, and meet the Emperor *Maximilian*; and then return'd again, waiting on him to the City Gates: *The Other*, to wit, the *Fly*, wou'd fly from the Artist's hand, round the Room, and return to him again This Instance proves the feasibility of doing things of great use; as that Action of *Proclus* the Mathematician, in the Reign of *Anastasius Dicorus*, who made Burning-Glasses, with that Skill and Admirable force, that he therewith Burnt, at a great distance, the Ships of the *Mysians* and *Thracians*, that Block'd up the City of *Constantinople*--- We shall pass over the Curiosities and Admirable Inventions, which are mention'd in the Duke of *Florences's* Garden at *Pratoline*; as also those of the Gardens of *Hippolitus d' Este*, Cardinal of *Ferrara* at *Tivoli*, near *Rome*, because they were more design'd for Pleasure, than real Use. For, our design is only to shew the real Advantage that may be drawn from *Mathematicks*; though we are also certain, that the most Surprizing Pleasures in Nature depend upon it. The great Clock of *Copernicus* was certainly a Curious Master-piece, which shew'd the Circutions of all the Celestial Orbs, the distinction of Days, Months, Years, where the Zodiack did explicate its Signs, the Changes of the Moon, her Conjunctions with the Sun; every hour produc'd upon the Scene some Mystery of our Faith. As the first Creation of Light, the Powerful Separation of the Elements, &c. What shall we say of *Cornelius Van Drebbel's* Organ, that wou'd make an Excellent Symphony it self, if set in the Sun-shine in the open Air?⁷⁷⁰

Snowballing commonplaces granted longevity to the “modernity” of Drebbel's invention.

The persistence of Drebbel's devices as commonplaces meant that still in 1692, Dunton was asking students, “What shall we say of Cornelius Van Drebbel's Organ?” Although situated in a rhetoric of modernity, the question itself had been commonplace for half a century.

⁷⁷⁰ Dunton, xi.

The stream of commonplacing we have traced in the English literature of the idea of progress also flowed through similar works in the Holy Roman Empire. This geographical range demonstrates how common the commonplace was. Yet in the Holy Roman Empire, the imperial resonance of the perpetual motion machine granted it a particular valence. The progression of *loci* from Syracusan King, to Persian monarch, to the Sultan invested the Archimedean sphere with an imperial pedigree. The sphere was perhaps especially important to the Habsburg emperor Rudolf II, whose own grandfather Ferdinand had sent the Sultan his silver sphere. Obtaining an Archimedean sphere for his *Kunstammer* reflected upon Rudolf's status as a mighty patron and monarch on a par with Archimedes, Sapor, and Ferdinand.

The organist and poet Johannes Staricius claimed to show how the legendary weapons of Achilles could be reproduced through natural magic in his *Heldenschatz* of 1615. In order to prove that the unimaginable is possible, Staricius digressed for several pages on the greatest achievements of human art, ancient and modern. He listed a number of inventions, including the dove of Archytas, the fly of Regiomontanus, the sphere of Archimedes and Sapor, *Kunstammer* collections in general and Drebbel's sphere in particular, which, said Staricius, could still be seen in Prague.⁷⁷¹

The Archimedean sphere also supported Caspar Dornau's argument that the inventions of modern man could equal or surpass the ancients in his *Felicitas Saeculi* of

⁷⁷¹ Johann Staricius, *Heldenschatz/ Das ist; Naturkündliches Bedencken uber un[d] bey Vulcanischer/ auch Natürlicher Magischer Fabrefaction und zubereitung der Waffen deß Helden Achillis in Griechenlandt* (Frankfurt: Steinius, 1615), 9-14. No perpetual motion fitting this description appears in the Prague 1607-11 inventory of the *Kunstammer*. R. Bauer and H. Haupt, "Das Kunstammerinventar Kaiser Rudolfs II, 1607-1611," *Jahrbuch der Kunsthistorischen Sammlungen in Wien* 72 (1976), entire volume. Phillip Hainhofer and Martin Zeiller described a "perpetuum mobile, welches in ainem gläserinen Ring ascendiert vnd descendiert" held in the Dresden *Kunstammer*. See Oscar Doering, *Des Augsburger Patriciers Philip Hainhofer Reisen nach Innsbruck und Dresden* (Vienna: Graeser, 1901), 167 and Zeiller, *Handbuch von allerley Nützlichen Erinnerungen* (Ulm: Balthasar Kühn, 1655), 490.

1617.⁷⁷² For example, Dornau favorably compared Galileo's telescope to Archimedes' sphere, quoting Claudian's epigram. While Archimedes could only see a model of the heavens, Galileo could study the celestial orbs themselves.⁷⁷³ Yet Dornau also continued to celebrate modern inventors of the Archimedean sphere. He began by describing several pneumatic instruments which can delight either by showing the motions of the heavenly bodies or by playing music, noting Drebbel among his examples.⁷⁷⁴ Archimedes also came "to mind," although Dornau called Archimedes ridiculous for thinking that he could move the earth.⁷⁷⁵

Towards the end of the treatise, Dornau discussed magnetic instruments, including compasses and perpetual motions. Then, after praising the collections of automata of Rudolf II, as well of the Nürnbergers, Leipzigers, Augsburgers, and Frankfurters, Dornau listed several modern automata which successfully competed with the ancients, including the spheres of Emperor Ferdinand and Sapor.⁷⁷⁶

⁷⁷² On Dornau, see Robert Seidel, *Späthumanismus in Schlesien: Caspar Dornau (1577-1631), Leben und Werk* (Tübingen: Niemeyer, 1994).

⁷⁷³ Dornau, *Felicitas Saeculi* (Bethaniae: Dörff, 1617). "Stupendum est; quod speculari tubo tantillae longitudinis . . . non dico vitreos contemplantur circulos, quos finxit quondam, istoque; sensu -*jura poli, regnumque deorum*! Ille *Syracosius transtulit arte senex*:"

⁷⁷⁴ The marginal notation at this point referred to "Claudian. ad Manl. Ioan Leo Hasler. Cornel. Trebel. Plutarch. Jacob Besso. schem. 52." Hassler was an organist and musician in the service of Rudolf II, also known for the construction of automatic musical instruments with the help of the clockmaker Georg Heinlein. See Christoph Imhoff, ed. *Berühmte Nürnberger aus neun Jahrhunderten* (Nürnberg: Albert Hofmann, 1984), 161.

⁷⁷⁵ Dornau (1617), C2v. "Quid fons Aeolicus? Tam fabre nostri Architectones fieri eum dicunt ac praefigurant: ut sive corporum coelestium motus explorare ames; sive aures mulcere tuas sono Musico, suaviter concinnato; sit ille in utrumque paratus. Pertinet eodem & Musica illa, quae prae caeteris vocantur, instrumenta: quae nullo tangente, semel concitatis rotis, vel caloris Solis manusve per tubum operante; cantum repraesentant non minus suavem; quam si manus artificis peritissimi nervos impellat. Haec delitias faciunt hominum generi: commodum vero incomparabile, antiquitati incognitum, adfert illa machina; quae ad restinguenda incendia per siphonem aquam copiosissimam in locum quantum vis sublimem, cito; haud multo conamine ejaculatur; maxime cum superante flammâ, nulli ad flagrantem aedem patet aditus. Archimedis quoque nunc in mentem venit: qui confidentia dicam, an ingenio, locum sibi, quo consisteret, dari petiit: & terram se commoturum de loco suo; in alium orbem, si quis foret, depulsurum, promisit. [marginal notation] Jacob Besson. schem. 52. Claudian. ad Manl. Ioan Leo Hasler. Cornel. Trebel. Plutarch. Jacob Besso. schem. 52."

⁷⁷⁶ *Ibid.* "Infinit foret laboris, planeque intolerabilis; si omnia recitanda mihi praesumerem; quae vi magnetis cognoscuntur paranturque ut magnetica ferramenta se conformant ad tellurem: ut circulos coelestes magnes detegit, polos ostendit; ut perpetui motus instrumentum praebet. . . . Invenit hoc opus olim ingeniosissimus Caesar Rudolphus II. in cujus Regio (Dresdam & Monachum, & alia loco praetero) thesaurus servabatur

Let us allow the ancients their waterclocks, & clepsydras, sundials . . . we prefer to enjoy our admirable machines of clocks, and those works, which the emulous hand has learned to create following the example of the stars. I say nothing of the enviable clock of the Strassburgers, nothing of the soluble heaven made of silver, which Kaiser Ferdinand sent to Suleiman, as a gift: which, without a doubt, Sapores the King of the Persians would greatly have preferred to his own proud efforts . . . Nor does the flying wooden dove of Architas the Tarentine thwart us: as was revealed to the eyes of our ancestors, at Nürnberg the Kaiser was saluted by a wooden eagle, which flew with a beating of wings down from the air above.⁷⁷⁷

The Archimedean sphere was one of a number of standard tropes used to prove both the abilities of modern man in general, and the glory of the Habsburg emperor in particular, as Dornau argued that the mechanical clocks and automata of the *Kunstkammer* far surpassed the waterclocks of the ancients.

VI: Setting New Standards

Due to the success Drebbel's perpetual machine enjoyed as an Archimedean commonplace, it became not only the most quotable of all Archimedean spheres, but of perpetual motions in general. Daniel Mögling, aka Valerius Saledinus, before going on to

selectissimarum rerum, quà naturae miraculo, quà artis divinitate elaboratarum. Potestis quoque animum referre ad Noricorum urbem, Lipsensium, Vindelicorum, Francof., (ut externos, taceam) in quibus tot tamque insignia αὐτῶματα praeparantur: ut non Lunam tantum artifices coelo devocasse, sed Solem quoque & stellarum militiam propè universam videantur.”

⁷⁷⁷ *Ibid*, D2. “Permittamus priscis hydrologia sua, & clepsydras, & horographia solaria: nos qui concinnare haec talia possumus, gaudere malumus admirandis horologiorum machinis, & iis operis, quae ad exemplar astrorum aemula manus fingere didicit. De Argentinensium invidendo horologio nihil dicam: nihil de coelo solutili ex argento, quod Ferdinandus Caesar Solymano misit, congiarii ergò: quod, sine dubio, Sapores Persarum Rex longè anteferet superbis suis conatibus: cum

Majoris ad instar
E vitro effigiem coflavit euntis olympi;
Ac tantus fudit spaciis, ut saepè sedendo
In medio, occasus altè spectaret & ortus
Stellarum, & vairs utroque ab littore flammis.

Nec Architae Tarentini nobis obstat columba è ligno volatilis: cum majorum oculis compertum sit: Norimbergae ab aquila lignea, applausu alarum ex alto aëre, salutatum fuisse Caesarem.”

describe his own perpetual motion, reviewed the literature concerning all prior perpetual motions in his *Perpetuum Mobile* of 1625. Drebbel's machine, which he discussed at length, far surpassed all previous attempts in his opinion.⁷⁷⁸ Drebbel was the only entry in the category of perpetual motion in Christoph Besold's 1643 *Thesaurus Practicus*.⁷⁷⁹ In 1718, Johann Albert Fabricius stated in his *Bibliotheca Graeca* that Drebbel was the only modern to successfully create an Archimedean sphere.⁷⁸⁰

Once the commonplace of Drebbel drifted away from the specific debate of ancient and modern, Drebbel not only became the most successful "Archimedean" artificer, but one of the most famous inventors of all time. Eberhard Happelius advertised his *Relationes Curiosae* as "noteworthy stories of ancient and modern times which have appeared on this great Theater of the World."⁷⁸¹ Although it was not the main theme of his work, an echo of the ancients versus moderns debate lingered. In a typical citation, Eberhard Happelius listed the most curious inventions of all time, including the ancient globe and burning mirror of Archimedes, Archytas' wooden dove, and an iron ship which flew by itself in an Egyptian Temple. If we want to see something even better, he said, we should consider Cornelis Drebbel's glass sphere."⁷⁸²

⁷⁷⁸ Daniel Mögling, *Perpetuum Mobile* (Frankfurt: Jennis, 1625), 23-39.

⁷⁷⁹ Christoph Besold, *Thesaurus Practicus* (Nürnberg: Wolfgang Endter, 1643), 19.

⁷⁸⁰ Fabricius (1718), 465. ". . . post Archimedeum fere unicus, ausus est elaborata à se liquore spirituofo mirabile opus agitante simulacrum universi per artem effingere, in eoque ob arcanum consensum spiritus istius cum aethere, non minus planetarum sphaeras atque circuitus quam anni, mensium, dierum, horarum. . . ."

⁷⁸¹ In Happelius' complete title, "*merckwürdigste Historien u. Geschichte d. vorigen u. jetzigen Zeiten welche sich auff diesem grossen Schau-Platze d. Welt zugetragen.*"

⁷⁸² Eberhard Happelius, *Relationes curiosae* (Hamburg: Wiering, 1683), 49. "Wer kan die Kunstliche Himmels-Kugel Archimedis, und desselben Spiegel/ vermittelt dessen er der Roemer Flotte in der Ferne angezundet; des Tarentinischen Architae hoeltzerne selbst fliehende Taube; jene eyserne Schiffe und Wagen/ so vouisich selber in einem Egyptischen Tempel in der Luft schwebeten/ ohne Verwunderung betrachten?"

Aber noch mehr! Betrachte die glaeserne Kugel Cornelii Trebbelii von Almar. . ."

Happelius also mentioned the self-playing clavier, although he did not attribute it to Drebbel, and he included an extended discussion of the perpetual motion later at page 58-9.

The remnants of the ancients and moderns debate appeared even more tattered in Johan van Nyenborgh's *Theater or Garden of Stories* of 1657. Nyenborgh issued lists of curiosities without any particular argument in mind. His examples of the wonders of art ranged at random across the globe and through time from Mexican goldsmiths to the ancient Greek sculptor Mikron, to a modern Neapolitan organ, to ancient ductile glass, to Archimedes.

When Nyenborgh reached Archimedes, he embarked on a recognizable sequence – at first. Nyenborgh followed Archimedes' burning mirror with Paulo Giovio's account of the silver sphere sent to the Ottoman sultan and Cornelis Drebbel's perpetually moving sphere. Then, he inexplicably turned to print.

Then in our century Cornelis Jacobszoon Drebbel from Alkmaar first discovered the Prime Mover, making a sphere, which moved perpetually following the course of Heaven, just as Laurens Coster first invented the Art of printing in Haarlem in 1440.⁷⁸³

Within Nyenborgh's jumble of curious works of art, we have suddenly stumbled upon an account of modern inventions, which savored faintly of two different arguments. One, comparing the works of the moderns to the ancients, linked Drebbel's invention of "our century" through Giovio back to Archimedes (although Nyenborgh omitted Archimedes' own sphere). Drebbel also recalled another argument concerning the greatness of modern Dutch inventions which connected to Coster's discovery of print.

Drebbel first circulated as a commonplace for invention within a particular context.

Soon this commonplace was mined for other purposes, and Drebbel became a casual

⁷⁸³ Johan van Nyenborgh, *Het Wonder-Toneel Ofte Lust-Hof Der Histori-Paerlen, Van Wonderbaere Behoudenissen/ misgaders vande vreemdigheden der Gewassen ende Gedierten op Aerden/ ende Wateren/ Blixem/ Bergen/ Mineralen/ Menschen/ magtige Steden/ Gebouwen/ Rijckdomen/ Begrafnissen/ op en ondergang der werelds Staten: Als oock van't Paradijs, Verschijnjngen, eenige Consten ende Sin-Gedichten, &c. Meer* (Groeningen: Augustyn Eissens, 1657), 218-9. "Dan in onse eeuwe heeft eenen Cornelis Jacobsen Drebbel van Alckmaer/ het Primum Mobile eerst ghevonden/ makende een kloot/ de hem eeuwelijck beweeghde/ na den loop des Hemels: Ghelijck Laurens Coster tot Haerlem/ 1440. de Const van't Boeck-drucken eerst gevonden heeft."

byword for a skilled artisan in general. As far away as New England, for instance, Nathaniel Ward referred to Drebbel in a completely unrelated discussion as the ultimate skilled artisan in his *Simple Cobbler of Aggawam* of 1647.⁷⁸⁴ Once Drebbel drifted away from his competing commonplaces Archimedes, Archytas, Regiomontanus, et al., he set a new standard against which later inventors could be measured.

In the history of philosophy he wrote for the Dauphin in 1675, Leibnitz assured the Prince that in the future, we would break through the gates of nature using the various machines invented by Drebbel, Bacon, Torricelli, Guericke, and Boyle.⁷⁸⁵ He also frequently described “restituting” the lost art of Drebbel’s submarine through the work of Papin.⁷⁸⁶ As the founder of submarine navigation, Drebbel’s boat set a standard that others including Papin and Mersenne, compared to Drebbel by Johann Joachim Becher in his *Foolish Wisdom and Wise Foolishness*, tried to reach.

Becher offered another brief review of notable inventions in a 1680 work printed in London and dedicated to the Royal Society. Renowned machines included the perpetual motion Drebbel demonstrated to Rudolf II, and the wooden dove of the ancient Archytas. For other examples, Becher directed the reader to such standard repositories of inventions as Polydore Vergil and Simon Majolus. He proved suspicious of these *loci* of invention, saying

⁷⁸⁴ *The simple cobbler of Aggawam in America* (London: Stephen Bowtell, 1647), 7.

⁷⁸⁵ Gottfried Wilhelm Leibniz, *Philosophischer Briefwechsel* (Berlin: Akademie Verlag, 2006), 398. “Ita futurum esse, ut tandem naturae claustra variis machinis a Drebelio, Bacono, Torricellio, Gerickio, Boylio admotis perfringantur.”

⁷⁸⁶ *Ibid*, 263. Leibniz wrote to Herzog Johann Friedrich van Hannover that “In Hydrostatica oder Wasser-Kunst, habe ich das verlohnrne *inventum Drebelii* mit einem Schiff unters Wasser bey Sturm (denn es unterm wasser ganz still), oder Seeraubern, und nach belieben wider herauff zu gehen, so Mersennus vergeblich nachthun wollen, restituirt.” The court librarian Haes was still reporting to Leibnitz twenty years later on Papin’s progress restituting the lost art of Drebbel. See Leibniz, *Mathematischer naturwissenschaftlicher und technischer Briefwechsel* (Berlin: Akademie Verlag, 2004), August, 1691, 143: “Mr Papin est occupé icy depuis quelques semaines à faire une experience, en quoy il surpassera, si elle reüssit bien, comme J’espere, le fameux Drebelius, à moïn jugement,” and May, 1692, 309: „J’ay eü occasion de donner en propres mains de Mr Papin le paquet susdit, se trouvant ptesentemt icy pour faire avant le depart de S.A. Monseigr le Landgrave une experience de la nature de celle de Drebel. . . .”

those things claimed for Regiomontanus' eagle and Archytas' dove were "more known than true."⁷⁸⁷ Yet even in a technical publication dedicated to the Royal Society, Becher continued to gesture to the required places, among which Drebbel held a prominent position.

Recently, continued Becher, Francesco Lana showed a way to travel in the air, just as Drebbel, Mersenne, and that Frenchman [Papin] had produced ships travelling under the water.⁷⁸⁸ At last Becher reached the main subject of his work, a thermoscopically regulated clock. Cornelis Drebbel used such a thermoscope for his perpetual motion, but Becher said, he himself was the first to make use of thermoscopes in automata since Drebbel.⁷⁸⁹ If Drebbel competed with ancients such as Archytas, inventors of the mid to late seventeenth century, such as Mersenne, Papin, and Lana competed in turn with Drebbel. Becher placed himself within this august lineage.⁷⁹⁰

Although Becher claimed to re-write Polydore Vergil in his *Wise Foolishness and Foolish Wisdom*, he did not fare very well within the work that eventually did replace Vergil, Paschius' *De Novis Inventis*.⁷⁹¹ Georg Paschius of Danzig, Professor of Morals in Kiel, wrote the most comprehensive history of invention at the end of the seventeenth century. Paschius studied at the universities of Rostock, Wittenberg, Leipzig, Halle, Jena, and Erfurt, and went on his academic peregrination through Germany, Bohemia, Poland, Denmark, the Netherlands,

⁷⁸⁷ J.J. Becher, *Theoria et experientia de nova temporis dimittendi ratione et accurata horologiorum constructione* (London: Typis T.N. & venales prostant apud Marcum Pardoe, 1680)4. "nota est machina Cornelii Drebbels, Rudolpho Caesari exhibita, & Tarenti Architam degisse, qui lineam Columbam volatilem fecit, antiquitas testatur. . . . promoventem . . . Quae de Aquila arte facta Carolo Quinto Imperatori ad medium milliare obvolante, & Architae Tarentini lignea columba narrantur, nota potius quam vera sunt."

⁷⁸⁸ *Ibid.* "Paucis abhinc annis P. Lana specimen in aere navigandi exhibuit, sicut Drebbel, Meresennus & Gallus ille nuperus Roterodami navim sub aquis."

⁷⁸⁹ 15-6. Cornelius Drebbel Alcmariensis primus Thermoscopii inventor exitisse perhibetur Post illum quod sciam nemo manum applicationi ad motus Mechanicos Thermoscoptis adhibuit, nisi quod ego anno 1656."

⁷⁹⁰ It was a comparison picked up by J.C. Adelung who in "Cornelis van Drebbel, ein Charlatan," *Geschichte Der Menschlichen Narrheit*, Vol. 2, (Leipzig: Weygand, 1786), 125, described Drebbel as "der Vorläufer und das Muster des im vorigen Bande beschriebenen Becher, dem er an Fähigkeiten und Character so ähnlich war. . . ."

⁷⁹¹ Becher's claim to re-write Vergil was mentioned by Atkinson, 58.

France, and England.⁷⁹² As Atkinson pointed out, the seventeenth-century emphasis on innovation in the mechanical arts rather than the founders of tradition left its mark on Paschius, as well over half of Paschius' work was devoted to medicine and the mechanical arts.⁷⁹³

Paschius published his history first as a dissertation at Kiel, and then in a second, expanded edition.⁷⁹⁴ In his over 800 page *De Novis Inventis*, Paschius found a *via media* in the ancients versus moderns debate through the development of a category of “new-old inventions” (“*Inventis Nov-Antiquis*”). This category combined respect for the ancient sources of all knowledge with the modern ability to control fortune through constant improvement and new inventions.⁷⁹⁵ The increasing pace of progress made new inventions ever easier to discover.⁷⁹⁶

Drebbel frequently appeared in this work, as a candidate for the invention of the thermoscope, as the inventor of the submarine, for his optical display, and as the inventor of the perpetual motion.⁷⁹⁷ Yet although Paschius had cited a few pages before hand the sphere of Archimedes, Ferdinand, and Sapor, the immediate context for his citation of Drebbel's perpetual motion was Becher, as an example of failed competition. Becher said he had invented the perpetual motion, but in reality he had been long preceded by the “most ingenious” Cornelis Drebbel (“*Verum longe ante Becherum invenit perpetuum mobile ingeniosissimus Cornelius Drebbelius*”).⁷⁹⁸

⁷⁹² John Ferguson compared his career to that of John Jonston (1885), 9.

⁷⁹³ Atkinson, 59.

⁷⁹⁴ Georg Paschius, *De Curiosis Huius Seculi Inventis, Quorum Accuratori Cultui Facem Praetulit Antiquitas* (Kiel: Reumann, 1695), and *De Novis Inventis* (Leipzig: Gross, 1700).

⁷⁹⁵ Paschius had previously presided over a dissertation, *De Homine Fortunae suae Fabro* (Kiel: Reumann, 1690).

⁷⁹⁶ Paschius, *De Novis Inventis*, [A]. “*Neque tamen propterea Recentiorum conatus in literis artibusque damnandi sunt; nam cum dies doceat diem, accidit ut artes subinde excolantur, experimenta augeantur, sitque haud difficile inventis aliquid addere.*”

⁷⁹⁷ 624-5, 651, 698-700.

⁷⁹⁸ *Ibid*, 699.

Commonplacing offered a dynamic of progress structured according to a leap-frogging of places, from antiquity to Drebbel to Becher. The theme of a *paragone* between ancients and moderns was as old as the technique of commonplacing itself. Yet the debate changed along with the new forms of commonplaces. Commonplaces came to include not only literary quotations, but also technical inventions such as thermoscopic automata. Furthermore, the increased speed of communication in early modern Europe meant that very recent *loci* could spread copiously enough to become common. The *paragone* now accelerated from one arching across the centuries between Archimedes and Drebbel to a much more recent competition between Drebbel, Papin and Becher. In the future, as others set the new standards, Drebbel would drop from the stock of shared knowledge.

Yet before then, Drebbel's fame as an inventor helped to establish his long-lived reception as a philosopher. As discussed further in the next chapter, the esteemed academic alchemist Andreas Libavius devoted a dissertation to Drebbel's perpetual motion in 1612. The very first question found in the appended *Quaestiones* was whether Drebbel had been the first to invent the perpetual motion.⁷⁹⁹ Within the dissertation, Libavius also compared Drebbel to Archimedes, Archytas, and Regiomontanus.⁸⁰⁰

⁷⁹⁹ Libavius, *Probabilis Investigatio Causarum Physicarum, Aliarumque Globi Archimedaevi novi & instrumenti musici per se absque evidente motore mobilium* (Coburg: Bertsch, 1612), question 1. "Cornelius Drebelius Belga seu Batavus coelum opere mechanico repraesentavit cum marinorum aestuum simulacro; Num id primus? Rx. De aestu marino non constat: de sphaera legimus Archimedis opus apud Cicer. Lib. 1. Tuscul. ubi dicitur Lunae, Solis & quinque errantium motus in sphaeram alligasse, effecisseque idem quod apud Timaeum mundi aedificator Deus, ut tarditate & celeritate dissimilimos motus una regeret conversio, imitatus id divino ingenio. De eadem est in I. De natura Deorum : arbitrari quosdam Archimedes plus valuisse in imitandis sphaerae conversionibus, quam naturam in efficiendis, praesertim cum multis partibus sint illa perfecta quam haec simulata solertius. Ibidem meminit familiaris sui Posidonii qui nuper effecerit sphaeram cujus singulae conversiones idem efficiant in Sole, Luna & quinque errantibus quod efficitur in coelo singulis diebus & noctibus. Fuit autem Archimedes tempore II. Belli Punici, captis Syracusis an. urbis 542. interfectus, & sepultus posita sphaera cum Cylindro super sepulchro eius. Praeter opera sphaerica vero inveniuntur multa alia partim per orbem in plano, partim globos."

⁸⁰⁰ *Ibid*, thesis 4. ". . . qualem globum vitreum dicitur olim confecisse Archimedes; aut qualem columbam volatilem Architas; aut quod alicubi legimus, quidam artificiosam muscam ex manu evolantem, aut alius Aquilam, quae Caesarem Norimbergam usque comitata sit &c."

In the wake of a Ramist “one method” for both rhetoric and philosophy, the unruly commonplace departed rhetorical debate and entered natural philosophy. In the process peculiar inconsistencies occasionally entered into the realm of reason. For instance, the citation of Drebbel’s invention made little logical sense in William Basse’s oft-reprinted *A Helpe to Discourse or A Misselany of Seriousnesse with Merriment*.

This text was miscellaneous in more senses than one. Basse aimed to provide the reader with an easy flow of *copia* for “discourse,” yet the text was fashioned as a series of questions and answers that were halfway between philosophical *quaestiones* and the sorts of question one might be asked in the course of a casual conversation. Mixed in among the riddles and jokes were such philosophical queries as “What are the causes of the ebbings and flowings of the Sea?” Just as Bodin had transformed the natural historical *locus* in natural philosophy by seeking causal explanation, Basse mixed together commonplace conversation and philosophical inquiry.

To answer the question of the tide, Basse began by citing a number of different opinions, eventually giving an account of Drebbel’s perpetual motion machine drawn from Thomas Tymme’s *Dialogue Philosophicall* of 1612. Following Tymme, Basse called Drebbel “Cornelius Bezael” in another commonplace alluding to the amazing powers of ingenuity granted to the Israelite architect Bezalel by God.⁸⁰¹ Drebbel’s machine purportedly showed the motion of the tides, and thus it made sense for Basse to cite the example of Drebbel’s machine in order to answer the question of the tides. However, Basse continued to cite other inventions which had absolutely no bearing upon the discussion.

And that fire is the cause of this as of all other motions insensible in nature may bee perceived, by that perpetuall shew or motion, presented to the Kings Maiesty, by Cornelius Bezael, which was

⁸⁰¹ See Wolfe (2004), 66.

thus done by extracting a fiery spirit out of minerall matter, which ioyned with an ayre in the hollow of the axletree, turned the wheele which turned the whole frame with a continuall reuolution without wearinesse or ceasing, to the admiration of his Maiesty, and as many as beheld it how it could be effected, at leastwise to be perpetuall: till a reason was rendered by the Author, whereupon hee applauded the rare invention: the same whereof afterwards caused the Emperour to send to intreate his Maiesty that he might come to his Court there to effect the like, being a worke as rare as these other of admiration following, which were as *Cassidorus* writeth, the lowing of mettals of sundry forms, a Picture of brasse which did sound a Trumpet aloud, a Brasen Serpent hissing, Birds artificially singing; the Iron-flye made at Norimberge, which being let out of the Artificers hand, did flye abroad among the guests that were at the Table, and at length returned to his hand againe; the artificiall Eagle which flew along by the Emperour a good part of his journey.⁸⁰²

As soon as Basse gave the example of Drebbel, he immediately cited other admirable inventions with which Drebbel's machine successfully competed (being "as rare as these other of admiration"). Regiomontanus' fly and eagle could not possibly shed light on the question of tides. Yet once Basse, driven by a physical question, sought an answer through the *locus* of Drebbel he opened the floodgates of his *copia*, and the world of rhetorical commonplacing collided with the world of the philosophical *locus*. In the next chapter, we will encounter Drebbel's legendary perpetual motion once again as part of his surprising philosophical reception.

⁸⁰² William Basse, *A Helpe to Discourse or A Misselany of Seriousnesse with Merriment* (London: Leonard Becket, 1627), 125-6.

Denk niet, myn Heer, riep ik uit, dat een flesje, een purgeer pil, een plaister of een doosje brandzalf, enz. de ziel van ons Theater zyn, ô neen, een ander *arcanum* is de *causa* onzer beweging; laat Drebbel uit de elementen ons den weg naar het *Perpetuum mobile* wyzen, wy vinden in het diep de oorzaak der steiltens.

Willem van Swaanenburg, *De vervrolykende Momus, of koddige berisper* (Amsterdam: Sold by the author, 1727), 396.

I: Alchemical Machines and Artisanal Philosophy

II: Drebbel and Maker's Knowledge

III: On The Nature of the Elements

IV: Innate Heat

V: From Temperament to Temperature and the Theory of the Winds

VI: The Magnetic Interpretation

VII: Libavius' Rival Interpretation: Nude Nature and Cloaked Texts

I: Alchemical Machines and Artisanal Philosophy

A generation ago historians of science and technology rediscovered the Zilsel thesis that formal experiments emerged from the older tradition of maker's knowledge. A central problem, as Alan Gabbey has stressed, was the lowly status of the mechanical arts.

If, as Gabbey has argued, art counters the course of nature, while natural knowledge reveals it, how could the mechanical arts ever gain philosophical authority?⁸⁰³

While the borders between art and nature have always been indistinct at the edges, they delineated the arts from philosophy within the encyclopaedia of knowledge. The struggle to secure philosophical status for the mechanical arts of all arts suffered an additional handicap. As a servile, illiberal art, the mechanical arts were not admitted to the encyclopaedia – and thus the university curriculum – at all. What changed in early modern

⁸⁰³Alan Gabbey, "Between *Ars* and *Philosophia Naturalis*: Reflections on the Historiography of Early Modern Mechanics," *Renaissance and Revolution: Humanists, Scholars, Craftsman, and Natural Philosophers in Early Modern Europe*, J. V. Field and Frank A.J.L. James, eds. (New York: Cambridge University Press, 1993), 133-145.

Europe that elevated the status of the mechanical arts and allowed for the rise of experiment?

Many have sought agency within the new extramural settings for knowledge making in early modern Europe. For instance, Pamela Long called attention to the elevation of the mechanical arts via princely patronage and the growth of mechanical literature.⁸⁰⁴ Pamela Smith and Paula Findlen pointed to other settings outside of the universities including princely courts but also extending to commercial capitalism which brought the artifactual and natural worlds closer together.⁸⁰⁵ Eric Ash and Deborah Harkness emphasized a state interest in large-scale technological projects integrating many participants from diverse social backgrounds.⁸⁰⁶

The history of alchemy has introduced an entirely new perspective to this historiography by drawing attention to the perfective rather than the mimetic or mathematical mechanical arts. Aristotle himself had distinguished between “those arts which cooperate with living biological processes and those which use dead matter.”⁸⁰⁷ While mechanical arts forced natural bodies to act against their natures, perfective arts completed nature by intervening in natural processes. Ability in the mathematical mechanical arts did not imply mastery of physics, which was conceived in the early seventeenth century as knowledge of the nature of the elements. The perfective arts did require qualitative knowledge of the elements and their function in vital processes.

⁸⁰⁴ Pamela Long, “Power, Patronage, and the Authorship of *Arts*: From Mechanical Know-how to Mechanical Knowledge in the Last Scribal Age,” *Isis* 88 (March 1997), 1-41.

⁸⁰⁵ See Pamela Smith and Paula Findlen, *Merchants & Marvels: Commerce, Science, and Art in Early Modern Europe* (New York: Routledge, 2002), 63.

⁸⁰⁶ Eric Ash, *Power, Knowledge, and Expertise in Elizabethan England* (Baltimore: Johns Hopkins University Press, 2004), Deborah Harkness, *The Jewel House of Art and Nature: Elizabethan London and the Social Foundations of the Scientific Revolution* (New Haven, Conn.: Yale Univ. Press, 2007), and David C. Goodman, *Power and Penury: Government, Technology, and Science in Philip II's Spain* (Cambridge: Cambridge University Press, 1988).

⁸⁰⁷ Close (1971), 175.

As William Newman has argued, alchemy was one such perfective art. It depended upon knowledge of specific natural qualities, unlike the mechanical arts which required knowledge of mathematical properties of bodies.⁸⁰⁸ Newman suggested that knowledge has always been sought through technology in the extramural alchemical tradition. This empirical approach bore great consequences when alchemy finally entered the university.

As alchemy entered the university at the turn of the seventeenth century, an ancient tradition of alchemical operative knowledge merged with academic natural philosophy in Central Europe.⁸⁰⁹ Academic alchemists sought to defend the status of alchemy as a liberal art with a right to a place within the encyclopaedia of knowledge. Placing a premium on knowledge found through practice, academic alchemists sought out the works of practicing artisans to introduce into their curricula. As a result, Cornelis Drebbel was one of many vernacular artisanal philosophers granted authority in philosophy within the academic curriculum.

While the importance of maker's knowledge has most often been found in Bacon and subsequent experimentalists in England, Drebbel's academic consumption points to the great esteem for artisanal philosophy among Central European academic alchemists. Such academics did not reject the authority of theoretical physics. Rather, they wished to reform the discipline so that artisans could lay claim to its authority. This surprising academic reception of a lowly artisan supports Newman's argument for the importance of alchemy in the rise of an empirical culture in natural philosophy.

⁸⁰⁸ William Newman, "Technology and Alchemical Debate in the Late Middle Ages," *Isis* 80:3 (Sep., 1989), 423-445 and *Promethean Ambitions* (Chicago: University of Chicago Press, 2004).

⁸⁰⁹ For the introduction of alchemy to the university see Bruce Moran, *Chemical pharmacy enters the university: Johannes Hartmann and the Didactic Care of Chymiatia in the Early Seventeenth Century* (Madison, Wis.: American Institute of the History of Pharmacy, 1991), Allen Debus, "Chemistry and the Universities in the 17th century," *Mededelingen van de Koninklijke Academe voor Wetenschappen, Letteren, en Schone Kunsten van Belgie* 48 (1986), 13-33, and Owen Hannaway, *The Chemists and the Word: the Didactic Origins of Chemistry* (Johns Hopkins University Press, 1975).

Drebbel has not loomed large in the history of science in general, and hardly at all in the history of alchemy. In the wake of Rosalie Colie's account, Drebbel has occasionally appeared as a skilled Baconian practical experimenter.⁸¹⁰ Luke Morgan recently compared Drebbel to Salomon de Caus as a typical engineer.⁸¹¹ Such engineers, he argued, developed a mimetic, mechanical knowledge of nature based in problem solving, and excluded from the academic curriculum. Morgan defended de Caus' garden designs from hermetic interpretations. In so doing, Morgan opposed the pragmatic knowledge of nature to an interest in the Hermetic tradition and the occult powers of nature. Such an opposition does not hold true for Drebbel.

Drebbel was a perfective artist, not a purely mimetic or mechanical one. He explicitly defended man's God-given ability to perfect (*verbesser*) nature.⁸¹² Such betterment of nature was made possible not through a mimetic recreation of the structures of nature, but through a knowledge of the hidden properties of nature. While it is true that Drebbel rubbed shoulders with mechanical practitioners, such as his colleague in the Ordnance Office

⁸¹⁰ Colie herself did deal with Drebbel as a natural philosopher as well as a mechanic, although the former dimension has often vanished in subsequent historiography. See Rosalie Colie, "Cornelis Drebbel and Salomon de Caus: Two Jacobean Models for Salomon's House," *Huntington Library Quarterly*, 18:4 (1954), 245-269, and "Some thankfulness to Constantine": a study of English influence upon the early works of Constantijn Huygens (The Hague, Nijhoff, 1956). For Drebbel as Baconian practical experimenter, see further J. Peter Zetterberg, "Echoes of nature in Salomon's House," *Journal of the History of Ideas*, 43 (1982), 179-93, William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton University Press: Princeton, 1994), 311, Perez Zagorin, *Francis Bacon* (Princeton: Princeton University Press, 1999), 124, Simon Werrett, "Wonders never cease: Descartes's *Météores* and the rainbow fountain," *British Journal for the History of Science* (2001), 34, 137, and Richard Serjeantson, "Natural knowledge in the *New Atlantis*" in *Francis Bacon's New Atlantis: New Interdisciplinary Essays*, Bronwen Price, ed. (New York: Manchester University Press: 2002), 85-6. The Baconian Drebbel can also be found in the history of art via Svetlana Alpers, *The Art of Describing: Dutch Art in the Seventeenth Century* (Chicago: University of Chicago Press, 1983), 4-5, 12-13, 23.

⁸¹¹ Luke Morgan, *Nature as model: Salomon de Caus and early seventeenth-century landscape design* (Philadelphia: University of Pennsylvania Press, 2007), 125, 135-6.

⁸¹² Drebbel, *On the Nature of the Elements*, Chapter Eleven, „Ob mochtest u fragen wie ist es möglich die dinge also zu verbessern sehen wir nicht das alle sahmen ihres gleichen vorbringen etwan besser etwan schlimmer? wie solten wir durchs Feuer mehr Clarificieren können dan Gott durch die Sonne? Hier auff andtworte das unser Clarificieren auf eine andere weise geschicht dan wir nehmen die Corpora die Gott durch die natur geclarificiert hatt unnd Clarificieren die wieder durchs Feuer unnd Wasser.“

Arnold Rotsipen (who patented a pistol, a printing press, and a lens-grinding machine), he laid claim to much greater philosophical authority than that generally claimed by artisans.

In the seventeenth century, Drebbel was famous not only as a mathematical practitioner, but as an alchemist, and as a natural philosopher.⁸¹³ Despite the current interest in artisanal philosophy, the content of Drebbel's *On the Nature of the Elements*, his lengthiest surviving work (although still under 6,000 words), has been little explored. This is because the text has been called derivative of Aristotle and Hero of Alexandria.⁸¹⁴ Thus, on the one hand Drebbel has occasionally appeared in the literature as an empiric and artisan opposed to literate and specifically academic philosophy. On the other, his writings have been cast as vernacular renditions of scholastic meteorology, and therefore unworthy of attention.⁸¹⁵

Vernacular popularizations of Aristotelian meteorology and vernacular alchemical works abounded in early modern Europe.⁸¹⁶ As discussed in the next section, the content of Drebbel's work differed radically from Aristotle's. In the period, *On the Nature of the Elements* was not considered a mere translation of a philosophical work, but a philosophical work in its own right. Furthermore, it was one which enjoyed a remarkable reception.

⁸¹³ Olaus Borrichius included Drebbel among a pantheon of Netherlandish alchemists in his history of alchemy. See Olaus Borrichius, *De Ortu & Progressu Chemiae Dissertatio*, *Bibliotheca Chemica Curiosa*, ed. J.L. Manget, 36. "Triumphant Belgae in suis *Isaacus Hollandis*, suis *Drebbeliis*, *Helmontiis*, *Ewaldii Vogelii*, *Balbaniis*, *Hogbelandis*." Bernardino Ramazzini, in an oration given at Padua in 1700, similarly lists Drebbel among a pantheon of chymical authors including "Libavius, Drebellius, Crollius, Helmontius, Poterius, Tachenius, ac postremo celeberrimus Etmullerus." See Bernardino Ramazzini, *Opera Omnia, Medica, & Physica* (London: 1717), 15.

⁸¹⁴ Even Rosalie Colie saw *On the Nature of the Elements* as a fulfillment of a particular type of philosopher devised by Drebbel's contemporary Bacon, rather than as a contribution made by Drebbel himself. See my discussion of Colie in Chapter Two.

⁸¹⁵ Most influentially in Jaeger's monograph. Vladimir Janković called *On the Nature of the Elements* "one of the most influential neo-scholastic renditions of classical ideas." See *Reading the Skies: A Cultural History of English Weather, 1685-1820* (Manchester: Manchester University Press, 2000), 180.

⁸¹⁶ In the case of alchemical texts, the pursuit of alchemy outside the walls of the academy had supported a vernacular alchemical literature at least since the fourteenth century. See Michela Pereira, "Alchemy and the Use of Vernacular Languages in the Late Middle Ages," *Speculum*, 74:2 (Apr. 1999), 336-356. See S.K. Heninger, *A handbook of Renaissance meteorology, with particular reference to Elizabethan and Jacobean literature* (Durham: Duke University Press, 1960) for vernacular meteorology in England.

What first catches the historian's attention in the case of *On the Nature of the Elements* and Drebbel's other short publications is their exceptional ability to travel between diverse social, cultural, and national reading publics. *On the Nature of the Elements* would appear in Dutch, German, Latin, and French and be reprinted over twenty times before the end of the eighteenth century.⁸¹⁷ Unlike vernacular popularizations of ancient authors, *On the Nature of*

⁸¹⁷ Three texts by Drebbel were published, frequently together. The first to be published was Drebbel's letter to King James I concerning his perpetual motion machine in 1607, followed by *On the Nature of the Elements*, first published in 1608, and *On the Quintessence* in 1621. See Cornelis Drebbel, *Wonder-vondt van de eenwighe bewegingh, die Corn. Drebbel door een eenwighe bewegende gheest, in een cloot besloten, te weghe ghebrocht heeft . . . ooc mede by gevoecht een boeck Pymander beschreven van Mercurius driemael de grootste* (Alckmaer : Jacob de Meester, 1607); *Ein kurtzer Tractat von der Natur der Elementen. in Niederländisch geschrieben; unnd allen der Naturliebhaberen zu Nutz ins Hochteutsch getrewlich vbergesetzt* (Leiden: von Haesten, 1608); *Ein kurtzer Tractat von der Natur der Elementen Und wie sie den Windt/ Regen blitz und Donner verursachen und wozu sie nutzen. Durch Cornelium Drebbel. In Niederländisch geschriben/ und allen der Natur liebhabern zu nutz in hochdeutsch getrewlich ubergesetzt* (Hamburg: Paul Lang, 1619); *Een kort tractaet van de natuere der elementen, ende hoe sy veroorsaecken den wint, regen, blixem, donder ende waeromme dienstich zijn* (Rotterdam: Pieter Jansz, 1621); *Een Kort Tractaet van de natuere der Elementen* (Haarlem: Vincent Casteleyn, 1621). *Quinta Essentia. . . : Accedit Ejusdem Epistola. . . De Perpetui Mobilis inventione. Editi curâ Joachimi Morsi* (Hamburg: Carstens, 1621); *Tractatus Duo*, Morsius, Ed. (Hamburg: Carstens, 1621)[This is the first edition to include all three texts together]; *Basilii Valentini. . . Offenbabrung der verborgenen Handgriffe auff das Universal gerichtet. . . Darbey mit angefügt, Corneli Drebbel Tractatus Ein kurtzer Tractat Von der Natur Der Elementen/ Vnd wie sie den Wind/ Regen/ Blitz vnd Donner verursachen/ vnd wozu sie nützen/ / Durch Cornelium Drebbel in Niederländisch geschrieben/ vnd allen der Natur liebhaberen zu nutz ins Hoch-Teutsch getrewlich ubergesetzt* (Erfurd: Birckner, 1624); "Corneli Drebbeli Chemicici & Mechanici peritissimi, Tractatus Prior de Natura Elementorum. Tractatus Posterior De Quinta Essentia. Epistola," in Johann Heinrich Alsted's *Compendium Philosophicum* (Herborn: Georg Corvinus, 1626); *Tractatus de natura elementorum qua ratione ventos pluvias, fulgura & tonitrua parturiant, &c. / in linguam Latinam translatus & in lucem emissus à Ioanne Ernesto Burggrauio* (Frankfurt: Röteli, 1628); *Ein kurtzer Tractat von der Natur der Elementen : vnd wie sie den Wind, Regen, Blitz vnd Donner verursachen, durch Cornelium Drebbel in nider teutsch geschrieben ; vnd allen der Natur Liebhabern zu Nutz ins hoch teutsch getrewlich vbergesetzt, durch Johann Ernst Burggreffen*(Frankfurt: Röteli, 1628); *Cornelii Drebellii Belgae Tractatus Duo I. De Natura Elementorum I. De Quinta Essentia Accedit bis de Mobilis Perpetui inventione Epistola lectu dignissim. E Belgico idomate in Latinum vertit. D. Petrus Laurebergius Professor in Athenaeo Hamburgensis* (Geneva: Ioan. de Tourne, 1628); *Openbaringhe der verborgener handtgrepen . . . Wt het Hoochduytsche overgeset ... Daer by gevoecht is een Tractaet vande nature der vier elementen, ; door Cornelis Drebbel* (Rotterdam: Jan van Waesberge, 1632) "Tractatus Fernelli Prebbel [sic], De elementis" in *Currus Triumphalis Antimonii*, Ed. Pierre Jean Faber (Toulouse: Petrus Bosc 1646); *Divers traiteꝝ de la philosophie naturelle . . . Les deux traiteꝝ de Corneille Drebel flaman. . .* (Paris: Chez Jean d'Houry, 1672); *Grondige oplossing van de natuur en eygenschappen der elementen. : En hoe sy veroorsaken donder, blixem, hitte, koude ... Als mede een klare beschrijving van de Quinta Essentia, noyt voor desen gedrukt ; noch een Dedicatie van 't Primum Mobile* (Amsterdam: Jacob Claus, 1688); *Grondige oplossing van de natuur en eygenschappen der elementen. En hoe sy veroorsaken Donder, Blixem, Hitte Koude, Wind, Regen, Hagel, Sneeuw, &c. En waar toe sy dienstig zijn. Als mede Een klare beschrijving van de Quinta Essentia of Vijfde Wesen. Noch een Dedicatie van't Primum Mobile alles gedaan door den grooten Hollandschen Filosooph Cornelis Drebbel van Alkmaar. Den tweeden druk. Van vele fonten gesuyvert, en met het Leven van den Autheur vermeerdert* (Rotterdam: Adrian van Dijk, 1701); *Cornel. Drebellii Belgae Tract. duo 1. de natura elementorum. 2. de quinta essentia. Acc. bis de mobilis perpetui inventione epistola. E Belgico idomate in Latinum vertit Andr. Luppius. item D. Henr. Churadi Urim Thurim.* (Amsterdam: 1702); *Gründliche Auflösung von der Natur und Eigenschaft der Elementen, und was die Ursache des Donners und Blitzes. . . mit einem Anhang . . . physicalische Fragen / von einem Liebhaber der Hermetischen Kunst herausgegeben* (Franckfurt am Mayn, 1715); *Cornelii Drebellii, Tractat, oder Abhandlung von Natur und Eigenschafft der Elementen, ingleichen des Donners, Blitzes, Hitze, Kälte, Windes, Regens, Hagels, und Schnee, &c, so sich in der obern und untern Region erzeugen und wozu sie Anlass geben: deme vorgefüget einige Merckwürdigkeiten, so man bin und her von diesem weisen Mann angetroffen. . . wie auch Herrn Edmund Hallei Erzählungen von denen Winden, zusammen gesammelt und herausgegeben von Polycarpo Chrysostomo* (Leipzig: Johan

the Elements would be included in philosophical compendia and favorably cited in academic textbooks as an authoritative source in its own right. Drebbel's slim vernacular pamphlet would be incorporated into heavy Latin folios and freighted with copious scholarly commentary. Importantly, the text would also be quoted in printed academic dissertations, which before the advent of scholarly journals were key channels of scholarly communication.⁸¹⁸

Drebbel himself never attended university and stood opposed to academic culture. Trained in the circle of his brother-in-law Hendrik Goltzius as an engraver, Drebbel announced his lack of Latin in his printed works.⁸¹⁹ According to Hartlib, Drebbel refused to send his own children to school.⁸²⁰ Within his strongly egalitarian texts, Drebbel disparaged "clever wits" and those who wrote books which are long or difficult to

Sigmund Strauss, 1723); *Grondige oplossing van de Natuur en Eygenschappen der Elementen, En hoe sy veroorsaaken Donder, Blixem, Hitte, Koude, Wind, Regen, Hagel, Sneeuw &c. En waar toe sy dienstig zyn. Als mede een klare beschryving van de Quinta Essentia, Noyt voor desen gedrukt. Noch een Dedicatie van't Primum mobile. Alles gedaan door den grooten Hollandschen Philosoph Cornelis Drebbel van Alkmaar. Vermeedert met het Leven van den zelve; als mede een Brief van Nacha Ree* (Amsterdam: Samuel Lamsveld, 1732); "Cornelii Drebbels, Von Denen Elementen" in *Josef Ferdinand's Kleeblatts Neue herausgab einiger rar gewordener Chymischen sehr nutzbaren Tractatelein* (Frankfurt und Leipzig: Tobias Göbhardt, 1768); "Kornelius Drebbel. Abhandlung von der Quintessenz; von Joachim Morsius herausgegeben im Jahre 1621" in *Neue alchymistische Bibliothek für den Naturkundiger unsers Jahrhunderts ausgesucht und herausgegeben von S [Friedrich Josef Wilhelm Schröder]* (Frankfurt: Brönner, 1772); *Kort begrip der hoofdstoffelyke natuurkunde, of Inleiding tot de kennis der eigenschappen van de vier elementen, als: de aarde, de lucht, 't water en vuur: vervattende den oorsprong van donder, blixem, hitte, koude, wind, regen, sneeuw, &c. hunne uitwerkingen en nuttigheden . . . vermeedert met des auteurs leven en een ophelderende kunstplaat* (Amsterdam: P.G. Geysbeek and L. Groenewoud, [1785]).

⁸¹⁸ R.J. W. Evans, "German Universities after the Thirty Years War," *History of Universities* 1 (1981), 169-90.

Kevin Chang, "From Oral Disputation to Written Text: The Transformation of the Dissertation in Early Modern Europe," *History of Universities* 1004 19(2): 129-187. William Clark, *Academic Charisma and the Origins of the Research University* (Chicago: University of Chicago Press, 2006). Cf. David Kronick, "Devant le deluge" and other essays on early modern Scientific Communication (Lanham, Md.: Scarecrow Press, 2004), 266.

⁸¹⁹ See the conclusion to Drebbel's letter to King James in the Appendix, "But since I cannot fully render my meaning either in English or Latin, I have written it in Dutch, and had it translated word for word, so that they many understand the sense unchanged . . ." Jaeger maintained Drebbel attended the Gymnasium in Alkmaar, but the evidence for this is slim indeed.

"Maer alsoo mijn meyninghe niet en can volcomen uytheelden/ noch in de Engelsche/ noch in de Latijnsche tael/ so hebbe dat in Duyts geschreven/ en van woordt tot woordt laten oversetten/ op dat den sin onveranderlijck soude moghen verstaen. . . ."

⁸²⁰ Hartlib, *Ephemerides*, 30/4/35A. "The binding ones-selfe to any Rule whatsoever dose hinder mightily a Mans free-Invention. Therefore Drebbel would not suffer his children to bee taught in schooles. Ergo non synthetice procedendum."

understand.⁸²¹ He acknowledged that some would accuse him for not “strengthening” his text with ancient authorities, but asserted that he had not read any of these and had only given readers what he himself had received from nature.⁸²²

As discussed further in the next chapter, the well-respected Professor at the Hamburg Gymnasium (1614-1624) and then at the University of Rostock (until 1639), and a prolific, pansophic author, Peter Lauremberg praised Drebbel’s *On the Nature of the Elements*. Asked to translate the work into Latin, he was surprised to find within this unassuming, yet popular work “writing of a new character, and by a new writer.”⁸²³ Bonaventure had long before placed various writers – scribe, compiler, commentator, and author – along a hierarchy of citation. All cited the work of others, but in different proportions. At the top of this hierarchy stood the author, who cited mostly his own work.⁸²⁴ Still, the author cited the works of others as well. In fact, to be an author, one had to cite authorities. Drebbel was a “new writer” who scorned citations and claimed authority in the work of his own hands.

Lauremberg noted a harmony between Drebbel’s philosophy and ancient theories. This did not lead him to call the text secondary or derivative. He accepted Drebbel’s claim to personal knowledge discovered through his own hands. Just as his contemporaries discerned

⁸²¹ In the Dedication, Drebbel says he does not want to be like those “clocke verstanden” who do not believe than mankind can understand the hidden causes of nature, and those who, afraid to lose their great reputation, cloak their reasoning in strange words lest all men be able to see their foolishness. “[Ich] wil nielt/ gelicjk veel voor my ghedaen/ haer roemende wonderlijcke dinghen/ stellende het bewijs daer van met seltsame name/ en vreemde processen/ wel wetende wanneer haer raem met naecte reden souden bewijsen/ dat alle Menschen haer sotheyt souden gewaer worden/ en also haren grotten nam verliefen. Hierom wil niet alleene bewijsen met reden en exempelen/ maer ooc die exempelen verclaren nae de waerhey:” See also the preface to *On the Nature of the Elements*, “Sollen wir grosse Bücher schreiben, Gott dar mit zu loben? Ist es nicht eitelheit?”

⁸²² Preface to *On the Nature of the Elements*, “Ich . . . verhoff du werdest es nicht mit unverstant verachten noch mich verdencken das ich dis mein schreiben mit den alten scribenten nicht bewisse und bekräftige, dan ich die warheit zu sagen keinen hieruber gelesen, sondern ich gebe dir solches wie ich es von der Natur empfangen habe. . . .”

⁸²³ Peter Lauremberg in his dedicatory letter to Georg Schumacher in Cornelis Drebbel, *Tractatus Duo: Prior de Natura Elementorum, . . . Posterior de Quinta Essentia. . . : Accedit Ejusdem Epistola. . . De Perpetui Mobilis inventione* (Hamburg: Carstens, 1621), 3. “Quod dum facio, inveni scriptum caractere quidem novo, novoque auctore dispaluisse in vulgus, sed tamen sapere nativam generositatem antiquioris Philosophiae.”

⁸²⁴ Andrew Bennet, *The Author* (New York: Routledge, 2005), 38-9.

classical qualities among the untutored noble savages of the New World, Lauremberg admired how the untaught Drebbel possessed the “native gentility of ancient Philosophy.”⁸²⁵ The fact that many (though not all) findings of this modern artisan corresponded with ancient theories only increased his prestige.

In Drebbel’s Central European academic reception, we find a vigorous respect for artisanal philosophy and the unique avenues to knowledge it had to offer. The esteem for empirical philosophy rather than authoritative citations so associated with the Royal Society’s Horatian motto, “Nullius in Verba,” prospered much earlier in the century in some parts of Central Europe. Why did the artisan Drebbel claim philosophical authority? And why did scholars accept his claim and translate his vernacular artisanal philosophy into the Latinate culture of academic natural philosophy? And why in Central Europe in particular?

The appeal of Ramism aids us in addressing these questions. Howard Hotson argued in *Commonplace Learning* that the greatest concentration of Ramists could be found not in England, but in Central Europe. It was there that alchemy, with all of its utilitarian possibilities, entered the academy.⁸²⁶ Professors in semi-Ramist *gymnasia*, *gymnasia illustrata*, and universities required an easily comprehensible alchemy and physics. They were the first to transform Drebbel’s extremely brief, comprehensive and comprehensible natural philosophy into an academic text. Just four years after the first (now lost) 1604 edition of *On the Nature of the Elements*, the work was translated from Dutch to German. Before another four years had passed, the prominent academic alchemist Andreas Libavius had translated it from German to Latin and included it with lengthy commentary within his hefty academic

⁸²⁵ Stelio Cro, “Classical Antiquity, America, and the Myth of the Noble Savage,” *Classical Tradition and the Americas*, Wolfgang Haase and Meyer Reinhold, eds. (Berlin: de Gruyter, 1994), 379-418.

⁸²⁶ Howard Hotson, *Commonplace Learning: Ramism and its German Ramifications, 1543-1630* (New York: Oxford University Press, 2007), 121.

folio, *Syntagma Arcanorum Chymicorum*.⁸²⁷ Ramism helps to explain the appeal of brevity and comprehensibility.

The Ramist appreciation for problem-solving and knowledge found in practice shows how Drebbel's social status could have furthered rather than hindered his claim to philosophical authority.⁸²⁸ Drebbel was famed both for his efficient natural philosophy and his engineering capacity. In this he differed from many other period writers. The works of Basil Valentine and Michael Sendivogius resemble Drebbel's *On the Nature of the Elements* in content, style, and readership. Yet Valentine and Sendivogius assumed false identities and pseudonyms, rather than employing the public presence that attended artisans like Drebbel to bolster their claims to authority.⁸²⁹ While championing the work of his own hand, Basil Valentine (i.e. Johann Thölde) purported to be not an artisan, but a fifteenth century monk.

Ramist and semi-Ramist readers appreciated not only Drebbel's easily comprehensible natural philosophy, but the fact that he was also a renowned contemporary engineer who put his ideas into practice. These two qualities came together when his readers purposefully conflated Drebbel's text and his wildly successful machines. As discussed further in the next chapter, Drebbel's making and demonstration of natural knowledge through machines appeared to offer pedagogues an easily apprehensible manual shortcut to encyclopaedic knowledge.⁸³⁰ The idea that students could attain comprehensive knowledge

⁸²⁷ This work was published in a two volume edition (1613-5), but Libavius already referred to his translation and treatment of Drebbel in a 1612 disputation, discussed below.

⁸²⁸ For Ramus' appreciation for problem-solving, see Michael Mahoney, "Petrus Ramus," *Dictionary of Scientific Biography* (New York: Scribner, 1975), 286-290. For the admiration of Ramists for "practice," see Hotson (2007), 86. For "usage" as the key concept of Ramism supporting an artisanal philosophy see Matton, "L'alchimie chez les Ramistes et Semi-ramistes," *Argumentation* 5 (1991), 406.

⁸²⁹ Drebbel's competitor in the English court Salomon de Caus and the Marburg engineer Benjamin Bramer might be compared as contemporary engineer/natural philosophers, yet their texts do not match *On the Nature of the Elements* in longevity and international reception. A better comparison would be the sixteenth century French potter Bernard Palissy.

⁸³⁰ For the Ramist search for shortcuts circumventing onerous mathematical and logical calculations, see Robert Goulding, "Method and Mathematics: Peter Ramus's Histories of the Sciences," *Journal of the History of Ideas*, 67: 1 (2006), 63-85.

by merely playing with one of Drebbel's microcosmic machines fired the imagination of harried teachers in small German principalities.

This added dimension of Drebbel's natural philosophy makes *On the Nature of the Elements* particularly interesting for the subsequent history of experimentalism in natural philosophy. It also situates an early respect for maker's knowledge not in Bacon's England but in Ramist Central Europe, and not outside the academy but within revised curricula. This observation runs counter to a widely held etiology that finds experiment within mechanical philosophy, and links mechanical philosophy to practitioners of the mechanical arts. According to this thesis, the success of automata and the increasing precision work of mechanical instruments led to greater esteem for the power of mechanical explanations.⁸³¹ The yoking of the new philosophy to mechanics has encouraged historians to look to mechanics for mechanical philosophy.

Yet when we do look in an ideal locale for a "mechanic's philosophy," the Ordnance Office, we find a character such as Drebbel.⁸³² Drebbel held a vitalist view of his machines, called them "living instruments," and employed them as the basis for his non-mechanical philosophy. The thesis concerning the origins of mechanical philosophy faces a problem if the most highly skilled mechanic of the Stuart court subscribed to a non-mechanical philosophy.

⁸³¹ Edgar Zilsel, "The Genesis of the Concept of Scientific Progress" *Journal of the History of Ideas* 6 (1945); Derek J. de Solla Price, "Automata and the Origins of Mechanism and Mechanistic Philosophy," *Technology and Culture*, 5:1 (Winter, 1964); Alexander Keller, "Mathematics, Mechanics, and the Origins of the Culture of Mechanical Invention," *Minerva* 23 (1985), 548-561; J.A. Bennett, "The Mechanics' Philosophy and the Mechanical Philosophy," *History of Science* 24 (1986), 325-349; Paolo Rossi, *Philosophy, Technology and the Arts in the Early Modern Era* (New York: Harper & Row, 1970).

⁸³² Frances Willmoth suggested investigating the Ordnance Office for the interaction of mechanics and mechanical philosophers in "Mathematical Sciences and Military Technology: the Ordnance Office in the Reign of Charles II," in *Renaissance and Revolution*, J. V. Field, ed. (Cambridge: Cambridge University Press, 1993), 117-132.

In this chapter, I document Drebbel's attitude towards maker's knowledge, outline the more radical features of his natural philosophy, and point to his importance for two renowned academic alchemists, Johann Hartmann (1568-1631) of Marburg, who introduced the study of alchemy to the university, and his rival Andreas Libavius (ca. 1560-1616), rector of the Coburg Gymnasium. From these hotspots of academic alchemy, Drebbel's natural philosophy spread east and west. Such a rapid and broad reception supports the importance of Drebbel's natural philosophy in the emerging empirical culture and the changing categories of art and science in early modern Europe.

II: Drebbel and Maker's Knowledge

Drebbel championed his maker's knowledge in both *On the Nature of the Elements* and his letter to King James I on the perpetual motion. He claimed to know everything about the elements through his own hands ("mit der handt") and without the help of any other writers.⁸³³ He constantly connected making (*maecken*) to understanding (*verstandt*), knowledge (*kennis*), and science (*wetenschap* or *scientie*).⁸³⁴ "Making" related to knowledge in three ways. Drebbel could discover (*ondervind*) the hidden causes of nature through the physical manipulation of the elements in devices. His working devices in turn proved that he had attained what he sought, and finally those devices could easily and quickly demonstrate that knowledge to others.

⁸³³ See Drebbel in *On the Nature of the Elements*, "Dieses lieber Bruder habe ich von der natur geschriben wie ich solches mit der handt befunden," and in the "Dedication," "Want verclare door den levendigen Godt/ dat noch die schriften van de Ouden/ noch eenighen Mensch my de minste hulp hier in ghedaen heeft: maer heb dit alleen ghevonden/ door gestadich opmercken/ in't ondersoecken van de Elementen."

⁸³⁴ "Dedication." "Voorts also *verstae* die oorsaek des Windts/ *maeck* Instrumenten die geweldigk windt gheven/ en door de *kennis* van ebbe en vloedt/ *maeck* een Instrument. . . . " „Want wy hebben ooc geen getuygenis/ dat de Ouden dese *wetenschap* *bekent* is geweest/ hoewel daer veel nagedracht. Cicero schrift / dat Archimedes had een Spheer *gemaect*/ die hem eeuwelijck na den loop des Hemels conde beweghen: maer soude door't verderflijcke Oorlogh/ beyde den Meester en zijn Instrument op eenen dagh vernielt zijn/ waerom het teecken van waerheyt verloren [emphasis mine]."

Drebbel had as much confidence in the abilities of other men as he did in his own, if those abilities were well-practiced. This emphasis on the *practice* of gifts in the “Dedication” reflects Drebbel’s motto “*Oeffen uw gaven recht*” (Practice your gifts rightly). “Practice” also encompassed a religious and socially egalitarian dimension. Bad practice (“*quade oeffeninghe*”) equaled sin. Good practice allowed everyone to gain equal lots in life and in divine salvation. At the start of the “Dedication,” Drebbel bemoaned the lack of understanding (*onverstandt*) which caused the different lots of man.⁸³⁵ In *On the Nature of the Elements*, he declared that if we test ourselves, we find that we are all created by God as bejeweled Kings, with all of nature for our inheritance.⁸³⁶ It is through maker’s knowledge and self-testing that man can gain understanding of nature and of himself, love God, avoid evil, and partake equally in the sweetness of natural knowledge. In his own life, Drebbel connected artisanal philosophy to social egalitarianism. As the Küfflers told Peiresc in 1624, “he lived always as a philosopher, concerning himself only with his observations, and, not caring for worldly things or aristocrats, he would sooner acknowledge a poor man than a great lord.”⁸³⁷

As Lauremberg noted, not only the type of author, but the style of writing was new. Drebbel’s style hovered at the very edge of literate communication, as close to embodied experience as possible. Drebbel used simple explanations and common examples, as was not unusual. However, he also included a special contrived demonstration which was the subject of the only illustration in the text besides for Drebbel’s own portrait. This demonstration

⁸³⁵ “. . . dat onverstandt is de oorsaeck van den verscheyden wil/ oordeel en leven des Menschen.”

⁸³⁶ “. . . lasser uns uns selber prufen/ sein wir nicht Könige des kostlichsten kleinods so Gott geschaffen? haben wir nicht allen reichertumb der Welt zu unserm dienst?”

⁸³⁷ Bibliothèque Carpentras, Ms. 1776, fol 410r. “Il vit tout a faict en filosofe ne se soucie que de ses observations, et mesprisé toutes les choses du monde et les Grands, et saluera plustot un pauvre homme qu’un grand seigneur.”

went beyond “virtual witnessing.”⁸³⁸ It allowed the reader to understand Drebbel’s theory better than the author could express it in words (“mehr dan ich schreiben konte”).⁸³⁹

Drebbel claimed to draw his philosophy from his own bodily knowledge, and to be able to reproduce that bodily knowledge in others.

In his letter to King James, Drebbel also stressed how his physical demonstrations would replace long-winded and confusing textual explanations. He contrasted his own manner of brief and physically confirmed writing with learned culture and its pessimistic view of man’s ability to understand hidden, universal causes such as the *primum mobile*. He could prove his ability to discover (*ondervind*) such causes by creating working, living instruments. This proof should suffice to explode the arguments of even the “clever wits.”

O King, I could demonstrate this as well with living instruments, as with natural reasoning, so that I therefore should have no need to write much. For I know well that most clever wits will not believe that we can understand these hidden causes with our understanding. Therefore as proof that I understand the cause of the *Primum mobile*, I make a globe that can move perpetually, following the course of the heavens . . .⁸⁴⁰

Drebbel’s claims for his artisanal philosophy were unbounded. He compared himself to all other investigators of nature, and even to the ancients whom he claimed to surpass.

Furthermore, the knowledge gained through his art did not stop at the border of human affairs. Drebbel’s “living instruments” could also lead beyond to knowledge of the divine.

⁸³⁸ Shapin and Schaffer discuss the way Boyle deployed engravings of his experimental equipment, the air-pump, in order to give his readers a sense of being “virtual witnesses” at an experiment, in *Leviathan and the Air-pump: Hobbes, Boyle, and the Experimental Life* (Princeton: Princeton University Press, 1985), 55.

⁸³⁹ Chapter Five. “Darumb mein Bruder was du dis im grunde betrachtetest wirstu recht verstehen die vorgehende exempel vom winde, mehr dan ich schreiben konte derowegen habe ich nicht mehr geschriben dan zum fundament und zu dem das wir weiter verstehen werden notig.” Chapter Six, “welche ursachen man mit natürlichen Rationibus beweisen kündte, aber der vorgehende ursachen verstehet, wirdt das volkömlicher verstehen dan ich beschreiben kondte.”

⁸⁴⁰ “Ten waer (o Coningh) dit so wel conde bewijsen met levendige instrumenten/ als met natuerlijcke reden/ soo en soude niet hebben bestaen dus veel te schrijven: Want my is wel bekent/ dat meest alle clocke vertanden niet willen ghelooven/ dat wy dese verburghen oorsaken met onse vernunft moghen begripen/ waerom tot bewijs daat verstaet die oorsaek van’t Primum mobile: So maeck een cloot/ die hem eeuwelijck bewegen can/ nae den loop des hemels. . . .”

“And therefore I am also prepared to show other proofs, hoping through that to make many people taste the pleasing sweetness of the hidden cause of things, since that discovery taught me that no pleasure can be compared to the true knowledge of Nature, which also teaches us to understand the complete divinity, wisdom, and power of God.”⁸⁴¹

III: On The Nature of the Elements

This extremely slim pamphlet offered an entire account of the elements and how they produce rain, snow, thunder, hail, and the winds. Drebbel coupled meteorology, hydraulic engineering, and the latest alchemy with a strong reliance upon the artisan’s ability to discover natural truths with his own hands and a commitment to make those truths as easy to understand as possible. Drebbel’s meteorology in *On the Nature of the Elements* followed the permutations of the various elements into each other, the constant cycling of the elements through the macrocosm, and the production of rain, thunder, winds, lightning, snow, and hail as the effects of various layers of hot and cold air of differing densities. It thus bore comparison with Aristotle’s *Meteorology*, especially in its emphasis on corpuscular condensation and rarefaction as a motive force. His use of pneumatic devices as demonstrations could also be compared with Hero of Alexandria’s *Pneumatica*.⁸⁴²

Yet even within its narrow span, the work encompassed more than meteorology and pneumatics. Drebbel fused alchemy and meteorology through his understanding of nature herself as alchemy, further blurring the art/nature divide. He distinguished between nature’s

⁸⁴¹ “Dedication.” “. . . waeromme ben also oock bereydt die andere proeven te vertoonē/ verhopende daer door veel Menschen te dooen smaken die aenghename soetheyt van de verburghen oersaeck der dinghen: want ondervindingh leert my/ dat geen soeticheyt by Natuers ware kennis te verghelijcken/ also ons leert verstaen die volmaeckte goetheyt/ wijsheyt en moghentheyt Gods: waerom wil niētt/ gelijck veel voor my ghedaen/ haer roemende wonderlijcke dinghen/ stellende het bewijs daer van met seltsame name/ en vreemde processen/ wel wetende wanneer haer raem met naecte reden souden bewijsen/ dat alle Menschen haer sotheyt souden gewaer worden/ en also haren grotten nam verliesen. Hierom wil niet alleene bewijsen met reden en exempelen/ maer ooc die exempelen verclaren naer de waerheyt:”

⁸⁴² M. Boas, “Hero’s Pneumatica: A Study of Its Transmission and Influence,” *Isis* 40:1 (Feb., 1949), 38-48.

“natural” and her more extreme, chymical actions. When nature acted gently and only heated the elements slightly, the elements transmuted into each other and produced wind and rain. More spectacular meteors, such as thunder and lightning, were the result of a chymical reaction within the element earth.⁸⁴³

Drebbel drew no distinction between the elementary sublunar realms and the superlunar realms. As a result, fire was the same, whether in the sun or on the earth, and whether natural or artificial. For example, earth’s purification into a salt was a crucial step in Drebbel’s account of vital processes such as generation, nutrition, and growth. The step could be accomplished equally well, said Drebbel, through “the power of fire or the Purification of nature.”⁸⁴⁴ Drebbel’s later hatching of chicken eggs in his self-regulating incubator would similarly subvert a Thomistic divide between the vital heat of nature and the artificial heat of a furnace.

This equation between the purification of nature and chymical operations allowed *On the Nature of the Elements* to be read not only as macrocosmic physics, but as a guide to the production of the philosopher’s stone. “If Alchemists correctly understood these processes, they would not struggle so pitifully to find the material for the philosopher’s stone,” said

⁸⁴³ Chapter Eight. “Aber wan diese aufgezügene Nebel schweben in sehr warmen örtten verursachen sie Donner und Blitz (durch die geschwinde vergrossung) unnd den windt: Aber wan der Lüfft natürlich und ein wenig Wermer, dan der nebel so gibt es allein windt und regen wie zu vor weitleuftiger angereicht.” In the previous chapter Drebbel had explained lightning and thunder mechanically as the splintering of cold, coagulated air through collision with the rapidly moving, thin hot air, “gleich wir sehen wan der Saltpeter gebrochen wirdt durch das Feuer unnd also verändert in die natur des Lüffts, Item wan wir ein nasses auch auff ein heiss eisen oder geschmolzen Blei schlendren welches durch die entbindung oder vergrossung der hitze krachet und brist gleich dem Donner. Item wir sehen an einem Feuer zeug durch das geschwindt brechen des steins, die ursach der brennenden klarheit etc.” I would not interpret the example of saltpeter here *prima facie* as a discussion of oxygen production, but as another example of the production of heat and thus expansion through rapid breaking, as in the explosion of gunpowder. Cf. Gerrit Tierie, *Cornelis Drebbel (1572-1633)* (Amsterdam: H. J. Paris, 1932).

⁸⁴⁴ Chapter Nine. “Dan die Erde durch des Feurs kraft oder Purification der natur entbunden verändert sich in Wasser wirdt saltzig und ein kraft der Erden, wie wir in der Calcination clärlich befinden.”

Drebbel.⁸⁴⁵ As Pamela Smith has pointed out, at least one early reader interpreted *On the Nature of the Elements* as a series of chymical processes.⁸⁴⁶

Alchemists not only imitated nature's chymical operations, but perfected them to create something purer than anything found in nature. Drebbel anticipated that he would be asked, "How can we through fire clarify more than God can through the Sun?" He responded that God began the process of clarification through nature, and we start where nature left off.⁸⁴⁷

Contemporaries did not read Drebbel's *On the Nature of the Elements* as a simple re-statement of Aristotelian meteorology. Rather, they were struck by important differences between Drebbel and Aristotle, just as they were impressed with the conspicuous similarities. Of course, Drebbel's lack of distinction between sublunar and superlunar realms, was one major difference. This lack of distinction allowed inhabitants of the earth to learn about celestial natures through earthly practice. The minimal and mutable natural hierarchy of the elements also reflected Drebbel's social egalitarianism. God divided the world only into the four more or less subtle elements. Fire, not the Aristotelian superlunar ether, took the highest position, filling the unending expanses of space and embracing the entire kingdom of the Lord ("seine stelle im allerhohesten genommen aldaes erfüllet die unendliche weite und umfangt alle herlichkeit des Herren"). Yet each element clarified its neighbor to its own level

⁸⁴⁵ "Dann verstünden dies viel Alchimisten wurden sie sich so iemmerlich nicht bekümmern ihre Materiam zu wissen."

⁸⁴⁶ Smith pointed to the British Library 1608 edition of Drebbel's works, in which a reader has inscribed the flyleaf with two recipes of the tincture according to Drebbel. See Pamela Smith, *Body of the Artisan*, 163. This reader identified a process in Chapter Ten of *On the Nature of the Elements*, as well as in the preface, where Drebbel described an alchemical vision. This vision was understood by others as his description of what he saw in his alembic, in his perpetual motion, or both. See British Library 1033.c.34.

⁸⁴⁷ Chapter Eleven. "Ob mochtest u fragen wie ist es möglich die dinge also zu verbessern sehen wir nicht das alle sahen ihres gleichen vorbringen etwan besser etwan schlimmer? wie solten wir durchs Feuer mehr Clarificieren können dan Gott durch die Sonne? Hier auff andtworte das unser Clarificieren auf eine andere weise geschicht dan wir nehmen die Corpora die Gott durch die natur gelclarificiert hatt unnd Clarificieren die wieder durchs Feuer unnd Wasser."

of clarity. Even the lowliest earth could reach the level of fire. Indeed, Drebbel said, nature's clarification teaches us to allow God's gifts to work within us unhindered so that we too may be clarified by the glory of divine light.⁸⁴⁸ Through nature, God has demonstrated the only law there is – love God above all and one's neighbor as oneself. The Dutch edition continued, “so that nobody should taste of the second death” (“op dat niemant den tweeden doodt soude smaken”).⁸⁴⁹ Drebbel offered not only universal knowledge of nature, but universal salvation.

Other key distinctions between Aristotelian and Drebbelian physics included the qualities of the elements, the theory of the winds and the rate of expansion between the elements. Drebbel's elements were not Aristotelian. Indeed, Drebbel says he only used the word since it was familiar to his readers (“ich schreiben von den gemeinen Elementen wie sie dir best bekant sein”). Although at certain points Drebbel referred to the dryness of the earth, Libavius pointed out that Drebbel's “earth” was not a simple body, but a mixed one containing within it “fire and water.” It was therefore not a cold and dry simple body like the Aristotelian element, but in effect a hot and wet mixed body, as chymists understood earth to be. Libavius claimed that Drebbel called what was in fact a salt, or soluble fixed liquid, “earth” only by comparison.⁸⁵⁰ Aristotle's cold and dry earth was the most passive of the

⁸⁴⁸ See *On the Nature of the Elements*, Chapter One. “Dan erstlich lehret us uns wie das Gottes geschöpff ihres beruffs warnehmen unnd arbeiden so lange sie materiam finden und Je mehr sie finden je besser Clarificieren sie so sie nicht verhindert werden. Auff das wir auch also unseren berueff in acht nehmen muchten unnd Gott unseren Schöpfer oder seine gaben in uns unverhindert arbeiden lassen damit wir auss einem liecht ins ander gehen unnd durch den schein seiner klarheit mochten geklarificiert werden.”

⁸⁴⁹ *On the Nature of the Elements*, Chapter One. “Lieber Bruder, was können wir Gott geben der alles hat? was sollen wir dan thun? Danckbar sein und von Gottes Sohn lernen demüth und das kleine gesetz Liebet Gott uber alles und eweren nechsten wie euch selbst/Dis ist das gesetz und lehr aller Apostelen und Propheten wie uns dan auch Gott solches in der Natur lehrt.”

⁸⁵⁰ Libavius, *Hermetic Revelations*, 364. “This author uses earth symbolically, or mystically, for a *mixed body*, because it agrees with earth in its primary quality, not as imagined by the Natural philosophers as cold and dry, but as created by God in the beginning, when it carried with it the vegetable and animal productive power. *Our earth is hot, it is said that it fits the heavens and the moon.* Our material is called thus due to certain conditions analogous to common earth, and out of consideration for the other elements. It is the entire root and fundament of the Hermetic art, having gained the power of heaven and earth, as in the Emerald Table: he

elements. Drebbel claimed, like the proponents of the popular central niter theory, that the earth contained the principle of life and nutrition. The other elements “serve” earth, as they carry it about the universe in what we would call the water cycle and aid it in its generative ferment.

Drebbel’s elements formed a telescoping chain, as each required the other and carried the others within it. Furthermore, the elements also bore vital forces (*gewächs*), nutrition (*Alimentum*), spirit (*Geist*), and seeds (*sahmen*) responsible for the generation, nourishment and preservation of life. The role of the elements as composers of bodies was therefore rather moot. Drebbel was more interested in the role they played as containers, corpuscles, and chains. As containers, the elements carried within them vital forces. They spread these forces as material corpuscles pushed pneumatically through the world.⁸⁵¹

ascends into heaven and again descends into earth: the spirit with the soul, &c. Also earth is its nurse: its power is complete when it returns into the earth. Hence Drebbel says that earth is composed out of the four Elements, and yet the three others, fire, air, and water, serve earth, fire working within air, air within water (or on water), water working in humid earth. In accounts according to the Hermetic art, Earth, moon, and mother are the same. Our earth is alive & molten, whence it is called “liquid salt.” It has a fixed body in the manner of a crystal, &c.”

“Terram hic autor accipit symbolice, seu mystice pro *corpore misto*, quod ex praedominio qualitatum convenit cum terra, non qualis fingitur à Physicis frigida sicca, sed qualis creata à Deo est in principio, cui etiam vim vegetabilem & animalium productivam contulit. *Terra nostra calida est, coelestisque dicitur, & lunae comparatur*. Est materia nostra ob quasdam conditiones terrae vulgari analogas, & respectu cum caeteris elementis nostris ita appellata. Est omnino radix & fundamentum artis Hermeticae, coelestium & terrenorum vim consecuta, ut est in tabula smaragdina: Ascendit à terra in coelum interumque descendit in terram: spiritus scil. cum anima, &c. Item nutrix eius terra est: virtus eius integra est, cum versum est in terram. Hinc Drebbelius dicit, terram esse compositam ex quatuor Elementis, & tamen tria caetera ignem, aerem aquam ministrare terrae, igne agente in aerem, aere in aquam (vel in aqua) aqua operante in terra humiditatem. Terra, luna, mater in artificio Hermetico rationibus, non re differunt. Terra nostra est viva & fusilis: unde & sal fusile dicitur. Habet corpus fixum more crystalli, &c.”

⁸⁵¹ Drebbel’s combination of vital interiors and corpuscular containers can be compared to Petrus Severinus. Jole Shackelford’s study of Severinus, *A philosophical path for Paracelsian medicine: the ideas, intellectual context, and influence of Petrus Severinus (1540/2-1602)* (Copenhagen: Museum Tusulanum Press, 2004), 17-8. “There is a striking resemblance between Severinus’ seminal centers and the inertial, material corpuscles endowed with active principles that characterized the natural hypotheses of Walter Charleton, Robert Boyle and other representatives of the new scientific spirit of the seventeenth century. However, there is an essential difference: Severinus permitted his *semina*, the loci for all change in the subvisible world, to take on a material nature, but they were intrinsically formal and immaterial, and were both logically and ontologically prior to matter. By contrast, the corpuscularians believed in a material basis for reality, even if some of them permitted corpuscles to be endowed with active principles and plastic forces.” On the relationship between Fernel and Severinus, see Massimo Bianchi, “Occulto e manifesto nella medicina del Rinascimento: Jean Fernel e Pietro Severino,” in *Atti e memorie dell’ Accademia Toscana de Scienze e Lettere, la Colombaria*, 47 (Florence, 1982), 185-248.

Natural phenomena therefore took place on two levels for Drebbel – an outer one of mechanical interactions, and an inner one of chemical interactions.

Drebbel's theory that the elements lived one inside of the other in a chain accounted for how the explosive transformations from one element to the next followed in a predictable pattern which could support life. They did not explode into chaos, but followed each other in a predictable chain. Drebbel emphasized energy and movement within an infinite and dynamic cosmos, rather than composition. His search for the perpetual motion was a search for the hidden energy supply of the universe which propelled the elements through their continual chain of explosive transformations.

According to Heinrich Dove, Drebbel tracked the ordinary movements of the atmosphere for the first time.⁸⁵² This interest in large-scale movement was supported by another of his major differences with Aristotle – his rejection of Aristotle's decuple rate of expansion. Aristotle proposed a set rate of expansion, such that one drop of earth rarefied into ten drops of water; and one drop of water into ten of air, and so forth. According to Drebbel, water expanded by thousands of times into air. This increased expansion made condensation and rarefaction a much more powerful motive force in nature. Furthermore, this rate was itself variable. Air, for instance was more or less dense since variable heat rarefied it more or less. Drebbel also argued that the greater the difference in densities between one state and the next, the greater the force of movement through expansion or contraction.

⁸⁵² See Heinrich Wilhelm Dove, *The Law of Storms Considered in Connection with the Ordinary Movements of the Atmosphere* (London: Longman, Green, Longman, Roberts, and Green, 1862), 302.

Between 1610 and 1620, Francis Bacon similarly rejected the decuple rate of expansion, but without citing Drebbel.⁸⁵³ Jan Amos Comenius also wrote that “Aristotle thought that the Elements were in a tenfold proportion to one another; but later men have found them near an hundred-fold. . . . That is, that of one drop of earth is made by rarification ten drops of water; and of one of water ten of air But this very proportion varies, because the air is in it selfe sometimes thicker and grosser, sometimes more rare and thin.”⁸⁵⁴

This variable and highly forceful transformation between the elements points to the major underlying distinction between Drebbelian and Aristotelian physics. Aristotle delineated a harmonic, orderly cosmos, with everything located in its natural place and composed of a balance of qualities. This temperament of elements supplied composition, and a set rate of expansion and contraction. Nothing was set in Drebbel’s world. The cosmos was infinite, and any part of nature could transmute into another part, and move with great force across the universe. Heat and cold were thus not restricted by any harmony or rate, and were understood as variable amounts of what we would call energy rather than as part of a composition. We can place Drebbel’s ideas concerning heat and cold, as his contemporaries did, in the context of a widely held alchemical interest in latent heat understood energetically.

⁸⁵³ Francis Bacon, “Phaenomena universi.” *Oxford Francis Bacon, VI, Philosophical Studies*, Graham Rees, ed. (Oxford: Clarendon Press, 1996), 71. “The fabrication of the peripatetics concerning the decuple proportion of the elements bear to each other in rarity is an arbitrary fiction, seeing that it is certain that air is at least a hundred times rarer than water, and flame than oil, but that flame itself is not ten times rarer than air.”

⁸⁵⁴ Jan Amos Comenius, *Naturall philosophie reformed by divine light, or, A synopsis of physicks* (London: Thomas Pierrepont, 1651), 82-4.

IV: Innate Heat

Many contemporaries understood Drebbel's works – both his written *On the Nature of the Elements* and his related machines – within the context of the innate heat of Jean Fernel. The sixteenth century innovative medical theorist Fernel had become highly influential among diverse readers. His medical textbooks offered not the traditional commentaries upon ancient works, but his own highly metaphysical theories. Alchemists considered his *On the Occult Causes of Things*, which promoted occult empiricism over Aristotelian rationalism, an alchemical work.⁸⁵⁵ To academic medical theorists, Fernel represented a modern school of medicine in competition with the ancients.⁸⁵⁶ He has even been seen as influential for Descartes.⁸⁵⁷

Fernel argued that not everything in the generation, growth, and health of an organism could be explained by the system of the four elements alone. There had to be something else above and beyond the four elements which maintained the unity, and life of a whole despite the changes occurring due to the interaction of elemental qualities. Fernel developed a tripartite structure of causation, adding to the elemental temperaments and the soul an integrating entity he called an “innate heat.”⁸⁵⁸

⁸⁵⁵ Sylvain Matton, “Fernel et les Alchimistes,” *Corpus* 41 (2002), 135-198. This issue of *Corpus* was dedicated to Fernel.

⁸⁵⁶ Nancy Siraisi, “Giovanni Argenterio and Sixteenth-Century Medical Innovation: Between Princely Patronage and Academic Controversy,” *Osiris* 6 (1990), 161.

⁸⁵⁷ Vincent Aucante, “Descartes's Experimental Method and the Generation of Animals,” *The Problem of Animal Generation in Early Modern Philosophy*, Justin E.H. Smith, ed. Cambridge: Cambridge University Press, 2006), 70.

⁸⁵⁸ For Hiroshi Hirai, “Humanisme, Néoplatonisme et *Prisca Theologia* dans le concept de semence de Jean Fernel,” *Corpus* 41 (2002), 43-70, this innate heat was Fernel's main innovation. See L.A. Deer, “Academic Theories of Generation: The contemporaries and successors of Jean Fernel (1497-1558),” (Ph.D. thesis, University of London, the Warburg Institute, 1980), 367-8. “The structure and diversity of the simple parts, whether those of an individual, species or genus, are the result of temperamental differences, which thus become responsible, at one level, for the multiplicity of nature in the physical world. At another level, these various natures are an effect of the differing species of the creatures, i.e. of differences in their souls or animae. The anima is for Fernel totally responsible for the functioning of the parts and of the whole, and for specific areas of action such as generation. The integration of these parts into a capable-of-functioning whole is the activity

Quoting from Aristotle on the *Generation of Animals*, Fernel argued for the presence in living bodies of this “innate heat” drawn from the element of the stars, and carried by the spirit of the world. The innate heat burned within the living body with the spirit as its flame, and the radical humor as its combustible matter, yet it burned cold, as was apparent in animals with cold temperaments.⁸⁵⁹ It was this innate heat which integrated the whole microcosm and in which elemental transmutation occurred, just as the spirit of the world penetrated the macrocosm, unifying what was above and what was below.

When alchemy entered the academy in Central Europe in the early seventeenth century, academic alchemists integrated Fernel’s theory of innate heat into a program of research into the chymical structure of life hidden within the elements. Parisian doctors fought back. Jean Riolan the elder defended Fernel’s legacy from the chymists, claiming that transmutation could never be achieved through art. The celestial essence could never be found, he claimed, in the elementary sublunar realm.⁸⁶⁰ Riolan policed the borders not only between nature and art, but between liberal and illiberal arts. Alchemy’s emphasis upon artisanal knowledge made it “a servile occupation.”⁸⁶¹

of the innate heat and spiritus: instruments of the soul within the body and ones which play a particularly important part in the operations of generation.”

⁸⁵⁹ *Ibid*, 389. “But since in them [snakes and other cold plants and animals] the elemental quality of cold dominates that of heat, they must live by virtue of a separate, vital heat, which is superior in its origins – in fact, divine- and which ‘does not stink of the crasser nature of elemental fire.’”

⁸⁶⁰ Andreas Libavius, “De Extract. Essent. & Elixyr. Lib IIX,” *Syntagma Arcanorum Chymicorum*, Vol. 2 (Frankfurt: Peter Kopff, 1613-1615), 392, “Caput XIII: De Quinta Essentia”: “Riolan, in his criticism of Quercetanus & Alchemy, denied that there can be found a quintessence in the middle of the world, and he even contended that that which the Chymists have shown under that name, is nothing but the elements, engendering a reputation and false hope in men through a false name. . .” “Riolanus, in centura contra Quercetanus, & Alchymiam, negabat dari posse in mundo medio essentiam quintam, atque adeo contendebat id quod Chymici exhiberent eo nomine, nihil esse praeter elementa, falso nomine inanem spem & existimationem hominibus procreantes. . .”

⁸⁶¹ Bruce Moran, *Andreas Libavius and the Transformation of Alchemy: Separating Chemical Cultures with Polemical Fire* (Sagamore Beach, MA: Watson, 2007), 178. For the Parisian context, see Antonio Clericuzio, “Teaching Chemistry and Chemical Textbooks in France. From Beguin to Lemery,” *Science & Education* 15 (2006), 335-355.

Andreas Libavius countered that through spagyria, chymists could separate such important entities such as that heat which is not elementary, but celestial in origin, which even Aristotle and Hippocrates admitted.⁸⁶² Certain chemical substances, like the tartar of wine, could be made to elicit forms of latent heat. Since such heat lay hidden in cold bodies, it was clear that it was not part of the bodies' elementary temperament, but derived from another source; "Chymists certainly separate a certain fiery substance out of mixed bodies, such as a very strong fire from the tartar of wine, so that it brings forth a fiery effect, which neither the earth, nor the phlegm, nor the vapid part, nor even the spirit of wine has."⁸⁶³

Pierre le Paulmier also attacked spagyria, claiming that the aims of alchemy – finding the Philosopher's Stone through the Fire of Nature – could not be pursued through simple separation by the regular fire of a furnace. "God, he declared, made all things in nature by means of the celestial fire. Separations erased the power of the original created thing and replaced it with a contrary nature."⁸⁶⁴

In defense of alchemy in his *De Igne Naturae*, Libavius reviewed the various ways that chymists could obtain various quintessences within their furnaces. The most superior form, (the philosophers' stone), could be obtained by taking one substance and making it mutate through four different dispositions analogous to the elements, displaying various

⁸⁶²Andreas Libavius, "De Extract. Essent. & Elixir. Lib IIX," 392. "Duplex autem ignis à sapientibus proponitur, coelestis unus, elementaris alter. Coelestem incluserunt etiam mixtis, quod est innatum ipsis calidum, quod Aristoteli nec ignis est, nec igneus defluxus, sed natura elemento stellarum cognata, quae sententia procul dubio ex Hippocrate translata est, qui in separatione rerum coeleste illud calidum in medio mundo aliqui sui parte substitisse affirmat Sed spiritu per omnia diffuso dum se insinuat rebus & calorem ejus conferet, mirabilium operum causa in mistis esse perhibeatur, nec fortuito ad mitiones primum condescendit, sed ab omnipotente creatore insita est, & seminia sua in eis accepit, quarum vi postea sit propagatio. Itaque Spagyrii etiam è mistis separant, & non quidem nudam; veruntamen in elemento aliquo praedominantem ostendunt, cum id quod Deus coniunxit homo totaliter separare nequeat. Haec est illa essentia, de qua praeses Alchymiae locus agit, nimirum in qua mistorum vires totae, totaque natura essentialis, ab omnium simplicium elementorum potestate diversa continetur, quanquam in aliqua magis, in aliis minus una etiam qualitates elementares, de quibus dictum est, quod in totum divelli nequeant, apparent."

⁸⁶³ *Ibid.* "Chymici certe ex mistis separant quandam igneam substantiam, ut ex tartaro vini ignem quandam tam vehementem, ut effectu quoque igneo se prodat, qualem nec terra vini habet, nec phlegma, nec pars vapidam, neque etiam spiritus."

⁸⁶⁴ Bruce Moran (2007), 200-201.

powers at various times, until it could be fixed while displaying contrary qualities simultaneously. This could be achieved by activating the inner fire hidden within earth through the application of an external fire, precipitating a series of cycles of elemental transmutation, until the inner heat latent within earth begins to work.

For earth in this magistry is not cold, but hot: so too is the earth of the world not that which the babbling philosophers make up in their commentaries on the elements, but that which sense shows is full of fire on the inside, that which Aristotle was forced to confess, and which Hippocrates acknowledged along with those who judge that the power of fire is greater in earth than under the moon, seeing that in earth it is in act & potency. . . . From earth it is called back to water, and then it goes off into an airy body, comparable with oil. From air it passes into a fixed fire, if it pleases the artisan, and that through no other artifice than the continuation of external fire. . . .⁸⁶⁵

The means of doing this by an artisan at his furnace had been fully revealed by writers such as Michael Sendivogius and Cornelis Drebbel.⁸⁶⁶

⁸⁶⁵ *De Igne Naturae, Syntagma Arcanorum Chymicorum*, Vol. 2 (Frankfurt: Peter Kopff, 1613-1615), 102. “Superest quarta, quam mysticam maximeque philosophicam appellamus, ut quae non sit ditentio in quatuor partes, sed unius per quatuor dispositiones mutatio, quae sit in magisterio magno lapidis philosophorum, & his quae ad similitudinem eius elaborantur. E terreo revocatur ad aqueum, indeque transit in aerium corpus, oleo comparandum. Ex aereo transitus est in igneum fixum, si placet artificio, idque non alio artificio, quam ignis externi continuatione, ut internus plane producat, seque etiam colore rubro prodat. Terra enim alba est, aer candidus, & splendens: aqua pura & translucida: quanquam non diu. Nam in principio operis dum calor agit in humidum frigidum, tenebrae ex abyssu emergunt, & super aqua diu manent donec lux oriatur. Postquam autem igneum elementum apparuit, id quod fit in solificio tantum, totum opus revocatur ad carceres iamque addito fermento denuo solvitur, & coagulatur, in quo iterum apparent signa Elementorum, & colores cum dispositionibus, sed modo essentiali. Est & rota quarta. Nam ignis est per fermentum auctus, resumtis initiis denuo elaboratur, & ad quintam naturam adducitur propius: indeque iterum propius donec ad summum subtilitatis, & nobilitatis in qua ars acquiescit pervenerit. . . . Hic igne externo in praeparata materia una, eademque industrie procurato in suo *Athanore, & tripode, ovoque arcanorum, internus ignis* gradatim facit mutationes, quae à frigido humido, quae est dispositio aquae, paulatim progreditur in siccum calidum grossum, quod est terreum (*Terra* enim in hoc magisterio non est frigida, sed *calida*: qualis est & terra mundi non illa quam fingunt in scholis garrientes philosophi elementales, sed quam sensus docet esse intus plenam igni, id quod fateri coactus est Aristoteles & agnovit Hippocrates cum illis qui ignis potestatem magis valere in terra, quam sub luna iudicant, quandoquidem in terra est actu & potentia: In sublunari regione tantum potentia, nisi quid halituum ibi concreseat, & motu accendatur, quo modo et alias vult Aristoteles inde calorem existere). E terreo revocatur ad aqueum, indeque transit in aerium corpus, oleo comparandum. Ex aereo transitus est in igneum fixum, si placet artificio, idque non alio artificio, quam ignis externi continuatione, ut internus plane producat, seque etiam colore rubro prodat.”

⁸⁶⁶ *Ibid.* “Inde factum putamus ut Michael Sedinvogius in novo lumine chymico (Ut appellatum est postea) seu tractatibus 12. de lapide philosophorum: item Cornelius Drebbelius Hollandus, & alii magisterium lapidis paene totum sermone de elementis expederint. . . .”

Indeed, Drebbel did speak of the quintessence in similar ways – not so much in his work *On the Elements*, but in his tract *On the Quintessence*. Drebbel said that the quintessence is called the “life of the elements. . . not only since the moment they have been deprived of this (which is a certain something above the elements), they are dead, but also because the four elements live in it inseparably.”⁸⁶⁷ Like Libavius, Drebbel claimed that the quintessence contained all the qualities of the elements. The quintessence could be manipulated through chemical processes such that any quality of the elements desired at a particular time could be called up by the operator.

Academic alchemists were on the hunt for proof that life-giving substances could be discovered chymically within the elements and extracted to offer their powers to the artisan. When Drebbel fused alchemy and mechanics in inventions employing light and heat in novel ways, his readers interpreted his exploits in light of Fernel’s second, celestial heat. The interest in latent heat disrupted heat’s compositional function as a part of a temperament, and can be linked to the transition from temperament to temperature underlying the study of variations in heat and cold.⁸⁶⁸

IV: From Temperament to Temperature and the Theory of the Winds

Drebbel’s conception of the elements as containers moving in a dynamic theatre of change not restricted by a decuple rate of expansion, rather than within a compositional

⁸⁶⁷ Drebbel, *De Quintessentia* (Hamburg: Carstens, 1621), Chapter III. “Sed à nonnullis quinta essentia dicitur, & elementorum vita; Cum, quia cuncta, hoc spiritu (qui quoddam est supra elementa) privata, mortua sunt: Tum etiam, quod quatuor elementa rediviva & individè in eo habitent: Sed subindè ignis, aer & aqua, subindè ignis & aer praevalent, atque terra in intimo sinu latet; quae si industriâ cujusquam ad actum perveniat, deque humiditate aquae triumphet, sic ut ignis & terra foras simul in conspectum prodeant, in veram quintam essentiam transit, omnesque debilitates tollit.”

⁸⁶⁸ Arianna Borrelli similarly supported alchemy’s role in the development of an interest in weather-glasses and thermoscopes by Drebbel and others, pointing to Paracelsian aerial chemistry and the alchemical *spiritus* as instigations towards a theory of winds (and thus weather and weather-forecasting) based on heated air. See Arianna Borrelli, “The Weather Glass and its Observers in the Early Seventeenth Century.” *Philosophies of Technology: Francis Bacon and his Contemporaries*, Claus Zittel, Gisela Engel, Nicole C. Karafyllis and Romano Nanni, eds., Leiden: forthcoming in 2008.

temperament, can be related to his investigations into variations of hot and cold. Drebbel experimented with various forms of fire through the chemical production of heat and cold (as in the breaking of saltpetre or the burning of sulfur).⁸⁶⁹ The chronicler of Alkmaar, Cornelis van Der Woude, reported in 1645 how Drebbel could make it so cold in the middle of the summer, as he demonstrated at the King's request in Westminster, that the King and all his nobles had to leave the room.⁸⁷⁰

Drebbel noted both the variable amounts of change between the elements, and how these changes followed cycles. All surviving evidence indicates that Drebbel was not numerically oriented. He investigated his world using hands endowed with a lifetime of

⁸⁶⁹ Robert Boyle, in his "Tract Concerning Flame," *Works*, Michael Hunter, ed. (London: Chatto, 2000), 60, described Drebbel's use of burning sulfur under glass as the source of heat for various chymical reactions, which could not succeed without them. This made Boyle suspect that sulfur was necessary not only for the intensity of its heat, but since it was not simple, or common flame ("non simplicem, vel communem flammam esse") and included various sulfuric salts or other particles which produced its peculiar blue flame.

⁸⁷⁰ Cornelis van der Woude, *Kronijcke van Alkmaer* (Alkmaar: Breken-geest, 1645), 117. "Hy konde maken met eenige Instrumenten, en sekere plaetsen, midden inden Somer, dat het so koude was, gelyc of het midden inden winter ware geweest: 'twelcke hy eens te werck stelde (op het versoeck van sijn *Majesteyt*) inde groote *Zale tot Westminster*, dat het in den Somer, op sekeren dach inde voornoemde *Sale*, soo kout wierde, dat den *Konink* met sijn Adel an veel groote Heeren genootsaecht waren deur de overgroote koude uyt de voorschreven *Zale* te wycken." Hartlib also described his "Refrigeratoria Instrumenta pro aestate et imprimis in locis calidioribus vti India etc." See Hartlib, *Ephemerides*, 29/3/55B-56A. As discussed in Chapter Three, Bacon described this phenomenon without crediting Drebbel.

Libavius described how saltpetre contained within it all the faculties of the elements, including heat and cold. See Andreas Libavius, "De Extract. Essent. & Elixyr. Lib IIX" in *Syntagm. Arcan. Chymic.* (1613), 469. "Even the common philosophers can guess that the faculties of different elements are in it. It is born in the earth, it catches fire, it spits out vapid fumes, and it boils with wateriness. When it is dissolved in water, it makes it very cold, as we feel in our teeth, and it freezes the hand; when the cones of it or its angular pyramids are compressed by the hand without force [enough] to break [them], it first heats up and then jumps apart with a hissing sound. There is so much abundance of spirit, and they are close [in nature] to airy and fiery spirits, such that out of a small mass a lot of steam is released, which is resolved into gun powder and purged through sulfur. In natural waters it purges, cuts open, penetrates, cleanses, loosens obstructions, moves and drives off sand."

"Diversorum elementorum facultates ei inesse et plebei Physici conuicere possunt. Nascitur n. in terra, ignem rapit, in aere fumos expuit vapidus; ebullitque aquositate. Cum in aquam soluitur, eam valde frigidam reddit, sensuque dentium, & manus friget; cum coni eius seu pyramides angulosi manu comprimuntur absque vi frangendi, ut primum incaluerunt, cum stridore dissiliunt. Tanta est spirituum copia, eorumque proxime aereorum & igneorum, ut ex parva mole halitus resolvantur multi, quod in pulvere pyro cernitur & eum per sulphur purgatur. In aquis naturalibus purgat, incidit, penetrat, deterget, obstructions expedit, movet, propelletque arenas."

Drebbel described breaking saltpetre and making it change into the nature of air in *On the Nature of the Elements*, "wir sehen wan der Saltpeter gebrochen wirdt durch das Feuer unnd also verandert in die natur des Lüffts." See Zbigniew Szydlo, *Water which does not wet hands: the Alchemy of Michael Sendivogius* (Warsaw: Polish Academy of Sciences, 1994).

experience. He did not need explicit, precise calculations to build sensitive devices and to gauge amounts of change. Therefore, he was uninterested in the precise measurements of weather change upon which the discipline of meteorology was eventually founded. Yet his philosophical theories encouraged attention to variable amounts (if not degrees) of change. This attention encouraged attention to weather patterns which might interest later meteorologists, even if they were disproven. For instance, one eighteenth-century reader noted a point of error in his 1632 edition of Drebbel's *On the Nature of the Elements*, based on his own precise barometric observations.⁸⁷¹

Due to Drebbel's attention to such variations, he developed a new theory of the winds which he explained through his famous contrived demonstration. This demonstration has previously been discussed as a candidate in the invention of the thermoscope. Its function as philosophical proof for a cosmic cycle was far richer and broader than such an interpretation would suggest. However, we can connect the demonstration's (contested) place in the history of thermometry to differences between Drebbel's view of heat and cold as energetic versus the Aristotelian temperament as compositional.

Contemporaries noted the novelty of this demonstration, and the theory of winds it demonstrated.⁸⁷² One Georg Scholtz, for example, defended Aristotle's theory of wind formation against Drebbel's, claiming that Drebbel could not use his "invention" in order to learn anything about macrocosmic processes.⁸⁷³ Rather than just a thought experiment, the

⁸⁷¹ British Library 1606.352, 81. "A dit strýd tegen alle ware befindingen want aldan is de lugt nit gedroogd door de voor afgaende weste winden dit meeste altýd veel Reggen geeft. (1722, 12, Novemb: jovi Meridiana 12a coelo inclarescente Barometro ad 28 7/12)"

⁸⁷² Despite the fact that this phenomenon was becoming common knowledge among practicing engineers and alchemists (alchemists well before the modern editions of Hero's *Pneumatica*). See Graham Hollister Short, "The Formation of Knowledge Concerning Atmospheric Pressure and Steam Power in Europe from Aleotti (1589) to Papin (1690)," *History of Technology* 2004, Vol. 25, 137. A related demonstration was also described in the vacuum debates. See Charles B. Schmitt, "Experimental evidence for and against a void: the sixteenth-century arguments," *Isis* 58:3 (1967), 361-2.

⁸⁷³ Georg Scholtz (*Sphaera Mirabilium Creationis, Creaturae, Creatoris* (Hamburg: Bismarck, 1654), 213-4.

demonstration was also reproduced by his readers; Isaac Beeckman, for instance, noted reproducing the demonstration in 1619.⁸⁷⁴ Beeckman's later discussion of fire points to the relationship between heat understood energetically rather than compositionally and the measurement of temperature. Beeckman considered fire not as a simple body which served to compose mixed bodies, but the name of the motion of a combination of specific *minima* ("sulfur, oleum, saevum et reliqua inflammabilia").⁸⁷⁵ He described how through this motion, one could determine "the particular temperament of every room, and how much one differs from the other in hot and cold" (die het temperament van elcke camer int bysonder weten conde; hoeveel deen van dander in hitte ende coude verschilde). He then went on to describe various thermoscopes and perpetual motions devised by means of this movement, including Drebbel's.⁸⁷⁶

In his wind demonstration, Drebbel suspended a retort above a vessel of water heated so that that expanding air bubbles issue from the mouth of the retort through the water (the production of wind). Once the retort cooled, the contraction of the cold, according to Drebbel, forced the water from the vessel up into the retort, higher above the

"Drebbelius in tractatu de elementis nititur demonstrare opus ventorum per inventum quoddam, ubi in vase retortum super aquam suspensum mediante igne pellit vapores, quos in vase clauso gyrantes, dicit esse similitudinem ventorum, qui ita generentur & moveantur. Sed quomodo haec ad mundum majorem spectant, ubi venti in aere libero circumvagantur, non autem claustris vasorum cohibet in furorem agitantur? Vbi saepè nullis apparentibus vaporibus vel nubibus, maximi ventorum flatus percipiuntur."

Libavius voiced similar reservations about the ability to find proof in the retort demonstration, pointing to the rival testimony of overseas exploration. See Libavius, 372. "Pergit in sua physica ventosa, & argumento commotionum in vitro Hermetico de varietate halituum seu flatuum maioris mundi disserit. Sane si vellemus omnem ventorum motum ubivis terrarum & in mari excutere, fortasse Vulcanus, & Aeolus noster Hermeticus non sufficeret, cum in sua sphaera non habeat sinus varios, & montes, planicies, cavernas, & alia quae flatus mirifice mutare possunt, uti testantur navigationes Indicae, & Americanae, in quibus admiranda de ventis legimus, rationibus non tanta facilitate se prodentibus."

⁸⁷⁴ Isaac Beeckman, *Journal tenu par Isaac Beeckman de 1604 à 1634*, Vol. I (Hague: M. Nijhoff, 1939), 346. "Den 10 November te Middelb., occasionem praebente cap. 6 libri Drebbelij Alcmariensis, gedrukt te Haerlem, *Van den natuyre der Elementen*, int Duytsch."

⁸⁷⁵ Isaac Beeckman, *Journal tenu par Isaac Beeckman de 1604 à 1634*, Vol. II (Hague: M. Nijhoff, 1939), 198, 27th May, 1622. "Dicendum igitur ignis materiam esse sulfur, oleum, saevum et reliqua inflammabilia. Sed ea non sunt ignis cum quiescunt, sed tum demum vocantur *ignis*, cum in minimas partes divisa sunt eaeque partes celerrimè moventur; prioresque semper sequentes, subsequuntur, per quem motum continuum disijcitur aer et acquiritur locus capacior, sine quo motu iste peragi non possit."

⁸⁷⁶ *Ibid*, 198-205.

level of water in the surrounding vessel (the retraction of wind). This demonstration showed how the rarefaction and condensation of air and water could move these elements preternaturally beyond their natural levels. Drebbel was interested in how this demonstration could explain macrocosmic meteorological cycles such as wind through pneumatic force. Drebbel did not distinguish between barometric pressure and heat (and neither did his demonstration, which was exposed to the air, rather than enclosed fully in glass like later thermoscopes). He therefore employed the same phenomena in constructing his heat-sensitive machines such as his perpetual motion and his self-regulating furnace.

The academic alchemist Heinrich Nollus connected the relationships between the elements to the alchemical four “grades” of heat. Since the elements depend upon each other, alchemists could deploy the fire’s dependence upon air to manage fires of different levels through relative amounts of airflow.⁸⁷⁷ His authorities on the mutual dependence of the four elements were Sendivogius and Drebbel.⁸⁷⁸ Drebbel’s furnaces which regulated its own temperature according to specific degrees of heat far surpassing the traditional four “grades,” employed not only the mutual dependence of air and fire, but the chain of transformation found in his demonstration, and encompassing air, water, and fire. These furnaces also gained renown among academic alchemists. Leipzig professor Johann Bohn discussed Drebbel’s furnace, for instance, in his 1685 dissertation, “De Igne.”⁸⁷⁹

⁸⁷⁷ Nollus, *Sanctuarium Naturae*, 113. “Ignis si aere destituitur, extinguitur. Inde sciunt Alchimistae ignem per aera distribuere in gradus, & secundum mensuram aeris registra sua, ut vocant, ordinant.”

⁸⁷⁸ Nollus, 114. “Consentit cum dictis Cornelius Drebel, ubi cap. 3. tractat. De Elementis sic ait: Ut reliqua tria Elementa absque igne sunt mortua: Ita & ipse sine illis est mortuus. Vnde perfecta Dei sapientia cernitur, quae nihil frustra creavit: Nam ut ignis est vita, & in aere vivit: sic aer vivit in igne, & aqua in terra; terraque in aqua, aqua in aere, &c. Ignis purgat aerem, aer aquam, aqua terram, & per ignem unumquodque reddit alterum suae claritati simile.”

⁸⁷⁹ Johann Bohn, “de Igne,” *Dissertationes Chymico-Physicae* (Leipzig: Johann Friedrich Gledisch, 1685), thesis 29. “Ille ignis apertus communiter dicitur & ignem rotae, reverberatorium suppressionis includit, imò huc spectat, si corpus, quod destillationi aptum immediatè super prunas per ostiolum furni, mox ocludendum, injiciatur, ita ut fumus seu vapor, vi ignis elevatus, in rostro seu canali longiore, lateri aut summitati fornacis infixio & vase recipiente munito, sensim in liquorem condensetur, qualis erat fornax, quam Londini apud Drebbelium

The “energetic,” rather than compositional view of heat bore other offspring besides temperature. The emphasis upon “energy” in Drebbel’s philosophy explains why his texts and his machines were of great interest to those interested in an occult “electrum.” Both Johann Ernst Burggrav and Johann Staricius, wrote treatises on magical “electrical” weapons closely related to Heinrich Khunrath’s tract on the subject.⁸⁸⁰ Drebbel’s perpetual motion provided evidence for both Burggrav and Staricius that such machines fueled by an occult power source could be devised. The universal hidden source of energy carried by the spirit of the world was frequently referred to in the period with the cabbalistic tessera, *linea viridis ubique gyrans* – the green line circling everywhere. For instance, Christian Adolph Balduin (discussed in the next chapter), whose investigation into the spirit of the world led to his discovery of a “phosphorus,” referred to this “blessed Greenness.”⁸⁸¹

The 1608 German edition of Drebbel’s *On the Nature of the Elements*, which I have argued was edited by Hartmann’s disciple Johann Ernst Burggrav, included a poem by “an anonymous Philalethes” on Geber’s medicine of the third order (the philosopher’s stone).⁸⁸²

The poem, which concluded, “THE GREEN LINE CIRCLES EVERYWHERE,”

(“LINEA VIRIDIS UBIQUE GYRAT”) was reprinted frequently in subsequent editions. It

Schröderus se vidisse perhibet, quamque *Glauberus* prolixius describit.” For Bohn, see Bruce Moran, *Distilling Knowledge* (Cambridge, MA: Harvard University Press, 2005) 124-6.

⁸⁸⁰ See Hereward Tilton, “Of Electrum and the Armour of Achilles: Myth and Magic in a Manuscript of Heinrich Khunrath (1560-1605),” *Aries* 6:2 (2006), 117-157 and Joachim Telle, “Mythologie und Alchemie: Zum forleben der antiken Götter in der frühneuzeitlichen Alchemieliteratur,” *Humanismus und Naturwissenschaften*, R. Schmitz and F. Krafft, eds. (Boppard am Rhein: Bold, 1980), 135-154.

⁸⁸¹ Balduin, *Aurum Aurae*, Chapter Eight. “O benedicta Viriditas, gyrans per universam, cujus Centrum ubique, peripheria verò diffusa per omnes naturae abyssos!”

⁸⁸² “Si centrum aethereum cognoveris accipe centrum

Aetheris, & centri quaere superficiem.

Junge superficiem centro: sic aether ab alto

Defulet in terram: terra polumque petet

Hanc Hermetis avem si multiplicaveris arte,

Totius arcani Rex eris Alchymici.

LINEA VIRIDIS UBIQUE GYRAT”

The 1619 Hamburg edition, the 1621 Rotterdam and Haarlem editions, the 1624 Erfurdt edition, the 1628 Frankfurt edition, the 1632 Rotterdam edition, were all basically identical to the 1608 edition. Even the 1621 Latin translation included the *Medicina tertii ordinis Gebri*. The poem was translated into French in the 1672 edition, and into German in the 1715 and 1723 editions.

thus provided an additional context supporting a “magnetic” interpretation of Drebbel’s *On the Nature of the Elements*, since it suggested that the importance of the universal connection provided by the spirit of the world to the discovery of the philosopher’s stone.

This reading long continued to inform the search for the “fire of nature” hidden within “earth.” As discussed in the next chapter, such a line of inquiry led directly to Becher’s theory of the oily earth, which was reprised by his student Stahl as phlogiston.⁸⁸³ Phlogiston currently enjoys the dubious honor of one of the most renowned discredited theories. For those who wish to point to a “Chemical Revolution” in the work of Lavoisier phlogiston represents the last stand of a misguided alchemy which can be distinguished from chemistry. Yet, as Douglas Allchin has argued, oxygen never in fact supplanted phlogiston.

One can easily appreciate that Lavoisier’s work led to the law of constant proportions and then to a coherent system of elements with atomic weights. Yet many persons at the time recognized that the new system did not wholly replace earlier explanations of energy relations in reactions. Though Lavoisier introduced the notion of caloric, many chemists found that it did not productively extend or reorganize the existing concepts of latent heat, heat capacity or phlogiston. Light, also, was listed along with oxygen in the new nomenclature, but for late phlogistonists, their concept went further in underscoring the strong relationship and conversions between light, heat and electricity, and their integrated roles in combustion, calcination and reduction.⁸⁸⁴

Rather than “one theory substituting for another,” “multiple, complementary explanations were possible- one using oxygen compositionally, and one using phlogiston (or some equivalent thereof (energetically)).⁸⁸⁵ After Lavoisier, phlogiston continued to be used as a

⁸⁸³ An odd aspect of Stahl’s thought is the identification of phlogiston as what prevents vital air, rather than what gives vitality to air, as the central nitre theory would suggest. Kevin Chang points to this as an area of Stahl’s thought in need of further elucidation. See Ku-Ming Chang, “Fermentation, Phlogiston and Matter Theory: Chemistry and Natural Philosophy in Georg Ernst Stahl’s *Zymotechnia Fundamentalis*,” *Early Science and Medicine* 7:1 (2002), 61-3. Allchin points to other phlogistonists who believed that phlogiston could be found in vital air. See Douglas Allchin, “Phlogiston After Oxygen,” *Ambix* 39 (1992), 113.

⁸⁸⁴ Allchin, 113-4.

⁸⁸⁵ *Ibid*, 115.

way to discuss fiery phenomena such as the light of phosphorus and the energy of electricity which could not be captured by the compositional focus of oxygen.

Drebbel was neither a simple mechanic nor an Aristotelian populariser. Rather, he fused his radical natural philosophy and his innovative engineering projects in the service of a machine-based but non-mechanical natural philosophy. His contemporaries realized that he deployed his theory of the elements in his wildly successful automatic machines (perpetual motion, self-playing claviers, incubators, and self-regulating ovens). As befit an author championing the discovery of natural knowledge through practice, Drebbel was interpreted in light of his famous machines, and his machines were interpreted in light of his natural philosophy. Neither did Drebbel's machine-based vital philosophy represent a dead end or an oddly quirky fusion replaced by the ultimately triumphant experimental mechanical philosophy. Drebbel continued to serve as an authority in a wide-spread and long-lived "magnetic" philosophy centered around the study of "inner heat" understood energetically.⁸⁸⁶

VI: The Magnetic Interpretation

The promoter of sympathetic cures, a magnetic blood-lamp, and electrical weapons, Johann Ernst Burggrav, described himself as a friend of Drebbel's and a long-term *domesticus* of Johann Hartmann.⁸⁸⁷ Burggrav was a rather well known alchemist in his day. While Olaus Borrichius praised Drebbel as one of the top Dutch alchemists, he placed Burggrav in his

⁸⁸⁶ On *magnesia* in Newton's thought, see Betty Jo Teeter Dobbs, *Janus Faces of Genius: the Role of Alchemy in Newton's Thought* (Cambridge: Cambridge University Press, 1991), 24-6. For the later seventeenth-century English interest in the aerial magnet, see Antonio Clericuzio, "The Internal Laboratory. The Chemical Reinterpretation of Medical Spirits in England (1650-1680)," *Alchemy and Chemistry in the 16th and 17th Centuries*. Rattansi, Piyo, and Antonio Clericuzio, eds. (Boston: Kluwer, 1994), 51-83.

⁸⁸⁷ Burggrav termed himself a "domesticus" of Hartmann in the dedicatory preface dated 6. Decemb. Anno 1619, of his 1620 edition of Clodius. There he praises his patrons for appointing Johann Hartmann to teach chymistry at Marburg. He also refers to his travels in England, France, Central Europe, and the Netherlands.

pantheon of German adepts.⁸⁸⁸ Burggrav's treatise on the distillation of oils was printed in Hartmann's *Practice of Chymistry* in 1634. The 1623 *Introduction to the Vital Philosophy* is variously ascribed to Burggrav and to Hartmann.⁸⁸⁹ As discussed in Chapter One, Burggrav claimed to be the editor of the 1608 German edition of Drebbel's works, so he may well be the "anonymous Philalethes" responsible for the Latin poem in that edition.

Burggrav issued another German edition and an independent Latin translation of *On the Nature of the Elements* in 1628. Burggrav dedicated his 1628 Latin edition of *On the Nature of the Elements* to Johann Pergens, Jacob Pergens, Peter von Zewel, and Adam von Zewel. The Pergens and the Zewels were related to the intelligencer Johann Moriaen and a wide network of adepts in Germany and the Netherlands.⁸⁹⁰ As members of the beleaguered Reform congregation of Cologne, they would also have been familiar with such intimates of Drebbel as the Küfflers.⁸⁹¹ Burggrav said these friends (*cognati et amici*) of his had often requested this work from him. They, as great cultivators of the secrets of nature, would be able to judge the great mysteries contained within it. In return, Burggrav requested that they continue to support his studies.⁸⁹²

⁸⁸⁸ Olaus Borricchius, *De Ortu & Progressis Chemiae Dissertatio*, In *Bibliotheca Chemica Curiosa*, ed. J.L. Manget, 36. The Germans boast of "Trevisanos, Alanos, Paracelsos, Theurneisseros, Basilios Valentinos, Majeros, Crollios, Libavios, Hartmannos, Lambspringos, Burggravios, Cunrados."

⁸⁸⁹ See Johann Ernst Burggrav, "Tractatus novus, de Oleis variis chimice destillatis," in Johann Hartmann, *Praxis Chimiatica* (Frankfurt, Rötelius, 1634). For Burggrav's authorship of *Introduction to the Vital Philosophy*, see Lynn Thorndike, *A History of Magic and Experimental Science*, (New York: Macmillan, 1958) Vol. VII, 183.

⁸⁹⁰ For the Pergens and Zewel families, see J.T. Young, *Faith, Medical Alchemy and Natural Philosophy: Johann Moriaen, Reformed Intelligencer, and the Hartlib Circle* (Brookfield, VT: Ashgate, 1998), 10. The Hooft family was related to the Pergens, and Arnout Hellemans Hooft recalls visiting the Zewels at his relative Pergens' house in Cologne in *Een naekt beeldt op een marmore matras seer schoon: het dagboek van een 'grand tour' (1649-1651)*, E. M. Grabowsky and P. J. Verkruijsse, Eds., (Hilversum: Uitgeverij Verloren, 2001), 59.

⁸⁹¹ Justin van Assche, a preacher in Cologne along with Johann Moriaen, was also familiar with Drebbel's perpetual motion machine, and was one of Beeckman's informants. For van Assche in Cologne, see Young, 10.

⁸⁹² Burggrav in Cornelis Drebbel, *Tractatus de natura elementorum qua ratione ventos pluvias, fulgura & tonitrua parturiant, &c. in linguam Latinam translatus & in lucem emissus à Ioanne Ernesto Burggravio* (Frankfurt: Rötelij, 1628). "Vobis Dn. Cognati atque amici honorandi libellum hunc quod à me petijstis saepius, inscribere atque dedicare volui, cum quòd purioris Philosophiae studium vos mirum in modum teneat, atque eo quoque non leviter tincti ac imbuti, de hisce alijsque summis Naturae Mysterijs dextrè iudicare valeatis, tum inprimis ut gratum animum, ob benevolam, quo me hactenus amplexi estis, affectum, quoquomodo declarem atque posteritati commendem,

Burggrav directed his German translation far more specifically to the Hessian court, dedicating it to a number of Hessian minor officials.⁸⁹³ Burggrav informed them that patrons such as King James, Rudolf II, and other noblemen were attracted to Drebbel, due to his great understanding and knowledge in secret philosophy and *Chymia*.⁸⁹⁴ Furthermore, as soon as understanding Philosophers get a chance to read *On the Nature of the Elements* they find it very appealing.⁸⁹⁵

Burggrav continued to describe having seen (about twenty years previously) Drebbel's perpetual motion machine among other technical wonders Drebbel installed at Eltham Palace.⁸⁹⁶ Indeed, Burggrav wrote to his Dutch friend Marcellus Vranckheim sometime before 1609, describing the perpetual motion machine. Vranckheim, in the midst of an academic peregrination, responded from Padua with a thirty-nine page tribute to Drebbel's perpetual motion machine and other wonderful discoveries of contemporary Netherlanders.⁸⁹⁷ The letter was first printed in Burggrav's *Biolychnium* in Franeker in 1611 and re-issued in Frankfurt in 1629 and 1630.⁸⁹⁸ Burggrav referred to the perpetual motion

etiam atque etiam rogans, ut eum ipsum hilari fronte ac aequo animo accipiatis, & meis studijs, ut antehac, ita in posterum quoque favere pergatis. Deus ter Opt. Max. vos omnes & singulos, quod unice in votis habeo, in omne aeuum saluos & incolumes conservet & tueatur. Dabam ad ripam Rheni in Comitatu Cattermeliboc. Metropoli percelebri, quae Sancto Goaro sacra, Calend. Martij, Anno 1628.”

⁸⁹³Johann Heinrich Losskandt, Philip Reinhardt Finck, Johann Weiss, Daniel Forchhund, and Ezechias Muscat.

⁸⁹⁴Burggrav in Cornelis Drebbel, *Ein kurtzer Tractat von der Natur der Elementen : vnd wie sie den Wind, Regen, Blitz vnd Donner verursachen, durch Cornelium Drebbel in nider teutsch geschrieben ; vnd allen der Natur Liebhabern zu Nutz ins hoch teutsch getrenlich vbergesetzt, durch Johann Ernst Burggreffen* (Frankfurt: Rötelij, 1628). “unnd bey Keyserlicher Majestät Rudolpho Secundo, unnd Jacobo König in England/ und auch viel ander HerrenStands und Hohen Personen/ wegen seines in der geheimen Philosophia & Chymia hohen Verstands und Wissenschaft/ in grossem Ansehen gewesen.”

⁸⁹⁵ *Ibid*, A3. “Ist auch bey vielen verständigen Philosophis, so es zu lesen bekommen/ ein angenehmes Büchlein gewesen.”

⁸⁹⁶ See Cornelis Drebbel, *Ein kurtzer Tractat von der Natur der Elementen* (Frankfurt: Rötelij, 1628), A2v. Discussed in Chapter One.

⁸⁹⁷ For instance, Vranckheim defended Jacob Metius (also from Alkmaar) as the inventor of the telescope against Galileo. See Vranckheim in Burggrav (1611), 53-4.. Interestingly, Vranckheim's letter is dated in December of 1609, although he refers to Galileo's *Siderens Nuncius* [not published until 1610] and his telescope, “cujus beneficio Observationes illas prodidisti in Lunae facie, fixis innumeris; lacteo circulo; stellis nebulosis: & quatuor Planetis, eorundemque circa Iovem periodis.”

⁸⁹⁸ Marcellus Vranckheim, “Epistola” in Johann Ernst Burggrav, *Biolychnium* (Franeker: Balck, 1611).

Vranckheim began his career as Constantijn L'empereur's private tutor until 1608. He then went abroad to

and the letter from his friend also in his work on “electrical weapons,” the *Achilles Panoplos* of 1612.⁸⁹⁹

Burggrav told Vranckheim that the machine was motivated by the “little, as they say, magnetic spark of the *Anima Mundi*, or the insensible astral spirit of all things, the harmony of superior and inferior things, that is, the agreement of the macro and microcosms” infused within the sphere, and showing the ebb and flow of tides precisely.⁹⁰⁰ This spirit is the fifth element of the world, uniting corporal and intellectual realms.⁹⁰¹ Vranckheim also described the self-playing clavier as having the same motor, by means of which it can, in a sunny sky, emit a heavenly symphony without being touched by a single finger.⁹⁰²

This is precisely the same description which we find appended to a dissertation published by Johann Hartmann among the “*Epithemata*.”⁹⁰³ There Hartmann described the “perpetual motion of the Dutchman Cornelis Drebbel, which is seen in England,

study at the expense of his patron, and defended in 1609 the theses *ZHTHMATA Quaedam ex V.I. & Politica miscellanea. . . in augustissimo Rauracorum Athenaeo, Pro Doctorali in V.I. Laurea & insignibus. . . Nonis Julian, loco & horis praestitutis* (Basileae: Joan. Jacobi Genathi, 1609) at Basel, and *MELETEMATA Quaedam Ad L.XIIX.C. De TRANSACT. dirigente clavum Icto Germaniae incomparabili Hermanno Vulteio Inchytae Hujus Mauritianae Procancellario, illustrissimi Principis Mauritiis, in augustiss. Ictorum Athenaeo horis sollemnibus stabe xiv. Kal. Jun.* (Marpurgi Cattorum: Officina Rodolphi Hutwelckeri, 1609) at Marburg. Vranckheim returned to Zutphen where he was appointed rector of the Latin school. See Peter T. Van Rooden’s *Theology, Biblical Scholarship and Rabbinical Studies in the Seventeenth Century* (Leiden: Brill, 1989), 21, and Friedrich Nettesheim’s *Geschichte der Schulen im alten Herzogthum Geldern* (Düsseldorf: Bagel, 1881), 331. Vranckheim wrote his letter a few month’s after earning his degree, signing it Dec. 1609 (IIX Kal Decem CIC. ICC. IX. Patavii Anten.)

⁸⁹⁹Burggrav, *Achilles Panoplos Redivivus; seu Panoplia physico-vulcania* (Amsterdam: Hendrik Laurentius, [1612]), 55.

⁹⁰⁰ Vranckheim in Burggrav (1611), 55, “scintillula Animae Mundi, quod ajunt, Magnetica, seu Astrali rerum omnium Spiritu insensibili, Harmonica superiorum et inferiorum, id est, Majoris, Minorisque, Mundi conspiratione: qua & aquas illas Globo vitreo Sphaeram illam inclusam ambiente, ut scribis, inditas, Aeviterno Motu, Motore Vero Inferno, An Externo, an Utroque? certis stisque temporibus credo suis agi incrementis progressionibus, regressionibus, Harmonica cum Oceani aestu Sympathia continenti ad momenta & puncta etiam accessu, recessu. . . “

⁹⁰¹*Ibid.*, 56, “Ab anima Mundi, hoc est, seu forma Spirituali generica, communissima, secretissima, quae unum & duo, & tria est, vinculum nempe tertium apprehendens duplicis termino, duplex extremeum, supremum & infimum id est, quinta Mundi essentia, non ex quatuor elementis conflata, sed quintum aliquod super illa ac praeter existens.

⁹⁰² *Ibid.*, 56-7. “Parem fere stuporem immittit Organi istius Musici tibi visum auditumque technergyma, quod eiusdem sive Mobilis, sive Moventis, Aeterni Virtute (Architecti relatu) Coelo puro, Sole libero, sola radiorum ab eo strictura excitato intus Cithaeraedo illo Genio Nulla Organicinis manu admota, symphoniam edit coelestissimam.”

⁹⁰³ Like lists of *quaestiones* accompanying other dissertations, the *epithemata* appear to be points to be taken into account during the dissertation, and were possibly pre-circulated before the dissertation. Special thanks to Kevin Chang for help in understanding the structure of this dissertation.

representing the eternal motion of the stars, the passage of time, and the tides of the ocean precisely, and also his musical organ which emits a most pleasant harmony during sunny skies, without being touched by any finger, but is silent under cloudy skies. It is agreed that it is moved, turned, and sustained by the *anima mundi* or spirit of the universe, astral and insensible, attracted, infused, and enclosed within that sphere and instrument through a Chymical artifice of magnetic power.”⁹⁰⁴

The dissertation was defended by Hartmann’s son-in-law Heinrich Petraeus (1589-1620). It was first published in 1611 and several times thereafter.⁹⁰⁵ Prince Moritz appointed Petraeus to the Marburg medical faculty in 1610 in order to introduce a vitalist natural philosophy there. The dissertation, composed as was usual at the time by the presiding professor Hartmann, was Petraeus’ final qualification for the medical degree. In it, Hartmann employed his disciple Burggrav’s account of Drebbel’s perpetual motion machine to support the chymical discipline both he and his student were hired to introduce in Marburg.

Hartmann put forth a powerful argument for the primacy of chymically-derived knowledge within the dissertation. He argued that *Chymia* should really be considered the mistress and the source of true philosophy, since by investigating the hidden recesses of nature through artifice, it rendered the theoretical speculations of doctors certain.⁹⁰⁶ *Chymia*,

⁹⁰⁴ *Disputationes Chymico-Medicae: Pleraeq; Sub Praesidio Job. Hartmanni Med. D. et Chymiatricae in Academia Marpurgensi Professoris Ordinarii, ab Aliquot medicinae Candidatis et Studiosis, biidem publicae censurae expositae* (Marburg: Paul Egenolph, 1611), 165-6. “Perpetuum mobile Cornelii Drebbel Batavi, quod in Anglia visitur, sempiternos siderum motus, temporumque vicissitudines, & Oceani reciprocationes ad momenta & puncta in aevum repraesentans: ut & organum ejusdem Musicum coelo sereno suavissimam harmoniam nullo digitulo tactum edens, nubilo silens, ab Anima mundi, seu spiritu universi, astrali insensibili in sphaeram & instrumentum illud artificio Chymico magnetica vi attracto, infuso, & concluso moveri uri, rotari, & coninuari vero consentaneum est.”

⁹⁰⁵ Heinrich Petraeus and Johann Hartmann, “*Contradictiones Apparentes Quatuor, in quibus praecipuae utriusque Medicinae Dogmaticae nempe, & Hermeticae hypotheis, & rationes breviter recensentur, excutiuntur, & conciliantur*” in Johann Hartmann, Ed., *Disputationes Chymico-Medicae* (Marburg: Egenolph, 1611). The disputation also appeared in 1614 and in Hartmann’s *Opera Omnia Medico-Chymica* (Frankfurt: Viduae Seylerianae, 1684; Frankfurt: Fievetus, 1690; Röder, 1694). On Petraeus, see Bruce Moran, *The Alchemical World of the German Court: Occult Philosophy and Chemical Medicine in the Circle of Moritz of Hessen (1572-1632)* (Stuttgart: F. Steiner, 1991), 55-6.

⁹⁰⁶ Petraeus, 163.

in revealing the arcana of nature, glorified the name of God, and procured the salvation of one's neighbor.⁹⁰⁷ Evidence of the wonderful things that can be achieved through *Chymia* could be found among those who have extracted the quintessence.⁹⁰⁸

The dissertation, *Contradictiones Apparentes Quatuor, in quibus praecipuae utriusque Medicinae Dogmaticae nempe, & Hermeticae hypothesis, & rationes breviter recensentur, excutiuntur, & conciliantur*, professed to be a reconciliation between Galenic and Hermetic medicine. The account of the elements Hartmann provided proved to be highly Fernelian. Following Fernel, Hartmann argued that the mere interaction of elementary qualities could not explain the specificity of natural bodies in generation and development. Rather, “a higher and nobler cause is sought, which like a craftsman governs their action and directs them to a certain result.”⁹⁰⁹

Like Fernel and Libavius, Hartmann quoted Aristotle to show that even the Stagirite accepted two different types of heat, a celestial and elementary one.⁹¹⁰ Thus, living things had two types of temperament; one which derived from the concordance of the four elements and was mutable, the other which was the form and remained constant. Such a distinction, said, Hartmann, allowed Fernel to devise his new account of disease.⁹¹¹ It was this form, deriving from the motion of the heavens, and inciting the motion of generation upon earth,

⁹⁰⁷ *Ibid*, 160.

⁹⁰⁸ *Ibid*, 161.

⁹⁰⁹ Johann Hartmann, “Contradictionum in Medicina Dogmatica & Hermetica apparentium conciliatio” in *Disputationes Chymico-Medicae* (Marburg: Egenolph, 1611). The disputation also appeared in 1614 and in Hartmann’s *Opera Omnia Medico-Chymica* (Frankfurt: Viduae Seylerianae, 1684; Frankfurt: Fievetus, 1690; Röder, 1694): “23. Cùm autem qualitates primae nequeant per se in agendo servare modum, causa aliqua superior & praestantior requiritur, quae instar opificis actionem earum gubernet, & ad certum finem dirigat. Talis in caeteris est sua cujuslibet forma, in animantibus ipsa anima, seu calor plasticus in semine.”

⁹¹⁰ *Ibid*, “24. Duplicem enim calorem in animalibus ipse agnoscit Arist. coelestem, in spumoso corpore spiritum, proportione elemento stellarum respondentem, efficientis, & formae vices obeuntem, & elementarem materialem.”

⁹¹¹ *Ibid*, “25. Hinc nonnulli duplex faciunt animalis temperamentum: aliud misti, concordiam quatuor qualitatium: aliud viventis, humoris primigenii, & caloris nativi aequalem mixtionem. Illud vocant temperamentum qualitatium quod facillè mutabile est: hoc verò formae, quod est constantius.

26. Quam distinctionem si adduxisset Fernelius, illi tanquam fundamento solidiori decretum suum de morbis formae superstruere potuisset.”

which explained the movement of Drebbel's perpetual motion, which corresponded to the motion of the heavens.⁹¹²

Fernel's natural philosophy served as an important source for the vital philosophy promoted by Prince Moritz in Hesse-Kassel. The author of *An Introduction to Vital Philosophy* (attributed either to Burggrav or to Hartmann) cited Fernel constantly. Furthermore, another Petraeus/Hartmann dissertation also found in the collection published by Hartmann in 1611, offered another account of the vital philosophy which further betrayed its Fernelian metaphysics.

This *Disputatio Hermetica, De Principiis Rerum Naturalium Realibus: in quâ aperitur & monstratur via vera ad vitalem Philosophiam* provided an enthusiastic introduction to vital philosophy. Hartmann did not attempt here to conciliate between schools of medicine, but to dramatize the wonders of vital philosophy. This highly unconventional dissertation employed no logical disputation, but rather portrayed a Dantesque allegorical pilgrimage through the layers of nature.

With Hermes as his guide, the narrator passed through the various spaces of the temple of nature, and at each stage noted another level of an extensive, pluralistic system which was highly Fernelian. Unlike Dante, the narrator did not start out the lowest level and work his way upwards. Rather, after prostrating in prayer at the fore-court, a ray of divine light scattered the cataracts from his eyes, and allowed his senses and intelligence to ascend a "Jacob's ladder" directly to the Holy of Holies.⁹¹³ After witnessing the greatest arcana of

⁹¹²*Ibid*, "27. Et quia finis mistionis est perpetua individuorum ad speciei conservationem successio & renovatio, causam habebit perpetuam perpetuo motu praeditam, qualis circularis est coelestibus corporibus competens. Coelum igitur omnia continens, ceu forma elementorum, continuae vicissitudinis inferiorum causa est, & contrariis suis motioris contrarias mutationes, ortus, & interius [interitus] efficit."

⁹¹³ Heinrich Petraeus and Johann Hartmann, *Disputatio Hermetica, De Principiis Rerum Naturalium Realibus: in quâ aperitur & monstratur via vera ad vitalem Philosophiam*, 24-5. "At quis afflatus aethereus tam subito mentem percillit, & ad sublimia raptat? Quae fulminea ista vox? procul hinc, procul ite profani: frustra Naturam adit, qui Pana non attraxerit: fures & latrones posticum ingressi de principiis sine Principio, de Deo sine Deo loquentes.

nature, the narrator descended from the Holy of Holies back toward the external door (the Porticus) via more and more manifest layers of nature.

Once inside the Holy of Holies the enthused narrator spied at once the shining green line rotating everything.⁹¹⁴ He related this spiritual unity of the green line moving all to a universalist and irenic ecclesiastical and social order, “O holy catholic church! O peaceful, o blessed Republic!”⁹¹⁵ The narrator asked Hermes to explain why “so many altars, icons, monuments, so many halls have been built in this circular amphitheater, and so many names and emblems have been fixed there in gilt letters? But first explain, what that wonderful point in the center means, from which everything flows. . . .?”⁹¹⁶ Hermes never did reveal to his easily distracted interrogator whose names and altars had been included in this all-encompassing social and religious theater. He answered only that the point was the prime matter of the philosophers, “that shared mother, the inexhaustible fountain of life: the origin of all natural actions, of generation, mixture, and transplantation, which occupying the universal anatomy of the body, produces operations according to the diversity of tinctures, impressions, & confluences.”

This response surprised the narrator, since he expected to see instead the Aristotelian shape-shifting matter, perhaps in the form of Proteus or some other shapeless monster, “without form, eternal, and uncreated.” According to the Thomistic interpretation of

Prostrati igitur corporibus, sublimatis, & exaltatis animis in aditu preces, & ἀρχῆς huic arae imponamus, & in limine salutemus eum qui solus est, qui dat esse, nosse, velle, posse, ut respondeat nobis ex adytis: γνωθὶ σεαυτὸν, imò Nosce Omnia. *Principium a JHOVAH, JHOVAH sunt omnia plena.* Principium ἀναρχὸν finis infinitus, primus motor immobilis, αὐτο-ὄν est sacro sancta Trin-unitas, Unus Verus Bonus Deus, Pater, Filius, Spiritus Sanctus: à cuius Ideam: λόγον: in cuius Bonitate, Voluntate, Amore: ad cuius Bonitatem, Veritatem, Unitatem sunt omnia & ipse omnia in Omnibus, & nihil ex omnibus. Ipsi sit laus, honor & gloria in secula seculorum, Amen.”

⁹¹⁴ *Ibid*, 26. “Quid linea illa viridis ubique radians, & gyrans universum? ὁ benedicta viriditas! ὁ Jucundum spectaculum!”

⁹¹⁵ *Ibid*, “ὁ sancta Ecclesia Catholica! Ὁ quieta, ὁ beata Respublica!”

⁹¹⁶ *Ibid*, 26. “Tu verò, mi Hermes, agedum dic nobis, quorsum tot altaria, tot icones, & monumenta, tot exedrae in cyclico hoc amphitheatro extractae, tot nomina & emblemata aureis hinc inde literis consignata sunt? Primum autem edissere, quid mirabile illud punctum in medio designat, à quo omnia emanare, & ad quod tanquam ad centrum omnia collineare videntur?”

Chapter Five: Artisan and Philosopher

Aristotle, prime matter had no real existence, but was pure potentiality. It was constantly changing since a true mixture could only exist if the temperament emerging from the mixture destroyed the previous substantial form and the prime matter in which it inhered. Hermes explained that the Aristotelian matter was a pure fiction worthy of Utopia or Gehenna. The prime matter of the philosophers, on the other hand was not “pure potential and almost not an entity at all.” It was the true universal subject, able to contain all forms not only in potentiality but in actuality.⁹¹⁷

The narrator spied a turning sphere, which he learned was the Pythagorean sphere, diffused throughout the world, whose center was everywhere and whose periphery was nowhere.⁹¹⁸ This represented the interior Form, which contained within it all the causes for each species, by means of which they fabricated for themselves a body, colors, tastes, qualities, magnitudes, positions, etc.⁹¹⁹

He then asked Hermes about the shining green Lion. This was the “incombustible sulfur, the fire of wisdom, the living fire of nature” itself, which Hippocrates described as

⁹¹⁷ *Ibid*, 26-7. “Ubi verò abstrusa illa Peripati decantatiss. materia delitescit? Putabam me versipelem aliquem Protheum, libidinosam Thaida, aut informe aliquod monstrum visurum: creditur enim ἀμορφος, ἀειδης, ἀποιος sensum omnem subterfugiens, etiam iudicii partem, solâ analogiâ, atque id ne vix quidem perceptibilis: perhibetur esse tenuissimae, peneque nullius entitatis (fortasse nullius veritatis) pura puta potentia, primum generationis subjectum, infinitum & aeternum. Ridiculum verò Eubulidis somnium narras, suave delirium, futiles & inutiles subtilitates. Peregrinum ignem inferunt, qui hunc foetorem in hoc sacello adolent. Exesto ignavissimum malè feriatu hominis cerebri, aut Cerberi figmentum, ens rationis irrationalis in Utopiam & Gehennam relegator. Mosis materia hanc planè extra naturae limites proscribit: nostra vero est verum, & essenziale subjectum, formas omnes actu possidens, elargiens, & conservans, non abstractum quid. Verùm, ne cum larvis luctari videamur, aliò convertamus oculos.”

⁹¹⁸ The circle with a center everywhere and a center nowhere was a commonplace deriving from a twelfth-century text attributed to Hermes, *The Book of the XXIV Philosophers*. See Edward Grant, *Much Ado about Nothing: Theories of Space and Vacuum from the Middle Ages to the Scientific Revolution* (Cambridge: Cambridge University Press, 1981), 145.

⁹¹⁹ *Ibid*, “Quid volubilis illa sphaera portendit? haec est Sphaera Pythag. per omnes mundi partes aequabiliter diffusa, cujus centrum est ubique, peripheria verò nusquam: repraesentat autem *interiorem illam Formam*, quae in se continet omnes causas propriae speciei, quibus suum sibi fabricat corpus, colores, sapes, qualitates, magnitudines, situs conformationes, consensus, durationes, omnesque signaturas tam intus quam foris inhaerentes officii consentaneas admirabili Scientiâ adjungit.”

moving all things.⁹²⁰ He also inquired what the stone with the circle of the sun upon it signified. This was the “internal sun, the native heat, much more noble than the elements, which corresponds to the stars, and through whose perennial circulation our blood is nourished with vivifying spirit – the primigenial moisture.”⁹²¹

This bizarre dissertation provoked strong reactions. Daniel Sennert attacked it within his discussion of the spirit of the world in his *De Consensu* of 1619.⁹²² Moderns, he said, believed that certain new machines function through the spirit of the world. Marcellus Vranckheim reviewed some of these in the letter prefixed to *The Lamp of Life and Death* of Burggrav, where he described the sphere of Cornelis Drebbel.⁹²³ Sennert quoted verbatim Burggrav’s description of the sphere found in Vranckheim and the second Hartmann/Petraeus dissertation. Then Sennert rebuked the “many Ramists and modern Chymists,” who have vituperatively attacked Aristotle’s prime matter. We can be sure that Sennert intended Hartmann, since the attacks he mentioned were taken verbatim from the first Hartmann/Petraeus disputation.⁹²⁴ He concluded by saying that those who attacked the

⁹²⁰ *Ibid*, 27. “En, quis Leo viridis nobis occurrit, cujus oculi inaccessibleis virtutis igne scintillant? Est hoc ipsum tincturae donum, nobile germen, faciens res cunctas germinare : hoc est incomcombustibile sulphur, ignis sapientiae, ignis *naturae* vivus, quem pulcherrimè describit venerandus senex Hipp. In l. de diaetâ, ubi inquit : Ignis omnia universim movere potest, aqua omnia per tota nutrire. ”

⁹²¹ “Quid praedurus ille lapis, cui solis circulus auro spendescens incumbit, designat? Internum solem, *calorem nativum*, longè nobilioris prosapiae, quàm elementa, proportione stellis respondentem ostendit, qui ex perenni circulatione spiritus vivifici sanguinis nostri fovetur. Hoc est *humidum illud primigenium*, oleaginosum illud & aëreum, insito spiritu totius formae custode, & propugnatore, nec non vitali calore perfusum. ” Deer clarified the relationship between these entities in Fernel’s thought, 393-4. “All things which burn, Fernel explains do so simply because they contain a certain oily material which is able to support flame. This oil is the analogue of the sulphur of the chemists, by which they explain the combustible nature of certain minerals. . . . The spiritus . . . is the flame of the fire within us, neither the celestial heat alone nor its aetherial vehicle considered separately from this heat, but the two in association and acting together. Pursuing the analogy, the ‘primigenial moisture’ . . . corresponds to the ‘oil’ which is the fuel of the ordinary flame. Heat: flame: oil : : celestial heat: spiritus: primigenial moisture.”

⁹²² Daniel Sennert, “Chymicorum cum Aristotelicis et Galeinics Consensu ad Dissensu liber,” *Opera Omnia* (Paris: Society, 1641), 943.

⁹²⁴ Sennert, 943. “Tandem Materiam primam Aristotelis quod attinet, contra quam hactenus acriter pugnarunt plerique Ramei & Recentiores quidam Chymici, eamque ut dictum, variis convitiis infectati sunt, & fersipellem Prothea, libidinosam Thaida, informe monstrum, Ridiculum Ebulidis somnium, suave delirium, futiles & inutiles subtilitates, ignanissimum maleferiati hominis Cerebri, aut Cerberi potius, figmentum, Ens rationes

Aristotelian prime matter in such a hostile matter should beware lest they cause injury to the creator of all forms.

Sennert's book stressed the points of agreement between Galenists and Chymists (*De Consensu Galenicorum ac Chymicorum*), as an irenic concordance of opinion. As Michael has argued, Sennert found a *via media* between the Platonist's *anima mundi*, and the Aristotelian orderly structure, by pointing to God the creator as the cause of the forms; "Sennert contends that the form of the world, the cosmic structure, is not a product of dispositions in matter towards completion; it is not the result of final ends functioning as causes, as in Aristotle's eternal uncreated world."⁹²⁵ Sennert thus differed with Hartmann concerning the spirit of the world. Yet beyond this difference, Sennert decried the vituperative language with which Hartmann attacked scholastic medicine.

While Sennert attacked Hartmann's speech as a bilious Ramist manner of philosophizing, Libavius contrasted Ramus positively with Hartmann. When Hartmann said that the prime matter of the schools as pure potentiality had no being and should be sent to "Utopia or Hell," Libavius remarked, "Petrus Ramus did not allow it in Physics because of its generality. He transferred it from Physics to Logic; he didn't send it to the devil in hell."⁹²⁶

Libavius' criticism appeared in his *Paracelsian Vital Philosophy according to Petrus Severinus, from the repetition by Johann Hartmann* of 1615. Unlike Sennert, Libavius pulled no punches in his condemnation of the *Disputatio Hermetica*. Throughout *Paracelsian Vital Philosophy*, Libavius followed one step behind Hermes and Hartmann, ridiculing their

irrationale, in Vtopiam & gehennam relegandum appellat, Videant illi, qui hoc faciunt, ne in creatorem rerum omnium iniurii sint, atque id, quod illi pulchrum & bonum visum fuit, ita vituperent & insectentur. "

⁹²⁵ Emily Michael, "Daniel Sennert on Matter and Form," *Early Science and Medicine*, 2:3 (1997), 298.

⁹²⁶ Andreas Libavius, "De Philosophia Vivente Seu vitali Paracelsi Iuxta P. Severinum Danum Ex Repetitione I. Hartmanni Chymiatri Marburgensis," *Examen Philosophiae Novae* (Frankfurt: Peter Kopff, 1615), 111. "Petrus Ramus in Physica non tulit propter generalitatem. Transtulit ex Physica in Logicam non allegavit ad diabolum in infernum."

conversation at every turn, in a polemic many times the length of the dissertation it criticized.

Libavius professed himself shocked by the *Disputatio Hermetica*. “Is this how you dispute in the Marburg Academy?” Hartmann, he said must either be an Enthusiast, drunk, dreaming, or fallen into melancholy. Only a plea of insanity could excuse him from impiety, with his discussion of pagan gods, icons, and altars.⁹²⁷ Hartmann had declared that the ancient command to know one’s self was too limited, one should know everything. Libavius claimed that this was that ancient sin of pride through which Eve, wishing to make herself like God, lost everything. This was also the opinion of the Enthusiasts, who seek the knowledge of everything through their own occult inspirations.⁹²⁸

Libavius continued to traipse after Hartmann as he entered the Holy of Holies, described as a “round machine of the world, which yet also had angles.” “Where then are you located?” asked Libavius, “for that place is nowhere.”⁹²⁹ He claimed that Hartmann had misunderstood the meaning of the “*linea viridis ubique gyrans*.” Libavius explained that this greenness referred to Nature (“ita ut viriditas sit NATURA, quae & generandi virtus, & anima mundi?”).⁹³⁰ As for Hartmann’s vitalist account of the fire of nature, Libavius conceded that there was a moving heat which led to generation and growth. Yet this heat was not living, unless Hartmann meant “vegetable” (“Non vivum calorem, sed tamen calorem docuisset rei nascenti insitum esse, nisi fortasse metaphorice loqui, & vivum pro vegeto, vitali”).⁹³¹

⁹²⁷*Ibid*, 101 “Siccine disputas in Academia Marpurgensi ? Dum in Proaulion venis, aut Enthusiasta es, aut ebruius, aut somnio, vel melancholia correptus. Delirare sine impietate poteras. Quis est iste Pan . . . ? ”

⁹²⁸ *Ibid*, 102. “Haec est superbia illa antiqua qua Eva Deo similis fieri volens perdidit omnia: ô bellum speculum DEIFICUM. Eadem est Enthusiastarum sententia, qui sibi inspirari occultè petunt omnium scientiam, quod subtilius explicatur de revelatione tantum sui ipsius, qua facta omnia noscantur. ”

⁹²⁹ *Ibid*, 103, “Ubique ergo habitat, hoc est nusquam. ”

⁹³⁰ *Ibid*, 104.

⁹³¹ *Ibid*, 126.

By enthusiastically claiming that all is in harmony, by throwing everything into a chaos, Hartmann ignored the divinely ordained order and providence of nature. The causes of things were not to be found in the many occult forces Hartman described, but in God, whom nature served as his created instrument. Indeed, all of Hartmann's terms – green lion, fire of wisdom, living fire of nature, etc. – were really nature.⁹³² Like Sennert, an orderless cosmos troubled Libavius. He sought to delineate the proper *ordo rerum*, and to defend alchemy's rightful place within that order. The enthusiastic pansophism that sought to melt down hierarchical differences was both foolhardy and impious. It not only ignored the postlapsarian state of man, but threatened to repeat the sin of Eve.

Libavius continued to attack Hartmann's *Disputatio Hermetica* in his notes on the 1614 Rosicrucian *Fama Fraternitatis*, his "Exercitatio Paracelsica Nova de Notandis excerpto Fraternitatis de Rosea Cruce" (1615). There Libavius satirized what he cast as Hartmann's/the Rosicrucians' claim for an absolute, immediate, and easy reformation of knowledge and society. Libavius compared several works to the Rosicrucian *Fama*, including the "vital philosophy of Hartmann."⁹³³ Specifically, he conflated Hartmann's description of the temple in his *Disputatio Hermetica* with the tomb of Christian Rosencreutz, which was said to contain a microcosm just like Hartmann's Pythagorean sphere.⁹³⁴

⁹³² *Ibid*, 127. "Vide iam, an idem sint Natura, Leo viridis, Ignis sapientiae, ignis naturae vivus, fatum orphei &c. Tua phantasia omnia in unum chaos confundit. Si rem spectes, ordinatio, providentia & volutas Dei primi causa est: Natura est creata quaedam, & insita rebus potentia, cuius vi, Deo provehente, unaquaequa nascitur, ex potentia in actum prodit, & naturaliter se gerit. *Ignis natura vegetus*, seu calor insitus potest quidem natura dici, si modificate loqui velis : re vera est instrumentum quoddam, quo utitur ad motus materiae, & actiones natura, sicut & *Hippocrates* in loco citato *motivum principium*, quod naturae formae attribuere solemus, esse indicabat. "

⁹³³ Libavius, "Philosophia Vivente," 264.

⁹³⁴ *Fama Fraternitatis* (Cassel: Wessel, 1614), 121. "Den minutum mundum belangend, funden wihr den in einem andern Altärlein verwahrer, gewiß schöner, als ihn auch ein verständiger Mensch ihme selbst einbilden möchte, dene lassen wir ohn abgerissen, biß uns auff diese unsere trewhertzige Famam vertraulich geantwortet wird, also haben wihr die Platen wieder übergelegt, den Altar darauff gestellt, die Thüre wiederumb verschlossen, und mit unser aller Sigill versichert, darüber auß anleytung und befehleh unser Rotae, etliche Büchlein, darunter auch die M . . ." This Book M had an image of the entire world. *Ibid*, 109. ". . . was wihr auch auß dem Buch M. heimliche erfahren (wiewohl wihr der gantzen Welt imaginem und contrafactur können für augen haben). . . "

The Rosicrucian's microcosm recalled the claims Claudian made for the Archimedean sphere, which he said contained all the laws of nature. Libavius played upon Claudian's verses praising the Archimedean sphere, in which Jupiter smiles (*risit*) upon seeing a man-made microcosm. Jupiter's smile became a guffaw when Libavius imagined him considering a microcosm within the tomb of Christian Rosencreutz.

Utterly astonishing is the chamber of the tomb of Christian à Rosy Cross, & hard to believe. Johann Hartmann was led by Hermes into a cloister that was both inside and outside the world, where he saw everything divine and human as though depicted in the shield of Achilles or Aeneas. This is nothing compared to the magician's circle. For the monument of the rosy cross is a certain small world, in which an artificial sun and eternal lamps offer light. Jupiter laughed at the sphere of Archimedes. What would he say or do when seeing that tiny monument, in which is the natural & artificial macrocosm? Speaking seriously now, I would consider nothing more desirable in all of Philosophy than to have the privilege of seeing and understanding the decorated monument of that old man.⁹³⁵ How much would the small or minute world most beautiful in appearance, a compendium extracted of all things past, present, & future, delight me, especially if it would expose to view the causes of all operations at once.

Admirabile prorsus est conclaue sepulchri *Chr. à Rosea Cruce*, & pene incredibile. *Johannes Hartmannus* ab *Hermete* ductus est inquoddam extra & intra mundanum coenobium, ibique vidit omnia diuina, humana, ut in clypeo *Achillis* vel *Aeneae* depicta. Nihil hoc ad rhombum. Paruus quidam mundus est monumentum roseae crucis, in quo sol artificialis cum aeternis lampadibus lumen praebent. *Risit Iupiter* Archimedis sphaeram. Quod diceret aut faceret viso illo monumento, in quo magnus mundus naturalis & artificialis cum minuto? Serio dico, si mihi seni contingeret videre & intelligere monumenti isti ornatum, in tota Philosophia nihil optabilius ducerem. Paruus seu minutus mundus visu pulcherrimus, compendium extractum rerum praeteritarum, praesentium & futurarum, quantum me oblectaret, praesertim si omnium operum causas simul aspectui subiiceret, de quo *Arist.* scribit *lib.I. de part.*

⁹³⁵ Archimedes is termed an old man, *senex* by Claudian, and his tomb famously was topped by a sphere. The old man could also refer to Rosencreutz.

anim. cap. 5.[where Aristotle described the pleasure of contemplating chains of causation].⁹³⁶

The Rosicrucian's little world, like Hartmann's enthusiastic Pythagorean sphere, circumvented the careful literary empiricism practiced by Libavius, and allowed an instant inspection of the Holy of Holies through a living microcosm.

The Rosicrucians claimed that their knowledge was that which Adam had after the fall. Libavius took issue with their enthusiasm, optimism, and diminution of the importance of the fall. He wonders why they specified they had the knowledge from "after the fall," when nature became imperfect and subject to vanity. Postlapsarian man had to turn to reason and experience to attempt to learn something about nature. Libavius rejected Croll's claim that Adam could see all of Philosophy, like "Drebelius, Sedinvogius and others" through the philosopher's stone. "Such a thing should not be claimed, but proven," he said.⁹³⁷ Here both Drebbel and Sendivogius appeared as examples of enthusiastic philosophers who claimed universal knowledge of the secret causes of nature through alchemy, despite the limited powers of postlapsarian man.

Libavius employed Drebbel once again as an example of an enthusiastic optimism that blindly ignored the imperfect and instable postlapsarian state of the world. Combating the idea that the microcosm is in harmony with the macrocosm, Libavius argued that the world is far too complicated for a simple harmony. He conceded that harmony reigned in the world before the fall, or in heavenly Jerusalem. But in this world, subject to original sin, everything fell prey to dissonance, disorder and decay. Consider the various churches, or

⁹³⁶ Andreas Libavius, "Exercitatio Paracelsica Nova de Notandis excerpto Fraternitatis de Rosea Cruce," *Examen Philosophiae Novae* (Frankfurt: Peter Kopff, 1615), 271.

⁹³⁷ *Ibid*, 278. "Est ea, quam Adam post lapsum habuit. Vellem ante lapsum. Neque enim ea, quae post lapsum ipsi fuit, caruit imperfectione. Maledicta enim tunc erat natura, & vanitati subjecta, adeoque obtenebratus intellectus Adae, ut necesse haberet à Deo vestiri. Quid multis? Coactus est Adam discere divina ex Deo; humana ex natura per rationem & experientiam. Ridiculis est Crollius & alii, qui affirmant, Adamum diu vixisse beneficio lapidis Philosophici, quem sciverit fabricare, & in quo viderit totam Philosophiam, ut Drebelius, Sedinvogius [sic] & alii. Non dicendum est, sed probandum."

forms of government. Do they all share the same harmony? The many disorders of nature – earthquakes, floods, etc. – show how unstable the world had become. Seneca was right when he said, “If that which is most stable, is inconstant, what is to be expected from instable things?” “Your tiny world, your little Archimedian, Drebbelian globe” might contain a single melody, said Libavius, but the macrocosm was full of difference.⁹³⁸

Libavius’ cosmos was not a circle with a circumference everywhere and a center nowhere. The postlapsarian world was subject to disorder, yet difference alone was not to blame. In fact, it was difference which constituted a divinely ordained *ordo rerum*. The society of men, after all was not composed of a single being, “just as the heavens do not contain one star, but innumerable ones, all fitting in a certain order, and marching along in the Republic with certain motions.”⁹³⁹

VII: Libavius’ Rival Interpretation: Nude Nature and Cloaked Texts

This was not always the opinion Libavius held of Drebbel and his works. Well before he encountered Hartmann’s treatment of Drebbel, Libavius encountered *On the Nature of the Elements* on his own. He selected the work as worthy of introduction to the academic

⁹³⁸ *Ibid*, 285. “De integro mundo ante peccatum, & coelesti Hierusalem in mundo Electorum verum est, quod dicitur, Nihil enim inordinatum, & dissonans fecit *Deus*, nec quicquam erit anharmonicum, ubi ipse omnia in omnibus. At in hoc mundo, qui est vanitati subjectus, & totus in malo, qui id affirmes? . . . Deinde experientia testatur in magno mundo multa esse inordinata. Haec qui sint sub una melodia? Inspice religiones. Sunt ne sub eodem tono? Considera Respub. Despoticam, Tyrannicam, regiam, seu monarchiam, oligarchicam, &c. Suntne eiusdem toni? Sanitas concentus quidam est & medicritas, at in mundo est regnum morborum adeo dissonans & varium, ut etiam & ipsi Paracelsici subinde novos, inauditos, & inexplicabiles ex astris & aliis causis divinent. Membra mundi qualitercunque cohaerent, at ruinae non parva dant indicia tumultibus coeli, terrae aeris, aquarum, ignium. *Totali ratione aliquis consensu est*: sed partialibus commotionibus quantum dissident, apertum est inundationibus marium, aereis pugnis, imbribus, terrae motibus, &c. unde Seneca non male: Si id, quid stabilissimum est, infidum est, quid expectandum de instabilibus? . . . Minutus vester mundus, globus Archimedaicus, Drebbelianus, &c. eandem habeant melodiam, & tonum eundum.”

⁹³⁹ *Ibid*, 305. “cum ergo in mundo inter homines (nam microcosmus non tantum unicus & singularis est homo, sed omnes quoque homines, seu omnium congregatio simul, sicut coelum non est vna stella, sed innumerabiles certo ordine inter se coaptatae, certisque motibus tanquam in Republ. incedentes) plurima sint inordinata, & dissonantia, diuersis iudiciis ob diuersas formas & affectiones obnoxia, facile fieri potest, ut melodia vestra mundana sit potius, quam diuina, qut saltem in plerisque dubiae accomodationis.”

curriculum, translating it into Latin and appending line by line commentary. Libavius' opinion of Drebbel evolved as he encountered Hartmann's interpretation. Libavius' own relationship with Hartmann was itself changing at this time. Their conflict over the interpretation of Drebbel sheds light on their own emerging differences, as well as on the importance of Drebbel to two such eminent academic alchemists.

In an effort to show that alchemy properly belonged in the curriculum, academic alchemists such as Libavius sought to do away with the enigmas typical of alchemy by publishing clear and precise alchemical textbooks. To that end, as Bruce Moran has shown, Libavius sought to distinguish the "true art of chymistry."⁹⁴⁰ In his *Hermetic Revelations*, intended for young students, Libavius brought together some of the best alchemical authors and interpreted their enigmas to produce a new kind of scholastic alchemical text.⁹⁴¹

Drebbel was one of seven alchemical authors selected by Libavius for processing into his new alchemical literature. Libavius called his seven modern chymists "Monads" (Drebbel is the fourth). He translated the work of each Monad into chapter by chapter epitomes or "analyses" made up of short Latin axioms and accompanied by his own lengthy commentary or "divinations." In this, Libavius showcased a Ramist method of literary "analysis," combing through artisanal texts and showing their underlying structure and logic. This approach led him to uncover a subterranean level of Drebbel's text which appeared entirely different from its surface.

Libavius interpreted *On the Nature of the Elements* as a classic work of metaline transmutation. He argued that Drebbel only pretended to talk about the four Aristotelian elements, since they were familiar to his readers. Beneath this seemingly simple account of

⁹⁴⁰ Moran (2007), especially Chapter 3.

⁹⁴¹ Andreas Libavius, „Apocalypseos Hermeticae Pars Posterior, quae est Divinationum Hermeticarum Heptas (henceforth Hermetic Revelations),” *Syntagma Arcanorum Chymicorum*, Vol. 2 (Frankfurt: Peter Kopff, 1613).

condensation and rarefaction, Libavius traced a complicated series of alchemical processes. He did so by reading *On the Nature of the Elements* in light of an extensive alchemical literature, from Hermes Trismegistus to Sendivogius (who, Libavius claimed, said in Latin the same things Drebbel said in German). He constantly pointed out that Drebbel's text was far more complicated than it seemed, referred to various techniques of composition and hermeneutics employed by Drebbel, and compared the text to classic works of alchemy.

For example, after translating and commenting upon Drebbel's first chapter, Libavius repeated his entire interpretation by casting the chapter in the mold of the Hermetic *Emerald Tablet*. Concerning the chymical perpetuum mobile produced in the alembic, Libavius quoted from Hermes, "*This is the Father of the entire thelesmos of the entire world (a simulacrum of the perfect works of the natural world in the elementary regions, and even of creation).*" Yet Libavius did not claim that the philosopher's stone offered automatic knowledge of the elements. Rather, knowledge of the elements emerged via induction during the process of producing the philosopher's stone. Libavius interpreted the Hermetic sentence, "*You see philosophy just as in a small mirror*" as "You have Theoretical and practical inductions, not so much through the completed stone, as through its preparation, when you see nature in the nude, as Sedinvogius [sic] writes."⁹⁴²

To Libavius, Drebbel was above all a chymical authority who could be reconciled with such chymical classics as Hermes. He therefore emphasized the concluding, more chymical chapters of *On the Nature of the Elements* as the key to the whole work.⁹⁴³ He was far less interested in Drebbel's retort demonstration of Chapter Four, which was so central to other writers. According to Libavius, "These things have nothing concerning the mysteries."

⁹⁴² *Ibid*, 365.

⁹⁴³ *Ibid*, 375. "Caput hoc decimum est medulla, & quasi epitome totius libelli Drebeliani. Integram enim artem sapientum in brevi synopsi proponit."

Far from the keystone of Drebbel's natural philosophy, the demonstration "is a digression for showing the motion and generation of winds, beneath heaven in the macrocosm, about which the natural philosophers write copiously."⁹⁴⁴ Yet, given the Ramist practice of comparing and contrasting authors, he went on to point out the difference between Drebbel's theory of wind and Aristotle's.

Drebbel's demonstration in Chapter Four did raise Libavius' suspicion that artisans claimed too much epistemological certainty in "seeing nature nude."⁹⁴⁵ He remained extremely doubtful of Drebbel's ability to extrapolate knowledge of the macrocosm from his demonstration. In Chapter Six, when the retort demonstration was discussed again, Libavius cautioned against inductive knowledge of the macrocosm gained from the alembic. The macrocosm's geography was infinitely more complicated than the contours of the alembic used in Drebbel's demonstration, and thus the one could not reproduce the phenomena of the other.⁹⁴⁶

Libavius displayed a deep respect for Drebbel as an alchemical artisan, and for *On the Nature of the Elements* as a classic work of alchemy which merited translation into an academic form. Yet he did not accept Drebbel's claim to know the macrocosm with certainty through the observations of his microcosm. Although Libavius accepted the existence of the spirit of the world, he did not agree with Hartmann that this occult force, as a link between the sensible and intelligible worlds, validated a universal natural philosophy.⁹⁴⁷ He did not wish his students to see nature nude within a magical microcosm, but, through Ramist analysis, to

⁹⁴⁴ *Ibid*, 370. "Nihil ista habent mysteriorum. Digressio est ad declarandos motus ventorum & generationes, sub coelo in maiore mundo, qua de re physici copiose."

⁹⁴⁵ *Ibid*. "& mundum arbitrari palmam esse, ut inspecto opere agitationum in sphaerula Athannoris mercurialem liquorem a9continente, putent se ubivis in magno & parvo mundo NUDAM naturam contemplatos esse."

⁹⁴⁶ *Ibid*, 372. "Sane si vellemus omnem ventorum motum ubivis terrarum & in mari excutere, fortasse Vulcanus, & Aeolus noster Hermeticus non sufficeret, cum in sua sphaera non habeat sinus varios, & montes, planicies, cavernas, & alia quae flatus mirifice mutare possunt, uti testantur navigationes Indicae, & Americanae, in quibus admiranda de ventis legimus, rationibus non tanta facilitate se prodentibus."

⁹⁴⁷ On Libavius and the spirit of the world, see Moran (2007), 286.

pull away the cloak of simplicity (“populari tegumine detracto in lucem protrahere studebimus”) concealing Drebbel’s literary classic.⁹⁴⁸

Libavius appeared to grow more critical of Drebbel when viewed through the lens of Sendivogius, his seventh and final Monad. Sendivogius’ open appeal to magnetic, occult powers led Libavius to satirize both his and Drebbel’s overall empirical epistemology.⁹⁴⁹ Who would deny that the earth has a magnetic power to attract the life-giving portions of the air? “Drebbel saw it in his little philosophical furnace; Sedinvogius [sic] saw nature nude. . . . This is that imaginary philosophy.” Libavius also criticized particular tenets of both as based on false foundations.⁹⁵⁰

Soon after writing the *Hermetic Revelations*, Libavius encountered Petraeus’ 1611 disputation. He responded with a disputation of his own at Coburg in 1612, defended by his student Peter Ziegler, solely devoted to Drebbel’s perpetual motion and solar-powered clavier. Professing philosophical modesty, Libavius clearly stated in his title that his was a mere probable investigation of causes of Drebbel’s perpetual motion (*Probabilis Investigatio Causarum Physicarum Aliarumque Globi Archimedaei novi & instrumenti musici per se absque evidente motore mobilium*).

At the start of the disputation Libavius said that while he had already fully dealt with Drebbel’s text, he felt he had to respond to Hartmann’s interpretation concerning Drebbel’s

⁹⁴⁸ Libavius (1613), 362. “Quoniam enim per typographos vulgatus est liber, formaque Enchiridii vix undecim capitulis, iisque paucorum foliorum comprehensus, populari etiam sermonis genere, & ad captum plebeium commodo traditus facile potest à studiosis totus perlegi. Mystera saltem attingemus, & populari tegumine detracto in lucem protrahere studebimus. . . .”

⁹⁴⁹ *Ibid*, 443: “Accedit, quod terra ista accipiat vim magneticam, (magnesium vocat) & propter naturae familiaritatem etiam appetat pinguedinem & aërium mercurium, vitae causam. Similiter fieri scribitur in *plantis, concurrentibus astrorum*, praesertim luminarium radiis. Quis neget sic esse? Vidit Drebbelius in furnulo physico: vidit Sedinvogius naturam nudam. O Lynceos homines, & rem dignam explosione omnium physicorum. . . . Haec est illa imaginaria philosophia”; *ibid*, 450, “[marginal notation: potestatis artis] Haec ille cum Drebbelio sic fieri putat argumento motus materiae in vitro physico Hermeticorum.”

⁹⁵⁰ See for example *ibid*, 440: “Ut autem Sedinvogius, ita & Drebbelius de generationibus rerum ex falso fundamento philosophabantur. . . .”

instruments. Libavius proposed and rejected various spiritual motive forces for the machine, from a rational soul, to the genius of a star, to the *spiritus mundi*. He also suggested winds, which could also be considered spirits, and offered examples of winds producing music and motion. However, since the clavier could be silenced by a cloud, which should not affect the wind, he rejects this opinion.

Libavius then returned to Hartmann's opinion voiced in the *Epithemata of Four Apparent Contradictions*. After offering an analytical paraphrase of Hartmann's description of the perpetual motion divided into mode, form, and act, Libavius ridiculed it. He wondered why Hartmann didn't go further and claim that Paracelsus' spirit of the fire (Vulcan) "moves the keys by tugging and releasing heavenly ropes let down to the earth, slowly, or quickly, as the music of Euclid and Boethius require."⁹⁵¹

Instead, he concluded that heat must provide the motion, based on the fact that clouds silenced the music. He proposed that Drebbel used the "invisible sulfur and fire of nature" to move his machine. This was not, however, Hartmann's vital, formal heat attracted magnetically into the machine from the sun. It was rather a chemical latent heat, which could be produced artificially through the circulation of the "elements" in the production of the philosopher's stone. The water which moved back and forth with the tide within the

⁹⁵¹ Libavius, *Probabilis Investigatio Causarum Physicarum, Aliarumque Globi Archimedeaei novi & instrumenti musici per se absque evidente motore mobilium* (Coburg: Bertsch, 1612), proposition 21. "Modus dicitur insensibilis & astralis: artificium modi, chymicum: Forma & actus, attractio magnetica, infusio, conclusio, motus, rotatio, continuatio, quod cum vero pronuncietur consentaneum, est fabulae somnium, quod Democritus fusissime rideret, & forse ridet ipse Drebelius, inventum esse hominem, qui magiam istam instrumentalem tam miseris revera, ad speciem phantastice pulchellis coloribus possit pingere. Asylum stultitiae Paracelsicae id est, quod fingit non demonstrat fieri, quae fieri naturaliter & humana arte non possunt. Mirum cur non dicatur Vulcanus coelestis Paracelsi demissis funiculis & regulis in terram movere claves, attrahendo, remittendo, tarde, celeriter, ut requirit Musica Euclidis & Boethii."

machine could be easily explained this way. It was probably some vitriolated, salty, mercurial liquid containing latent heat.⁹⁵²

Libavius had a harder time explaining how such a chemical latent heat could produce the music of the self-playing clavier. The clavier played only when the sun shone, yet it was hard to conceive of such a complicated instrument being purely solar-powered. Libavius supposed that Drebbel, through his alchemical knowledge of mobile spirits and the ways of circulation, devised a spirit which could be excited by only a very little heat. This would explain how the instrument could be sensitive to such minute changes, such that it stopped playing when a cloud passed in front of the sun. Another possibility was the Drebbel used here too a chemical containing its own internal principle of “ebullition,” the fire of nature, as in his marine tide. He could have placed it in very sensitive hollow glass wheels (perhaps even ones made from the famous flexible glass, out of crystal and the philosopher’s stone) which could be made to move and turn easily by the vapor of Drebbel’s bubbling chemicals.⁹⁵³ This is much more likely than the “foolishly devised opinion concerning the soul and spirit of the world attracted by a magnetic power, as in the weapon salve.” It “is shameful to stray to Metaphysics and fictions immune from disputation,” when there are natural causes available.

⁹⁵² 24. Vidit Drebbelius in suo vitro, in quo lapidem coxit, eiusmodi aestus & ebullitions, vidit gyros, assurgentes nebulas, spiritus, pluvias, ventorum, tonitruorum, caeterarumque turbarum elementarium simulacra. 25. Si volumes industriale ex chymica observatione ascribere effectum, habes probabilem causam gyrorum coelestium: habes aestus marini ex liquore mercuriali vitriolato salinoque quibus inest suum sulphur invisibile & ignis naturae, qui liquor quia actuosus est & spiritualis, ex parva mole excitatus magnam vim habebit, ut patet in circulatione sapientum.

⁹⁵³ *Ibid*, 30. Cum ergo Drebbelius in suo furnulo notasset mirabilem motum spirituum inclusorum, atue etiam nosset circulationum morem, sicubi spiritus sunt subtiles, qui parvo calore excitari possunt, vel etiam internam ebullitionis causam habent, ut in aestu marino: sic disposuit rotas ex material levissima, subtiles (ponimus ex vitro tenuissimo, quod fortasse est flexile, ex crystallo & lapide Philosophorum: haec enim material esse affirmatur a Philosophis mysticis) intus cavas, in motum adeo proclives, tamque artificiose suspensas, ut exili aura subeunte circumeant & agitentur, postequ semel motae aliquandiu perseverant, ut rotae perpetuae vertiginis.

A year after Libavius' dissertation on Drebbel's perpetual motion, Hartmann complained, in the preface to his 1613 re-edition of his 1611 collection of dissertation, that Libavius had humiliated him in public.⁹⁵⁴ Libavius defended himself against this criticism in his own preface addressed to Hartmann in his *Vital Philosophy . . . according to Hartmann*.⁹⁵⁵ This was the lengthy work discussed above in which Libavius assailed the *Disputatio Hermetica*, another one of the 1611 Petraeus/Hartmann dissertations. In other words, rather than repenting of his 1612 attack upon the *Four Apparent Contradictions*, he threw down the gauntlet once again.

Libavius would not apologize for his 1612 onslaught. While Hartmann, his former friend, had been secretly attacking him behind his back in letters to powerful men, he had been completely free of malice in his public criticism of Hartmann.

I was accustomed then, and still now, to give the Gymnasium entrusted to me practice with questions both enjoyable and useful for knowledge. Meanwhile I ran across your judgment concerning the instrument of Drebbel (whose book I had added to my *Syntagma*, translated into Latin and elucidated with commentary) which seemed to me to agree little with his opinion, but to digress towards something magical of the sort which Crollius proposed. I disputed against it without affront to you, and you may also battle with me concerning some part of the art. If you believe that you understand it more correctly, come, let's debate the same question again, and you can try to undermine my opinion.⁹⁵⁶

Libavius' public criticism defended the truth in the open arena of academic disputation, unlike Hartmann's private correspondence. As Moran has discussed, Libavius employed "polemical fire" to define the discipline of alchemy. Drebbel's perpetual motion

⁹⁵⁴ Reprinted in Hartmann, *Opera Omnia* part 4: 3-4, op cit. Moran (2007), 235-6.

⁹⁵⁵ Andreas Libavius, "Censura Philosophia vitalis Joannis Hartmanni Marpurgici Professoris" in *Appendix Necessaria* (Frankfurt: Peter Kopff, 1615), 88.

⁹⁵⁶ *Ibid*, 89. "Solebam, uti etiam nunc exercere Gymnasium mihi commissum quaestionibus & iucundis & utilibus scitu. Interea occurrit tuum de instrumentis Drebellii, cuius librum latinitate donatum, & scholiis illustratum meo syntagmati adieceram, iudicium, quod mihi minime videbatur sententiae eius convenire, sed ad magicum quid, qualia Crollius proposuit, deflectere. Disputavi contra id sine tua contumelia, & licet tibi etiam mecum de aliqua artis parte in certamen descendere. Si putas verius te sentire, age de eadem quaestione denuo disputa, & meam sententiam subruere conare."

machine, concerning which Libavius first publicly aired his differences with Hartmann, continued to serve as a leitmotif in Libavius' series of philippics against Crollius, the vital philosophy, and the Rosicrucians.

Libavius and Hartmann shared many similarities. Both were German semi-Ramist academic alchemists.⁹⁵⁷ Both introduced the study of Drebbel and his works in search of a clear, useful, and didactic natural philosophy. Both accepted the idea of a Fernelian “innate heat” or “fire of nature,” and interpreted Drebbel’s works in that light. Yet their interpretations differed radically. For Libavius, this fire of nature was a latent heat found in certain chemicals, like the tartar of wine, which could be extracted and made to heat on its own at certain times. Thus Libavius determined that Drebbel used the “fire of nature,” or a heat-containing chemical, to provide the heat driving his machine. For Hartmann, this fire of nature was a vital celestial force carried by the spirit of the world, which kept all things alive and in motion. Thus, he, à la Burggrav, believed that Drebbel had imprinted the solar powers of this fire into the machine, which explained how it remained in motion, as well as its “magnetic” relationship to the sun.

Much depended on their different interpretations of Drebbel’s transmutation of the elements. Libavius believed that when Drebbel referred to the transmutation of the “elements,” he was really referring to the various dispositions through which Drebbel cycled his material for the philosopher’s stone – which Libavius said was mercury.⁹⁵⁸ Therefore, he argued that Drebbel’s machine was moved by a chemically elaborated material which could

⁹⁵⁷ For Libavius as a moderate Semi-Ramist, see Bruce Moran, (2007), 20-1.

⁹⁵⁸ See Libavius’ translation and interpretation of *On the Nature of the Elements* in “Apocalypseos Hermeticae Pars Posterior, quae est Divinationum Hermeticarum Heptas” in *Syntagma Arcanorum Chymicorum*, Vol. 2 (Frankfurt: Peter Kopff, 1613).

spontaneously bubble up or heat itself.⁹⁵⁹ According to Hartmann's "magnetic theory of the elements" there was a spirit above and beyond the elements which not only integrated the individual parts of organisms, as Fernel had described, but which connected the elements in their chain of transmutation. It was this spirit which moved the machine and accounted for its signs of intelligence and links to the sun.

A major distinction between the two lies in their attitudes toward the ability of alchemical observation to lead to knowledge of the macrocosm. Hartmann argued strenuously for the certainty of chemically-derived knowledge, which took the philosopher straight to the heart of nature. Libavius never conceded more than "probable" knowledge from the observation of effects within the microcosmic alembic. Libavius preserved an overall cosmic hierarchy, in which man was placed in an inferior and instable realm. While Libavius defended alchemy's abilities against its academic opponents, his outlook on man's abilities in general was rather gloomy. As Matton has argued, Libavius championed the universal character of the chymical discipline as available to all through the humanistic study of texts and not individual divine inspiration or a connection to superior realms. In this he typified Ramus' literary empiricism, yet his rejection of the macrocosmic-macrocosmic relationship in chymistry rendered him unable to support alchemy as a "high science" leading to knowledge of the macrocosm.⁹⁶⁰

In the next chapter, we will trace the macrocosm/microcosm relationship further in the Hartmann school. There we will find distinctively Ramist inspired interests in pedagogical ease, comprehensiveness, certainty, and practice. These interests, however, were coupled with a vital philosophy, encouraging pedagogues to introduce "living instruments"

⁹⁵⁹ See Libavius' disputation at Coburg on Drebbel's perpetual motion machine, *Probabilis Investigatio Causarum Physicarum, Aliarumque Globi Archimedaei novi & instrumenti musici per se absque evidente motore mobilium* (Coburg: Bertsch, 1612), discussed further below.

⁹⁶⁰ Matton, 408-413.

Chapter Five: Artisan and Philosopher

into their curriculum. Within these animated microcosms, they hoped to show their students all the laws of the macrocosm, as though within the Rosicrucian microcosm.

Chapter Six: The Booklet of Nature

Triumphant Belgae in suis *Isaacs Hollandis*, suis *Drebbeliis*, *Helmontiis*, *Ewaldii Vogelii*,
Balbiansis, *Hogbelandis*.

- Olaus Borrichius, *De Ortu et Progressu Chemiae*
In *Bibliotheca Chemica Curiosa*, Ed. J.L. Manget, 36.

- I: Introduction
- II: Living Instruments
- III: Playing with Machines in the Hartmann School
- IV: Theoretical Physics
- V: Mid-Century and after
- VI: Periodicals

I: Introduction

Eric Jorink has recently emphasized the fusion of natural and divine knowledge pursued by a wide population of Dutch *liefhebbers* as the study of the two books of God- the Bible and the Book of Nature.⁹⁶¹ In later eras, Drebbel was seen as a particularly strong advocate of this idea.⁹⁶² For instance, Johann Cohausen responded in a 1717 work to a question set by the Bordeaux Academy of Science: how do we explain the light of phosphorus? Cohausen reviewed several types of light-bearing substances, from natural ones such as the light seen on water, on wood, and in stones, to the many artificial phosphors (light-bearers) which had been devised chemically during the last decades of the seventeenth century. The third part of Cohausen's work, "On Hermetic Phosphors," examined the light phosphorus could shed on the darkest mysteries of philosophy and divinity.⁹⁶³ The extent of natural and artificial phosphors led Cohausen to exult over the infinite light of God in which we might one day bathe in heaven. Cohausen sought examples from alchemical authors who

⁹⁶¹ Eric Jorink, *Het Boeck der Natuere: Nederlandse Geleerden en de Wonderen van Gods Schepping 1575-1715* (Leiden: Primavera, 2006).

⁹⁶² As discussed further in Chapter Seven.

⁹⁶³ Johann Cohausen, *Lumen Novum Phosphoris Accensum, Sive Exercitatio Physico-Chymica, De Causa lucis in Phosphoris tam naturalibus quàm artificialibus* (Amsterdam: Oosterwyk, 1717), 289-90. "Si talis in creaturâ & quidem artificiali sit lux, ô incomprehensibilis Dei Majestas, quae tua erit lux! In quanto versabimur lumine, qui Te lucis inexhaustae abyssum aliquandò in beatorum patriâ intuebimur! Faxit Altissimus!"

Chapter Six: The Booklet of Nature

were similarly enlightened with the knowledge of the divine through the study of nature.

One of the examples he chose was a vision Drebbel described in his preface to *On the Nature of the Elements*, which Cohausen paraphrased at length.⁹⁶⁴

The editor of the 1723 edition of Drebbel's *On the Nature of the Elements*, Georg Brendel, likewise admired Drebbel's ability to acquire his knowledge through his own manual labors, through the guidance of God and nature alone, and without the help of human instruction, either oral or written. Brendel ascribed Drebbel's abilities to the singular connection he had drawn between the Bible and the book of nature.⁹⁶⁵ Brendel was incorrect when he said that during Drebbel's time, natural and divine knowledge were considered "two disciplines" in need of being brought together. As Jorink has pointed out, the idea of God's two books was a commonplace across Europe. Yet there were important differences between Drebbel's particular view of the "book of nature," and many of the accounts traced by Jorink.

⁹⁶⁴ *Ibid*, 281. "Nempe ut ex *doctrina naturâ* & creaturis infinitus Creator non sine stupore & adoratione cognoscatur, ut monet Cornelius Drebbelius. Hic perscrutatus elementa, contemplabatur terrae spiritum crystallinum in modum nebulae alicujus, animam tinctam quasi sanguine, corpus autem stabile & indomitum instar cristalli. Videbat spiritum militantem adversus corpus. Quod cum tandem superâsset, ex ambobus factum est unum. Corpus serviebat animae, eratque illi stabile domicilium. Spiritus elevabat corpus & animam: anima ornamentum addebat tum spiritui tum corpori colore suo purpureo, & ferè, ut ait coelesti. Sic interitum, resurrectionem atque immortalitatem oculis observabat, magis magisque redditus sapientissimae naturae amator, suique Creatoris adorator." For more on Cohausen and his *Lumen*, see Anna Marie Roos, "Johann Heinrich Cohausen (1665-1750), Salt Iatrochemistry, and Theories of Longevity in his Satire, *Hermippus Redivivus* (1742)," *Medical History*, 51:2 (2007), 181-200, and my discussion below.

⁹⁶⁵ Cornelis Drebbel, *Tractat, oder Abhandlung von Natur und Eigenschafft der Elementen* (Leipzig: Johan Sigmund Strauss, 1723), B3. "Nur bewundere ich die ungemeyne Geschicklichkeit unsers vortrefflichen Autoris, worinnen er sich ungewöhnlich hervor gethan/ und anbey selbst gestehet/ dass er durch die Führung Gottes und der Natur ohne menschliche Hülffe/ Anweisung/ mündlich Lehre Bücher noch Schrifften/ durch eigenen Fleiss/ Nachsinnen/ Betrachten und Hand-anlegung diese grosse Geheimnuesse entdeckt/ und würcklich ausgearbeitet. Zu welcher Vollkommenheit/ sonderlich um die Zeit/ da unser Autor gelebet/ wenig Menschen gekommen sind. Allein nichts ist Ursach als die Faulheit/ und die verkehrte Ordnung zu philosophiren gewesen. Dann man hat die Gottes Gelahrheit/ und natürliche Weissheit vor 2. Disciplinen gehalten/ die sich nicht mit einander betragen könnten/ da man aber nachgehends gesehen/ dass das Buch der Schöpfung/ ja das gantze Alte und Neue Testament hierinnen einen öffentlichen Wiederruff thäten; nicht weniger auch die gantze Natur in allen ihren Würckungen bezeugte/ dass Gott und sein Geschöpff nimmermehr könnten getrennet werden. . . ."

Jorink attended to learned conceptions of the book of nature, largely centered around the academic culture of Leiden. For many Leiden scholars, the book of nature was a vast, all-encompassing folio.⁹⁶⁶ Many lifetimes could be spent perusing this text and collecting citations from it. For Drebbel, natural and divine knowledge was not only easily accessible to all, but could be contained in the slimmest of volumes. Voluminous books betokened vanity. There was only one succinct law which God has taught us both through the writings of the prophets and through nature – love your neighbor as yourself, and God above all.⁹⁶⁷

Drebbel placed knowledge at the very limits of literate communication in another way as well. For him, natural knowledge was not to be found in books. He hoped that the reader would not consider him lacking in wisdom for not citing any authorities in his “Büchlein” (Booklet), but truth be told, he had not read any of these. He only gave the reader what he himself had learned through the work of his own hands.⁹⁶⁸ Drebbel sought his universally and rapidly accessible knowledge of nature and the divine not through books, but through the manipulation of nature through art. Manual experience could cut the links of *verba* and *res*.

Drebbel sought to compress all knowledge of nature into a single machine, his chymico-mechanical microcosm. As we will see, Heinrich Nollus, professor of alchemy at the Steinfurt Gymnasium, and later at the University of Giessen, was one of many who

⁹⁶⁶ Jorink, 46.

⁹⁶⁷ Drebbel, Preface to *On the Nature of the Elements*. See Appendix. “Sollen wir grosse Bücher schreiben, Gott dar mit zu loben? Ist es nicht eitelheit? Lieber Bruder, was können wir Gott geben der alles hat? was sollen wir dan thun? Danckbar sein und von Gottes Sohn lernen demüth und das kleine gesetz Liebet Gott über alles und eweren nechsten wie euch selbst /Dis ist das gesetz und lehr aller Apostelen und Propheten wie uns dan auch Gott solches in der Natur lehrt.”

⁹⁶⁸ Ibid. “. . . ich war meinem Gott danckbar und liebte die Natur, und understundt mich gegenwertiges Buchlein deinert wegen lieber leser zu verfertigen, verhoff du werdest es nicht mit unverstant verachten noch mich verdencken das ich dis mein schreiben mit den alten scribenten nicht bewesse und bekräftige, dan ich die warheit zu sagen keinen hieruber gelesen, sondern ich gebe dir solches wie ich es von der Natur empfangen habe. . . .”

compared Drebbel's microcosm to the one mentioned in the Rosicrucian *Fama*. Within the Rosicrucian treasury could be found both a microcosm, and the book M, which gave the Rosicrucians a complete image of the world.⁹⁶⁹ Nollius interpreted the microcosm itself as a universal replica of nature, as though it itself was the Book M. Instead of studying the divinely written Book of Nature, man could issue his own edition of the microcosm, and thus gain instant access to knowledge natural and divine.

In turn, Nollius connected Drebbel's own book to the knowledge gained through the machine. Like Cohausen a hundred years later, Nollius cited at length from Drebbel's preface to *On the Nature of the Elements*. He interpreted Drebbel's vision as the knowledge to be gained from the perpetual motion. The microcosm was a sign of a time to come when greatest mysteries would be able to be read as though in an open book.⁹⁷⁰

In tracing the reception of Drebbel's texts and inventions, we will follow a variety of debates over how to read the book the nature. The mastery of nature Drebbel claimed for

⁹⁶⁹ *Fama Fraternitatis* (Cassel: Wessel, 1614), 121. "Den minutum mundum belangend, funden wihr den in einem andern Altärlein verwahrer, gewiß schöner, als ihn auch ein verständiger Mensch ihme selbst einbilden möchte, dene lassen wir ohn abgerissen, biß uns auff diese unsere trewhertzige Famam vertraulich geantwortet wird, also haben wihr die Platen wieder übergelegt, den Altar darauff gestellt, die Thüre wiederumb verschlossen, und mit unser aller Sigill versichert, darüber auß anleytung und befehlch unser Rotae, etliche Büchlein [note they are described as thin books], darunter auch die M . . ." *Ibid*, 109. ". . . was wihr auch auß dem Buch M. heimliche erfahren (wiewohl wihr der gantzen Welt imaginem und contrafactur können für augen haben). . . ." Reading this book heightened the *ingenium*, as it had for Paracelsus. See *Ibid*, 102, "Theophrastus. . . den Librum M. fleissig gelesen und sein scharffes ingenium dardurch angezündet."

⁹⁷⁰ Heinrich Nollius, *Naturae Sanctuarium* (Frankfurt: Rosa, 1619), 152. "Huc spectant & haec Cornelii Drebellii, quae in praefatione sui libri de Elementis de terra assert, ubi sic ait: Ich ersuchte die Elementen die mich leherten die Natur der Erden, ihren Crystallinen Geist sahe ich wie en Nebel/ihre gefarbte Seel wie ein Blut/ ihren standvesten Leib wie ein Crystall. Den Geist sahe ich fechten unnd überwinden Leib und Seel/ welche doch sich vereinigten. Der Leib diente den Geist unnd der Seelen für ene veste Wohnung: der Geist erleuchtete den Leib unnd die Seele wie en Crystalliner himmel: die Seele ziehrete den Leib unnd Geist mit ihrer himmlischer Rubin roter Farbe. Praeterea e terra coelitus demissa perpetuum mobile microcosmumque vere omnium Elementorum & Elementorum operationes ad oculum tibi demonstrantem obtinebis, si eam Philosophico igne in sua aqua solveris, & in formam, quam terra ante Elementorum & Elementorum educationem in Chaos habuit, reduxeris, animamque universi e Sole in ipsam affatim singulari artificio impresseris. O mirabilium mirabilissimum! O immensam dei sapientiam, quae tanta mysteria fragilibus hominibus ex abundantia benignitate concessisti! Quando tandem aliquando umbras deponemus, ut in perfecta luce te absque aenigmate videamus, & aeternum tuam immensam praestantiam dilucide in operibus naturae limites escedentibus intueamur, atque in Deo uno tanquam in libro summe perspicuo omnia mysteria aperte legamus?"

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himself both within his inventions and in his writings made him a point of contention for over a century. Through the early modern practices of travel, collection, and commonplacing, natural philosophers faced storehouses of evidence. Even among those appreciative of artisanal philosophy, the question remained how to sift through all these new sources. Andrea Libavius urged a careful literary empiricism upon his students; alchemists in the ambit of Johann Hartmann, by contrast, enthusiastically embraced machine-based shortcuts to knowledge. Athanasius Kircher collected the works of many into grand theaters of art and nature published under his own name, while new scientific societies assigned the labor of collection and interpretation to their many members. Yet the societies themselves adopted radically different styles of interpretation, from the concordance of opinions to be found in the *Ephemerides* of the Holy Roman Imperial Academy, to the minimal citation favored in the *Transactions* of the Royal Society. In this chapter, I will show Drebbel appearing in many renditions of the Book of Nature, from pamphlet and periodical to encyclopaedia.

II: Living Instruments

In her article on Drebbel's perpetual motion machine, Jennifer Drake-Brockman translated Drebbel's "living instruments" (levendige instrumenten) as "working models."⁹⁷¹ Such a translation does not capture the full force of these physico-mechanical contraptions for natural philosophy. Drebbel's description of his instruments as alive did not necessarily entail an extraneous vital form attracted into the machine, as Hartmann had reasoned (although finding support for this view as well in Drebbel's writings would not be difficult).

⁹⁷¹ Jennifer Drake-Brockman, "The Perpetuum Mobile of Cornelis Drebbel," in *Learning, Language, and Invention: Essays presented to Francis Maddison* (Brookfield, VT: Variorum, 1994), 129. Drake-Brockman's article predates the current interest in the history of alchemy.

At the most basic level, he certainly did insist that his machines were “alive” since they were based not in mechanical weights and measures but in the virtues of the elements. For instance, in his “Dedication” to King James I, Drebbel discussed investigating the nature of water (“Natuer des Waters”), trying to make its movement alive (levendigh). He wanted to make it move out of its own nature (“uyt zijn selfs natuer”), rather than through an externally applied force, but this movement always fell dead (“doot”).⁹⁷² Drebbel’s editor G.P. Schaghen also emphasized the quality of Drebbel’s device as “living.” Gesturing more towards the interpretation later given the machine by the Hartmann school, Schagen described the device in the title of the work as containing “an enclosed spirit” (*Wonder-vondt van de eeuwighe bewegingh, die Corn. Drebbel door een eeuwighe bewegende gheest, in een cloot besloten, te weghe ghebrocht heeft*).

In either case, the status of Drebbel’s instrument as “living” ruptured the art/nature divide and linked the construction of devices to knowledge about nature. Such “living instruments” offered the promise of a shortcut to natural knowledge, without the difficult mathematical proofs which Ramus grew to despise.⁹⁷³ In his dedicatory foreward, Schaghen wrote, “If this knowledge was common among astronomers, one would not require so many theorems in calculating the planets and other stars, but astronomy would be easy and Copernicus would prosper, since he demonstrated (with reason) that the Earth goes around every 24 hours, but this Alkmaarian philosopher can demonstrate the same not only with

⁹⁷² “Waerom met goeden yver die Natuer des Waters aenghegrepen/ willende dat uyt zijn selfs natuer/ door vrscheyden vaten ende pijpen (op vreemde manieren geboghen) opwaerts doen climmen/ mater twas al voor niet: want ten wilde niet een hayr breedt rijsen: Maer gelijck zijn natuer/ liep altydt nae beneden/ hebbe niet te min verscheyden lustige Fonteynkens ghemaect/ soo op verscheyden manieren/ een tijdt langh doort dalen van haer eyghen water/ opwaerts straelden/ op die hooghte van twintigh oft meer voeten: Maer dese beweeghnis was geringh doot/ ten water wederom door vallende wateren levendight gemaect

⁹⁷³ See Robert Goulding, “Method and Mathematics: Peter Ramus’s Histories of the Sciences,” *Journal of the History of Ideas*, 67: 1 (2006), 76.

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reason but also with living instruments.”⁹⁷⁴ For Schaghen, this unprecedented ease in learning about nature through “living instruments” heralded a new age of peace and Christian harmony. While the seventeenth century did not in fact bring the millennium, a novel enthusiasm for Drebbel’s machine-based artisanal philosophy soon took hold in Ramist Central Europe.

It was Drebbel’s ability to construct “living instruments” that, in some circles, gave him authority as a philosopher surpassing those using mathematical or physical reasoning alone. Drake-Brockman has also argued that it took someone from Galileo’s circle to recognize the relationship between the movement of the perpetual motion machine and the famous “retort” demonstration from Drebbel’s *On the Nature of the Elements*. Only the interest of Galileo and his correspondent Antonini “warrants the rescue of Drebbel’s *perpetuum mobile* from obscurity,” said Drake-Brockman.⁹⁷⁵

This was not the case. Academic alchemists and others in the orbit of Johann Hartmann pointed out the relationship between Drebbel’s retort demonstration in *On the Nature of the Elements* and his perpetual motion. They recognized that the central hollow globe of the perpetual motion contained air which, by rarefying or condensing, pushed the water in the attached glass tube back and forth. However, this recognition of the relationship between the perpetual motion and Drebbel’s theory of the elements did not necessitate a mechanical interpretation of the machine. Rather, this group of interpreters shared a particular metaphysical foundation for their understanding of elementary transmutation.

⁹⁷⁴ See Schagen’s preface. “Soo dese wetenschap onder de Sterkondigers ghemeen was soo en soudemen niet behoeven soo veel stellingen en rekenigh der Planeten en ander Sterren maer de Ster-konst soude licht zyn en Copernicus soude bloeyen: want die bewyſt (met reden) dat het Aerdrÿck alle 24. uren ront om gaet: Maer desen Alekmaersche Philosooph cant selfde niet alleen met reden maer oock met levendige Instrumenten bewyſen.”

⁹⁷⁵ Drake-Brockman, 147.

They did not accept the Thomist unicist view that granted each substance only one form.⁹⁷⁶

Following Fernel, they argued that this view could not explain many natural phenomena. As a result they argued for a “second fire” carried into living things by the soul of the world, which penetrated all matter. It was this supervening innate heat which integrated the parts of living things, providing a constant source of movement and animation, and remaining even as the crasser elements underwent their round of transmutation.

Vital philosophers argued that the universal *anima mundi* could be employed in sympathetic magic. The *anima mundi* connected all things, including the heavens and earth and the macrocosm and the microcosm. This universal occult connection allowed for action at a distance in such enterprises as the sympathetic cure of wounds. These vital philosophers interpreted Drebbel’s machine in the same way. They argued that Drebbel, employing the *anima mundi*, had attracted this “second fire” into an artificial object, thus animating it. It was this (vital) innate heat which provided the constant source of motion for the chain of elements contained in the machine. Since this “second fire” was drawn from the celestial fire, it also explained the machine’s correspondence to the sun and to the motion of the other heavenly bodies.

As a living microcosm, the machine therefore gave direct access to the real movements of the macrocosm, suggesting thrilling philosophical and pedagogical possibilities. It would no longer be necessary to reason about the structures of the macrocosm, or even to observe it in tedious and piecemeal fashion with the newly invented telescope. The perpetual motion far outshone the telescope in its ability to display all the structures of the macrocosm, comprehensively, easily, and delightfully.

⁹⁷⁶ Discussed in Chapter Five, and defined by Emily Michael, “Daniel Sennert on Matter and Form: At the Juncture of the Old and the New,” *Early Science and Medicine* (1997), 272 – 300.

As we have seen, Hartmann's rival Andreas Libavius also interpreted Drebbel's machine in light of this second, non-elementary occult heat. However, he denied the heat's metaphysical vital and formal qualities. The fact that Drebbel employed hidden forms of heat within the chemicals contained in his machine did not grant the machine a soul. It also did not connect the machine to the macrocosm, and thus provided no certain knowledge of the structure and movement of the heavens. Libavius addressed this question in his 1612 dissertation on the perpetual motion. Since philosophers themselves were still disputing the structure of the heavens, there was no way a machine could be built to give certain knowledge of the actual heavens. At best, the machine could be built according to probable theories.

Can a perfect simulacrum be made in this way? It cannot: nay indeed, even now the astrologers dispute among themselves about the number of the spheres & the method of the motion. Natural Philosophers, not satisfied by the Aristotelian definition that stars above are moved by their orbs, argue whether the Planets are moved by spheres or circles, and indeed, some also debate whether the heavens stand still & the earth is moved, according to the Copernicans &c.⁹⁷⁷

Libavius identified this heat as the effect of particular artificially contrived chemicals, rather than a form supervening within the four elements. He argued that Drebbel only used the term "element" analogously in his *On the Nature of the Elements* while actually discussing specific chemicals and alchemical processes. The details of Drebbel's process for the philosopher's stone could be uncovered through the careful collation of Drebbel's works with an extensive alchemical corpus.

⁹⁷⁷ Libavius (1612) 2. "Fierine potest eiusmodi simulacrum perfectum? Rx. Non potest: imo adhuc astrologi inter se certant de numero sphaerarum, & ratione motus: Physici disputant, Planetae circulis, an sphaeris moveantur, non contenti Aristotelica definitione, quod astra moveantur super orbibus suis: quidam etiam stetne coelum & terra moventur, ut Coperniciani &c. Lites de Calendario notae sunt. Probabili aliqua ratione φαινόμενος potest repraesentari coelum, non επιγυμνικώς, hypothesibus quibusdam propositis."

As a result Drebbel's retort demonstration, which employed only simple water, air, and fire did not interest Libavius. By heating and the cooling a retort with its mouth suspended in a vase of water, Drebbel pointed out the expansion and contraction of the air and argued that this same motion supplied the motive force of the winds. For Libavius, this demonstration of the wind bore no relationship to the *magisterium* of the philosopher's stone. He did refer in his dissertation to the retort demonstration, comparing it to Aeolian spheres as an example of the manifest heat of pneumatics, yet he argued that such manifest spirits could not explain all the features of the machine.⁹⁷⁸ Libavius argued that the secret of the perpetual motion could indeed be sought in Drebbel's *On the Nature of the Elements*, but he pointed to his interpretation of Drebbel's stoicheology as a process for the philosopher's stone, rather than to the retort demonstration.⁹⁷⁹ Thus, although we might consider Libavius' chemical interpretation of "innate heat" more "modern" than Hartmann's metaphysical one, he did not connect the retort to the motive force of the perpetual motion, as did members of the Hartmann school.

II: Playing with Instruments in the Hartmann School

Hartmann's interpretation had many followers. We find, for instance, a related interpretation of Drebbel's "living instrument" in the 900 page compendium entitled

⁹⁷⁸ *Ibid*, *Quaestione* 6. "Calorem disgregando flatus praebere & ex consequente motum, docent aeolii folles forma globorum aquam continentium, qui super prunes positi flatus emittunt. Drebelius ipse instrumentum forma retortae seu Cornu proposuit, ex quo igni facto, etiam sine intus existente aqua halitus emittuntur rostro in aquam immerso." Thesis 16. "Venti quoque item aer, ignis & alii plures vocantur spiritus, & hi quidem corporei. Sunt venti aer halitibus & vaporibus mistus, qui cum principium motus accepit & fertur, etiam satis corporaliter tangere potest, spiritibus illis aetheries & sive incorporeis, sive incorporeo proximis per omnia insensibiliter volantibus, nisi fortasse eos coagulare potuit Drebelius. Sed tunc non erunt valde agiles & motivi."

⁹⁷⁹ *Ibid*, Thesis 2. "Scimus Cornelium illum edito libro de elementis, eorumque motibus & passionibus, ventis, tonitru, tranquillitate, fulminibus, mitionibus, coloribus, & aliis disseruisse ad similitudinem eorum, quae in lapidis Philosophici coctione eveniunt, potissimumque in dicta fermentatione & conjunctione, cujus libri nos summam sententiamque commentariis tomo II. Syntagmatis arcanorum adjectis complexi sumus: sed quod putavit Harmannus amplius est considerandum." Also see in the *Quaestiones*, "Drebbeliana fundamenta ostendi possunt in eiusdem Elementario."

Chapter Six: The Booklet of Nature

Sanctuary of Nature, published by the Kassel alchemist Heinrich Nollus in 1619. As a student of Petraeus, Nollus' interpretation of Drebbel's works bore marked similarities to that current in the Hartmann school.⁹⁸⁰ Nollus introduced the study of alchemy to the Steinfurt Gymnasium. To that end, he wrote a number of alchemical textbooks offering clear alchemical pedagogy. In the *Sanctuary of Nature*, he attempted a grand *summa* of alchemical literature.

Nollus, an admirer of the Rosicrucians, himself planned a fraternity R.C. (Rotae Coelestis). He was determined to bring the ideals of fraternal association to the new discipline of academic alchemy. In a manner recalling the stress upon civility in later scientific societies, Nollus drew up rules for the proper association of Hermetic philosophers. He pointed out that progress must be the work of more than one individual. To that end, the commerce between learned men should be pious and free of any jealousy. Nollus further suggested conferences every year, where scholars could share what new things had been discovered *in re medica & philosophica*. He also limited the power of individual authorities, saying that nature should be valued more than all the books of "Galen and Aristotle."⁹⁸¹

⁹⁸⁰ On Nollus, see Bruce Moran (1991), 122-9, and Carlos Gilly, "Das Bekenntnis zur Gnosis von Paracelsus bis auf die Schüler Jacob Böhmes," *From Poimandres to Jacob Böhme: Gnosis, Hermeticism and the Christian Tradition*, R. van den Broek, Cis van Heertum, eds. (Amsterdam: in de Pelikaan, 2000), 385-426. Nollus defended a thesis in Marburg under the aegis of Harmann's son-in-law, Heinrich Petraeus. See Heinrich Nollus, "De Methodo medendi Hermetica, proposita solenniter a Dn. M. Henrico Nollio, Med. In Ill. Arnoldino, quod est Steinfurti, prof. Ord.," *Agonismata Medica Marpurgensia* (Marburg: Egenolph, 1619), 346-353. Drebbel's editor Joachim Morsius, who developed a close literary relationship with Nollus, would dedicate Drebbel's *On the Quintessence* to Nollus in 1621.

⁹⁸¹ Heinrich Nollus, *Theoria Philosophiae Hermeticae* (Hanoviae: Petrus Antonius, 1617), 3. "I. Ad verae sapientiae, veraeque medicinae studium nemo admittitor, nisi sit vere pius & ingeniosus. II. Emendationis opus non est unius hominis. III. Ergo solide docti viri, qui Deum sincere colant, inter se habentio commercium, atque sine ulla invidia sibi mutuo, quicquid è natura eruerint, communicantio. IV. quotannis adcertum locum conueniuntio, axiomata inuenta conferuntio, atque id, quod de novo intra anni spacium in re medica & philosophica explorauerunt, in medium proferuntio, ut ad naturae axiomata discutiatur. V. Nihil cogitantio, nihil faciuntio, nisi quod in Dei honorem, & proximi salutem cedat. VI. Taciturnitatem & Deo & sibi vouentio perpetuam. VII. Naturam eiusque veritatem pluris aestimantio, quam omnes libros Galeni, Aristotelis, &c."

Ultimately, Nollius' enthusiasm carried him too far. Nollius lost his position at the University of Giessen after the publication of his *Parergi Philosophici Speculum* of 1623. He remained, however, a revered authority to some. John Winthrop Jr., for instance, found a volume in a book sale in the Hague which had been previously owned by Nollius; he excerpted the pages with Nollius' signature and bound them within his own copy of the *Sanctuary of Nature*.⁹⁸²

Nollius was one of Drebbel's great admirers. As discussed further in the next chapter, Joachim Morsius selected Nollius as the dedicatee for his 1621 edition of Drebbel's *On the Quintessence*. Nollius cited Drebbel as an authority at many points, quoting frequently and at length from *On the Nature of the Elements*.⁹⁸³

Like Libavius, Nollius read Drebbel in light of the Hermetic Emerald Tablet, Basil Valentine, and Michael Sendivogius. What was above was the same as what was below; celestial things are among the terrestrial things, and terrestrial things are in the heavens, but in a celestial manner.⁹⁸⁴ This Hermetic structure of the universe, which Nollius claimed was far superior to the vulgar structures of the astronomers, meant that alchemists could uncover the celestial things hidden at the lowest point within earth.⁹⁸⁵ Through the successive

⁹⁸² See the volume in the New York Academy of Medicine Library. "Quod hic scriptum est in sequenti pagina videtur proprio Nollii manus scriptum: Eam cartam exerpsi ex libro quodam Hagae quid ibi venalis erat, qui ut videtur fuit quondam in possessione ipsius Nollii."

⁹⁸³ Heinrich Nollius, *Naturae Sanctuarium* (Frankfurt: Rosa, 1619), 11, 61, 112, 126, 148, 152, 236, 279, 752. Zbigniew Szydło discussed Nollius' citations of Sendivogius and mentioned his citations of Drebbel in *Water which does not wet hands: the Alchemy of Michael Sendivogius* (Warsaw: Polish Academy of Sciences, 1994).

⁹⁸⁴ Nollius (1619), 63. "Id quod est superius, est sicut id quod est inferius, & quod est inferius, est sicut id quod est superius. Coelestia sunt in terrestribus, set terrestri modo: terrestria sunt in coelestibus, sed coelesti modo." See Nollius, 30, for "innate heat" and its correspondence to the heavens. Just as all elementary things in the microcosm are conserved through the inner balsam, so too is man the microcosm preserved in life through his innate heat. See Nollius 35 "Quemadmodum omne quod in Elementis macrocosmi consisiti, ex iis & in iis innati balsami virtute conservatur: ita & microcosmus seu homo ex Elementis suis internis nativi sui caloris efficacia vitam suam prolongat, & in multos continuat annos."

⁹⁸⁵ *Ibid.* "Vulgaris Astronomia ex vulgaribus libris est petenda. Commendo tyroni Physices Astronomicum Systema Keckermanni: & progredior ad Alchymiam, viam naturalis veritatis septimam."

conversion of the “elements,” the “rota elementorum,” the earth could be brought into a ferment, and the motion of the heat would impel its purer parts towards the surface.⁹⁸⁶

The difference between Libavius and Nollius was that Nollius, as a vitalist, claimed that during these chemical processes the soul of the world linked to the sun would be “impressed” into matter (“animamque universi e Sole in ipsam affatim singulari artificio impresseris”). Thus Drebbel’s perpetual motion was alive and a true microcosm, showing the actual motions of the heavens.⁹⁸⁷

Nollius recommended that the student of astronomy consult such a living globe in the *Hermetic Physics* (one of several works included in *Sanctuary of Nature*). There he described two different types of spheres. One was merely imitative; through it, the student could quickly learn the traditional doctrine of the sphere. However, the student could never gain new knowledge of the cosmos from a merely imitative representation.⁹⁸⁸

The second type of globe was a living microcosm, in which all the heavenly bodies were moved by the universal spirit just as in heaven. Both the Rosicrucian globe and

⁹⁸⁶ Nollius, 150-1. “Terra enim est universale receptaculum omnium virium superiorum & inferiorum, atque in se Spiritum universi fixit. . . . Quare quicquid reliqua Elementa in terram stillant & proiciunt, omne recipit, servandum servat, manifestandum manifestat: in ea omne productum manet, ac per calorem motivuum putrefit, & per eundem separato puro ab impuro multiplicatur : Quod grave est, in illa occultatur, & leve pellit calor in eius superficiem. Est ergo omnis seminis & commixtionis nutrix & matrix, tueturque semen & compositum ad maturitatem usque. . . .Necesse vero est, si tantum thesaurum invenire desideras, ut ante omnia Dei auxilio conversionem terrae in aquam, aquae in aerem, & aeris in ignem probe scias.”

⁹⁸⁷ Nollius, 152. “Huc spectant & haec Cornelii Drebellii, quae in praefatione sui libri de Elementis de terra assert, ubi sic ait: Ich ersuchte die Elementen die mich leherten die Natur der Erden, ihren Crystallinen Geist sahe ich wie en Nebel/ihre gefarbte Seel wie ein Blut/ ihren standvesten Leib wie ein Crystall. Den Geist sahe ich fechten unnd uberwinden Leib und Seel/ welche doch sich vereinigten. Der Leib diente den Geist unnd der Seelen fur ene veste Wohnung; der Geist erleuchtete den Leib unnd die Seele wie en Crystallienner himmel: die Seele ziehrete den Leib unnd Geist mit ihrer himmlischer Rubin roter Farbe.

Praeterea e terra coelitus demissa perpetuum mobile microcosmumque vere omnium Elementorum & Elementatorum operationes ad oculum tibi demonstrantem obtinebis, si eam Philosophico igne in sua aqua solveris, & in formam, quam terra ante Elementorum & Elementatorum educationem in Chao habuit, reduceris, animamque universi e Sole in ipsam affatim singulari artificio impresseris.

O mirabilium mirabilissimum! O immensam dei sapientiam, quae tanta mysteria fragilibus hominibus ex abundantia benignitate concessisti! Quando tandem aliquando umbras deponemus, ut in perfecta luce te absque aenigmate videamus, & aeternum tuam immensam praestantiam dilucide in operibus naturae limites escedentibus intueamur, atque in Deo uno tanquam in libro summe perspicuo omnia mysteria aperte legamus?”

⁹⁸⁸ Nollius (1619), 61.

Drebbel's sphere were of this type. "In England," said Nollius, "a perpetuum mobile is to be seen, which similarly represents the entire world, and shows in a wonderful way the motions of the stars, the conjunctions and oppositions of the planets and even the disposition of inferior things, with precision. The author of this perpetual motion is Cornelius Drebel, a Philosopher not to be despised."⁹⁸⁹

For more on the harmony of the world witnessed in the microcosm, Nollius directed his reader to the end of the *Hermetic Physics*, where he gave some general advice on attaining knowledge of the macrocosm. One should consult "the true Philosophers" "who with *their own hand* have constructed a perpetual motion, and who show in that construction not only the creation of the world, but even . . . are able to show most compendiously the course of the stars, the elements, and the nature of everything [emphasis mine]."⁹⁹⁰

Daniel Mögling (1596-1635), court physician and mathematician to Moritz' cousin, Landgrave Philipp III of Hessen-Butzbach, shared the interpretation of Drebbel's perpetual motion current in Kassel.⁹⁹¹ Writing under one of his pseudonyms, Valerius Saledinus, Mögling published a state-of-the-art review of perpetual motions at the Frankfurt spring fair of 1625.⁹⁹² Of all the perpetual motions attempted to date, Mögling most admired Drebbel's "mystico-magical" machine, devoting considerable space to the literature available concerning Drebbel's machine.

⁹⁸⁹ *Ibid.* "In Anglia perpetuum mobile visitur, quod similiter universum mundum repraesentat, & astrorum motus, coniunctiones & oppositiones planetarum mirandum in modum, atque inferiorum dispositiones exacte ostendit. Perpetui eius mobilis autor est Cornelius Drebel, Philosophus non contemnendus."

⁹⁹⁰ Nollius (1619), 684, Caput VIII, "De Harmonia macrocosmi & perpetui Mobilis." "Consulendi ergo & compellandis sunt veri Philosophi, qui manu sua perpetuum mobile confecerunt, atque non tantum in eius confectioe mundi creationem ostendere, sed etiam in eo confecto & elaborato cursum astrorum, Elementorum, & omnium naturam compendiose monstrare poterunt."

⁹⁹¹ Moran gave Mögling as an example of the continuance of Moritz's interests in neighboring courts. See Moran (1991), 172.

⁹⁹² Writing to Wilhelm Schickard in 1627, Mögling recommended his own work as an authority on pneumatics. See Schickard, *Briefwechsel*, Friedrich Seck, ed., (Stuttgart: Frommann-Holzboog, 2002), 285. "Consult the one named Valerius Saledinus, if you haven't yet done it, Fludd, Drebbel, Galileo, Porta, and Salomon de Caus (formerly the Palatine engineer), the *Spiritualia* of Hero, etc."

Mögling began his account with the description of the perpetual motion found in Hartmann's disputation. He then turned to Vranckheim's letter to Burggrav, mentioned that Drebbel's perpetual motion could now be found in several German princely *Kunstkammern*, and recounted in particular the story of one Strasburg doctor who obtained a copy of the device. Mögling next recommended Drebbel's own writings. If one wished to understand how the device worked, one should read about the "retort" in Chapter Four of *On the Nature of the Elements*.

Mögling directed the reader next to Fludd and to the account of Drebbel's device published by Heinrich Schuler. He further compared Drebbel's microcosm to Claudian's epigram on Archimedes' microcosm, cited Drebbel's letter to King James from the edition published by Joachim Morsius, and likened Drebbel's account to Adam Bodenstein's view that a chymical perpetual motion should be possible.⁹⁹³

Mögling argued that such chymical motions refuted the various authors who denied the possibility of the perpetual motion. These had based their attacks on mechanical motions, yet chymical motions, he said, were more works of nature than of art. It was this type which he believed that Drebbel built, and which he hoped to build himself. In his own perpetual motion, he planned to recreate the microcosm made so famous by the Rosicrucians in their *Fama*. This would reveal the principles of nature so easily that children would learn them merely by playing with the sphere in school, and astronomers would be able to forego all of their difficult calculations.⁹⁹⁴

⁹⁹³ Daniel Mögling (Valerius Saledinus), *Perpetuum Mobile* (Frankfurt: Luca Jennis, 1625), 24-54. Mögling referred to Heinrich Schuler. Schuler claimed to have seen Drebbel's machine twice near Prague in Schuler, *Methodus und Principia Aller Wasserkünste die von der Welt anfang erfunden seyn/ und noch erfunden werden können* (Geraw an der Slier: N.A., 1622), 20. "Durch diss Principium Igneum hat Trebell in Engellandt sein künstlich Wasser in dem engen Schachtlein/ oder aussgehender Circumferentz einer Glasscheiben/ darüber ich zweymal naher Prag in Böhmen gezogen biss an den Horizont Retrogrado unnd zusteigend gemacht."

⁹⁹⁴ Mögling (1625), 54-5.

Mögling himself wrote works in favor of the Rosicrucians under another pseudonym, Theophilus Schweighart. In his *Prodromus Rhodo-stauroticus*, Mögling offered a view of the perpetuum mobile as an open key to philosophy as we have already seen it discussed throughout the Hartmann school. There Mögling said, in a direct translation of Nollius' advice, that he who wished to understand the harmony of the macrocosm should seek out those philosophers who have themselves created perpetual motions, since such devices showed immediately as in a compendium not only the creation of the world, but the motion of heaven, the elements, and the nature and property of all things.⁹⁹⁵

VIII: *On the Nature of the Elements* as Theoretical Physics: The Interpretation of Encyclopaedists Peter Lauremberg and Johann Heinrich Alsted

A gaping hole in the legacy of Ramus was a new, facile physics.⁹⁹⁶ For some semi-Ramist encyclopaedists, Drebbel served not as an alchemical author, but as an ideally comprehensible and efficient artisanal author of physics who could rival Aristotle and supply that lack. In this paragone between ancient and modern physics, we find a shift from the traditional focus of physics. Ramists and semi-Ramists compared Drebbel's artisanal philosophy to the matter theory of Aristotle's *Meteorology* rather than to the epistemological

⁹⁹⁵ Daniel Mögling (Theophilus Schweighart), *Prodromus rhodo-stauroticus* (Prague: N.A., 1620). "Was aber beneben diesem die Harmoniam dess Macrocosmi, mit dem perpetuo mobili, oder primo mobili belanget, wil dieselbe mehr in augenscheinlicher Besichtigung/ als weitleufftiger Beschreibung bestehent/ muessen wir heirvon diejenige Philosophos ersuchen/welche solches perpetuum mobile selbstzen zugerichtet/ und in dessen Zurichtung nicht allein die Erschaffung der Welt/ sondern in dem allbereit zugerichteten/ den Lauff der Gestirn/ der Elementen unnd aller Ding Natur und Eygenschaft compendiose, augenscheinlich vorzeigen können/ und zweiffel ich dann nicht/ wann wir solchen trefflichen Schatz erlangen und theilhaftig werden können/ durch Gottes sonderbare Gnade/ werden wir di säntische Scul Philosophy/und Wortgesänke/ so bisshero in den Schulen die Oberhand gehabt/ gern verwerffen/ und mit den wahren filiis doctrinae, nach der reinen unvervälschten Philosophy/ so uns sonderlich von der hocherleuchten Fraternitet unnd Collegio R.C. wird angebotten/ mit emsigem Fleiss trachten werden. Und seye dieses also kürztlich von der Harmonia dess macro und microcosmi berichtet."

⁹⁹⁶ On the need for a Ramist physics, see Hotson (2007), 119. In the wake of Ramus, Alsted developed a canon of modern philosophical authors divided into six types (Platonic, Aristotelian, Stoic, Lullian, chemical and sacred) and among the chemical he included Drebbel. See Matton, 410.

superstructure of the *Physics*.⁹⁹⁷ The removal of a deductive framework further leveled the playing field between our artisanal philosopher and the empirically inclined Stagirite of the *Meteorology*.

Two variations on the encyclopedic reception of Drebbel's physics can be found in the work of Peter Lauremberg and Johann Heinrich Alsted. They identified Drebbel as an authority in physics comparable to Aristotle, rather than as an alchemical writer such as Basil Valentine or Sendivogius. Neither Lauremberg nor Alsted granted chymistry the elevated status in the encyclopaedia of knowledge for which Hartmann was campaigning.⁹⁹⁸ Thus, their identification of Drebbel as an author of theoretical physics heightened his status within the newly methodized encyclopaedia.

Peter Lauremberg sought to reform and methodize the encyclopaedia of knowledge along Aristotelian lines. In his *Pansophia*, Lauremberg remained so soberly within the bounds of human knowledge that Comenius complained that the work was "unworthy of so sublime a title."⁹⁹⁹ To Lauremberg, Drebbel's *On the Nature of the Elements* excelled as an easily comprehensible modern treatment of the elements which harmonized remarkably well with Peripatetic philosophy.

Lauremberg did not seem to have expected much from his first casual reading of Drebbel's vernacular work. Some Hamburg physicians asked him to spend a few hours translating it into Latin, Lauremberg says. When he set out to do this, he was amazed to find

⁹⁹⁷ For the focus on the *Physics* in neo-scholastic instruction, see Chene (1996).

⁹⁹⁸ In Lauremberg's *Pansophia*, he classifies alchemy as an art, not a science. See Peter Lauremberg, *Pansophia sive Paedia Philosophica: Instructio generalis, accurata & solida. . . Adjectâ liberalium plaeerarumque nonnullarum etiam Illiberalium constitutione. Omnia ad methodum Aristotelicam*. (Rostock: Joachim Pedanus, 1638), 63. Alsted is far more optimistic about chymistry than Lauremberg, yet he never clarifies a clear status for it. He divides chymistry into many parts of varying status, placing "mechanico-mathematical" chymistry much lower than the "mechanico-physical" part of the practice. See Jean-Marc Mandosio, "L'Alchimie dans les Classifications des Arts et des Sciences" in *Alchimie et Philosophie*, 28; Matton, 416.

⁹⁹⁹ Cited in Young, 100.

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“writing of a new character, and by a new writer” yet by someone who innately knew “the gentility of ancient Philosophy.”¹⁰⁰⁰ Lauremberg praised the combination of Drebbel’s clear, almost tactile explanations with an ingenuity on a par with ancient philosophers. In the last two alchemical chapters, Lauremberg says, “the foundations of abstruse wisdom are laid out so clearly that they can be known, seen, and even touched by anyone whose blood is not frozen in his veins.” The rest of the discussion of the nature of the Elements, transmutation, rain, thunder, lightning and wind could be drawn verbatim, or nearly so, from Aristotle and his Greek, Latin and vernacular interpreters.¹⁰⁰¹ This was to the great glory of Drebbel, not only because that which he proposed agreed “with ancient, certain and genuine Philosophy, but much more because by meditating and experimenting with his own excellent *ingenium*, he has reached a level which rarely anyone reaches even with the help of many teachers and books.”¹⁰⁰²

As an artisanal work based in practice and circumventing years of inefficient pedagogy, Drebbel’s text was bound to appeal to the encyclopaedist and Herborn professor Johann Heinrich Alsted (1588-1638). Alsted praised *On the Nature of the Elements*, which he read in Lauremberg’s translation, as a work of theoretical physics in the most hyperbolic

¹⁰⁰⁰ Peter Lauremberg in his dedicatory letter to Georg Schumacher in Cornelis Drebbel, *Tractatus Duo: Prior de Natura Elementorum . . . Posterior de Quinta Essentia. . . : Accedit Ejusdem Epistola. . . De Perpetui Mobilis inventione* (Hamburg: Carstens, 1621), 3. “Quia tamen illius usus fructus communiter esse credebatur in rem Philosophicae & Chemicæ dignitatis, coepie ego, rogatus ab amicis, Medicis huius civitatis excellentibus, per unum aut alterum bihorium interpretationi illius incumbere.”

¹⁰⁰¹ *Ibid.* “Quod dum facio, inveni scriptum caractere quidem novo, novoque auctore dispaluisse in vulgus, sed tamen sapere nativum generositatem antiquioris Philosophiæ: chemicæ quidem duo illius postrema capita, in quibus abstrusioris sapientiae fundamenta tam apertè deteguntur, ut & agnosci: & videri & palpari facilè possint ab eo, cui non prorsus frigidus obsistit circum præcordia sanguis. Peripateticæ verò, quicquid reliquum est argumenti de Elementorum naturis, transmutationibus, pluviis, tonitribus, fulguribus, ventis. Ea enim omnia ex Aristotele huiusque Interpretibus Graecis, Latinis, Barbaris, vel verbotenus deducere, in proclivi esse potest ei, qui istorum Heroum scripta non nimis invisâ ignotaque habet.”

¹⁰⁰² *Ibid.*, 5. “Ea tamen res non tam dedecore quàm gloria esse potest Drebbelio: non tantum quia cum priscâ, solidâ, & genuinâ Philosophiâ conspirant ea quæ propint; sed multò magis, quia ipse ingenii sui excellentiâ meditando atque experiundo sequutus est id, quò multi multorum præceptorum & librorum adminiculis usi, rarò, atque aegrè perveniunt.” For Lauremberg, see *Memoriae Hamburgenses* (Hamburg: Christian Liebbeitz, 1720).

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terms. In his 1626 *Philosophical Compendium*, Johann Heinrich Alsted called it a “golden treatise” and the “key to physics.” He recommended Drebbel as one of the two greatest writers on the nature of the elements, ever (the other being Cornelius Agrippa).¹⁰⁰³ Among his *Quaestiones* in the section on Meteors Alsted asked, “Who has best described the generation of wind, rain, and other meteors? Cornelius Drebbel in *On the Nature of the Elements*.”¹⁰⁰⁴ Although Alsted covered the whole of philosophy in this one volume, he took the space to print all of Drebbel’s extant works in Lauremberg’s translation, adding marginal

¹⁰⁰³ See Alsted’s *Philosophical Compendium* (Herborn: Georg Corvinus, 1626), 147-8. “22. *Quaenam utilitas ad nos redeat ex solidâ & accuratâ cognitione quatuor elementorum?* Id paucis ostendam verbis C.D. summi mechanici & chymici. Sic autem ille in brevi & aureo suo tractatu de naturâ elementorum. Volui verò elementorum indolem & affectiones praecipuè describere, quia nihil reperi, quod me apertiori & tutiori semitâ deduceret ad cognitionem Dei creatoris. Elementa sunt habitaculum universae naturae, absque quibus naturam nemo cognoscet. In iis & ex iis nutrimus & sustentamur. Ea si ignoraverimus, ingorare nos oportet & nosmetipsos & totam naturam. Qui elementa novisse didicit, & seipsum, & naturam, absqua quâ nemo intelligit, nemo verè amat creatoris omnipotentiam, sapientiam, bonitatem, &c. Confer C.A. Qui duo authores ita scripserunt de elementis, ut jure merito omnibus scriptoribus anteponantur”; 254: “Id verò ut felicius praestemus, agite volvamus & revolvamus aureum hunc DREBBELII tractatum de Naturâ elementorum: quem quidem ego in deliciis habeo, & clavem Physices appello.” Special thanks to Howard Hotson for help in identifying the “C.A.” cited by Alsted in the *Philosophical Compendium* as Agrippa. Although Alsted does not spell out who “C.A.” is in the *Philosophical Compendium*, he does explicitly compare Drebbel and Agrippa in a similar passage in the *Encyclopaedia*, as Hotson pointed out. See “Magia” in Alsted’s *Encyclopaedia* (Herborn: Georg Corvinus, 1630), 2268, where Alsted paraphrases Drebbel and compares it to Agrippa: “Fundamentum physcium est in eximia cognitione naturae, naturae, inquam, stellarum, spiritus mundi & quatuor elemntorum. Et primo quidem natura & influxus stellarum accuratè debet observari: quia Magia naturalis in eo est occupata, ut possit maritare naturam superiorum & inferiorum, seu inferiora superiorum dotibus, tanquam quibusdam illecebris, ita copulare, seu miracula, non tam arte, quàm naturâ, cui se ars ministram praebet. Deinde, spiritus mundi est primum mobile & principium operum Dei, ita ut hoc uno introitus ad veram naturae cognitionem pateat. Hic nempe spiritus est vita quatuor elementorum. Hunc itaque spiritum oportet investigare, nominatim in iis corporibus, in quibus major est ejus copia. Denique, quatuor elementa digito quasi monstrant mirabilia Dei in natura, adeo ut nihil reperiatur, quod nos apertiori & tutiori semita deducat ad cognitionem Dei creatoris, & naturae ab ipso creatae, quàm indoles & affectio quatuor elementorum. Elementa siquiduem sunt habitaculum universae naturae, absque quibus Magia naturalis idem est, quod lepus sine pedibus. Nam in iis, ex iis, & per ea sunt omnia corpora naturalia. Quapropter si illa ignoraverimus, ignorare nos oportet & nosmet ipsos, & totam naturam. quare maneat illud Magiae naturalis emblema: Qui elementa novisse didicit, is Deum didicit, & seipsum & naturam. Hac de re placet adscribere insignum locum ex Agrippa. . . .”

The praise of *On the Nature of the Elements* as “golden” appears more than once. As late as 1699, Anton Francesco Bertini also termed it a “golden book.” See Bertini, *La medicina difesa dalle calunnie degli uomini volgare e dalle opposizioni de’ dotti* (Lucca: 1699), 348-9.

¹⁰⁰⁴ Alsted, 165. “15. Quisnam omnium optimè descripserit generationem ventorum pluviarum, & similium meteororum? Cornelius Drebbel in tractatu de naturâ elementorum. Vide sub finem hujus compendii Physicae.”

lemmata. He even reprinted the liminary material from the 1621 edition praising Lauremberg.¹⁰⁰⁵

Alsted stood out among semi-Ramist methodizers for accepting the manipulation of divine energies in nature through alchemy which Libavius had attacked.¹⁰⁰⁶ In his definition of magic in the *Encyclopaedia*, Alsted linked natural magic to physics; physics entailed knowledge of the “natures of stars, the spirit of the world, and the four elements.” Natural magic drew upon the same knowledge. Natural magic connected the realm of the stars to the realm of the elements through the natural medium of the spirit of the world. Thus the spirit of the world, the *primum mobile* of God’s creation, offered an entry into the true knowledge of nature, said Alsted, proceeding to paraphrase Drebbel in *On the Nature of the Elements*.¹⁰⁰⁷ The knowledge of the *primum mobile* of the *spiritus mundi* entailed by natural magic ensured true knowledge of physics.

We can trace Alsted’s interpretation of Drebbel’s theory of the elements as showcasing the *spiritus mundi* back to Burggrav’s interpretation of Drebbel’s perpetual motion machine. In his *Cursus philosophici encyclopaedia* of 1620, Alsted had not yet encountered Drebbel’s natural philosophy in Lauremberg’s translation. Instead, he cited Burggrav’s description of the perpetual motion in the *Biolychnium* as evidence for the *spiritus mundi* linking superior and inferior realms and enabling the construction of an *apotelesm*, or perpetually moving microcosm.¹⁰⁰⁸ Like Hartmann, Alsted championed Drebbel’s natural

¹⁰⁰⁵ Alsted included eight other authors, total, in his compendium, usually as extracts. He lists them as “I. Institutio Puerilis M. Antonii Mureti, II. Cornelii Drebelii 1.2.3., III. Cossa Christophori Rudolphi, IV. Geometria Petri Rami in Compendium redacta studio Willebrordi Snelii, V. Zachariae Rosenbachii Index geographicus, VI. Epicteti Enchiridion, VII. Ciceronis Princeps Studio G. Bellendeni, VIII. Theriobulia Johannis Dubravii.” He also includes liminary material for Snellius’ edition of Ramus.

¹⁰⁰⁶ Matton, 407.

¹⁰⁰⁷ “Magia” in Alsted’s *Encyclopedia* (Herborn: Georg Corvinus, 1630), 2268, quoted above. Thanks once again to Hotson for this reference.

¹⁰⁰⁸ Johann Heinrich Alsted, *Cursus philosophici encyclopaedia libris XXVII* (Herborn: Christophor Corvinus, 1620), 982. “Hoc apotelesma verè admirandum censeri debet, si quis hujusmodi globum fabrefacere possit, in quo

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philosophy as based in the magical (and encyclopaedic) art of micro and macrocosmic harmony, as proven in the use of the *primum mobile* within his perpetual motion machine.

The students of Alsted, such as Johann Sibbertus Küffler (1595-1677) and Jan Amos Comenius (1592-1670) followed Drebbel's career eagerly.¹⁰⁰⁹ Küffler and his brothers wed Drebbel's daughters, becoming the self-appointed curators of Drebbel's legacy both in England and on the continent.¹⁰¹⁰ According to his manuscript *De Arte Spontanei Motus quem Perpetuum vocant* (1639), Comenius shifted the course of his own activities over the course of the 1630's, based on the slightest piece of news concerning Drebbel.¹⁰¹¹

John Jonston (1603-1675), the Polish doctor and Comenian pansophist, sought out Drebbel and his friends personally. Jonston visited Drebbel himself during one of his trips to London. He recorded viewing a fly through a microscope with Drebbel in London.¹⁰¹² Jonston also served as the intermediary between Hartlib and Comenius, and was just the sort of optimistic, methodical pansophist to whom Drebbel appealed.¹⁰¹³

In his *Constancy of Nature* Jonston argued that the world was not destined for inevitable decay, and demonstrated how the moderns rivaled the ancients in every discipline. We have already encountered Jonston's treatment of Drebbel (in Chapter Four) as an

variae sphaerae movent absque principio externo & violento. Hoc autem is demum praestiterit, qui cognitum habet spiritum sive animam mundi, ut vocant. Intellige hinc vim illam motricem, quam Deus indidit omnibus corporibus, non verò animam mundi Platoniam. Hac de re Burggravius in Biolychnio suo sic ait: Hic (nempe Cornelius Drebbelius) sphaeram fabricavit, quâ mobilis sempiterni virtute, perennes explicatissimosque siderum coelestium motus ac leges temporum motuumque in iis praedestinationes repraesentavit. A coelo interno, seu astro invisibili est ista virtus."

¹⁰⁰⁹ Küffler defended a dissertation at Herborn under the aegis of Alsted. Thanks to Howard Hotson for this reference. Johann Sibbertus Küffler, *Disputatio physica de corporis naturalis generalibus principiis et affectionibus* (Herborn: Christoph Corvinus, 1615).

¹⁰¹⁰ For the Küffler's careers, see Young, *passim*.

¹⁰¹¹ Referring to Drebbel's letter to King James printed in Alsted's *Encyclopaedia*, Comenius thought that Drebbel had discovered the perpetual motion. Then having read Petrus Mormius' claim that Drebbel's perpetual motion was a fake, he once again felt that he had a chance of discovering the perpetual motion first. This was the first of many reports which kept Comenius distracted from his pansophic work for a decade.

¹⁰¹² John Jonston, *Historiae Naturalis de Insectis Libri III* (Frankfurt: Merian, 1653), 67. "Variis depingi cancellatim quasi coloribus, pavonis instar, per microscopium apud celebrem illum mechanicum Drebellium Londini observavimus."

¹⁰¹³ *The Letters of Jan Jonston to Samuel Hartlib* (Warsaw: Retro-Art, 2000).

inventor rivaling the ancients. However, he also included Drebbel in his discussion of theoretical physics. In this field too the moderns outdid Aristotle. “In Aristotle, innumerable speculations concerning Matter, the World, Heaven and other things are false. We have them now corrected by Alsachus, Danaeus, Campanella, Verulam, Bartholinus, Nollius, Ruthardus and many others.” Jonston concluded, “I know not whether Drebbellius hath not exceeded the Ancients in his Book of the Elements.”¹⁰¹⁴

Jonston did not reach a judgment on this *paragone* between Drebbel and the ancients. What is striking here is that there was a contest at all and that it was discussed in Jonston’s section on theoretical rather than practical physics. Although a nonacademic artisan, Drebbel did not surpass the ancients by abandoning the field of theoretical physics for mathematics or the mechanical arts, as did his peers in England such as Robert Norton or Thomas Smith.¹⁰¹⁵ Rather, according to Jonston, he was judged against Aristotle on Aristotle’s own ground.

Contrast Jonston with John Wilkins, who divided his *Mathematical Magick* (1648) into two sections, one rational or liberal and the other mechanical or illiberal. Although Wilkins described Drebbel’s perpetual motion as a “chymical experiment” (and not a merely mechanical device) and referred to Drebbel’s “discourse upon it,” he did so only in the mechanical section of *Mathematical Magick*.¹⁰¹⁶ That Drebbel produced his device through his

¹⁰¹⁴ John Jonston, *History of the Constancy of Nature*, (London: John Streater, 1657), 83; *De Constantia Naturae* (Amsterdam, John Jansson, 1634), 68-9, “Nil in Philosophia Theoretica deest.” “Nam I. in Aristotele innumere speculationes de Materia, Mundo, Coelo, & aliis, falsae sunt. Nos jam illas ab Aslacho, Danaeo, Campanella, Verulamio, Bartholino, Nollio, Ruthardo & plurimis aliis correctas habemus. Drebbellius, nescio an non Veteres scripto de Elementis vicerit.”

Although aware of *On the Nature of the Elements*, Jonston cited Sennert, rather than Drebbel, for the experiment of wind generation in *Thaummatographia Naturalis* (Amsterdam: Blau, 1632), 106, “De Origine Ventorum.” See Sennert, *Opera Omnia*, (Leiden: Joannes Antonius Huguetan & Marcus Antonius Rauaud, 1650), Vol. 1, 64-5.

¹⁰¹⁵ See for example, Robert Norton, *Gunner’s Dialogue with the Art of great Artillery* (London, John Tap, 1628) and *A Mathematical Appendix* (London: Roger Jackson, 1604).

¹⁰¹⁶ John Wilkins, *Mathematical Magick* (London: Samuel Gellibrand, 1648), 229-230.

knowledge of *chymia*, and even wrote works about it, did not lift him above the level of a mechanic in Wilkins' eyes.

Whether supported by an appeal to higher forces as in the Hartmann school and Alsted, the literary alchemical tradition, à la Libavius, or the sober appreciation for artisanal, tactile explanation found in Lauremberg, Central European Ramist and semi-Ramist natural philosophers championed an artisanal philosophy, and taught it to their students. This story of an artisanal philosopher promoted by magical and alchemical empiricists should occasion us to question the technological determinism allying mechanics and mechanical philosophers in the rise of scientific experiment in England. Mechanics such as Drebbel did indeed write natural philosophy, but it was not necessarily mechanical.

The Ramist desire to find a machine-based epistemology in order to avoid mathematical proofs also shows that the mathematization of nature was not the only avenue of empirical natural philosophy open at the time. In the first decade of the seventeenth century, qualitative physics enjoyed a drastically higher epistemological status than quantitative mechanical arts.¹⁰¹⁷ Drebbel, as an early champion of maker's knowledge, was eager to buttress his claim by grafting his machines upon the "living" qualities of nature. His emphasis upon clarity, accessibility, and Christian charity rendered his strong claim for the authority of artisanal philosophy the more attractive to enthusiastic semi-Ramist methodizers.

¹⁰¹⁷ Alan Gabbey, "Between *Ars* and *Philosophia Naturalis*: Reflections on the Historiography of Early Modern Mechanics," *Renaissance and Revolution: Humanists, Scholars, Craftsman, and Natural Philosophers in Early Modern Europe*, J. V. Field and Frank A.J.L. James, eds. (New York: Cambridge University Press, 1993), 133-145.

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IV: Mid-century and after

Drebbel continued to enjoy philosophical authority well after his death. His *On the Nature of the Elements* was cited as an authority in disputations and textbooks through the second half of the century. In a medical reference work, the city physician of Frankfurt Johann Schröder cited Drebbel as the authority for the nature of fire.¹⁰¹⁸ In his chemical textbook *Oedipus Chymicus*, Johann Joachim Becher recommended that the reader consult *On the Nature of the Elements* for an account of the incorruptible chain of the elements.¹⁰¹⁹ Athanasius Kircher, without citing Drebbel, lifted wholesale from *On the Nature of the Elements* for his own “magnetic” account of the elements [Fig. 1].¹⁰²⁰ In a review of alchemical literature, Olaus Borrichius included Drebbel among the most famous Dutch alchemists.¹⁰²¹ Meanwhile, those who cited Drebbel’s text as an authority in discussions of the *spiritus mundi* included “D.J.B.,”

¹⁰¹⁸ Johann Schröder, *Quercetani Redivivi Tomus II Hoc est, Ars Medica Auxiliatrix, videlicet Diaetetica, Pharmaceutica, & Chirurgica* (Frankfurt Johann Beyer, 1648), 4. “Ignis natura est calfacere, attenuare, illustrare, purgare. Est enim corpus simplicissimum, ideoque omnia ad suam naturam seu simplicitatem reducere nititur. De quo Drebbelii lib. *De Elementorum natura* c. 2 Ignis, inquit, omnia & clarificat & mutat in eum statum, in quo à Deo fuere collocata.”

¹⁰¹⁹ J.J. Becher, “De Alteratione & Connexione Elementorum,” *Oedipus Chymicus* (Frankfurt: Sande, 1664), 324-5.

“Nullum Elementum, adeò simplex reperitur, ut nullum admixtum habeat; neque enim absque altero consistere potest. Ita Terrae admixta est Aqua, Aër & Ignis, quod & de reliquis sentiendum, ab eo autem quod praedominatur, sumitur denominatio. Elementa excessu alterationem, temperamento requiem causant, firmiter nunquam sic connectuntur, ut alterationem non subeant, nisi quodlibet elementum per reliquos gradus sit alteratum ac dispositum, prout in Metallurgiae meae Parte primâ sub titulo de Variatione Elementorum uberius tractatur. Ignis per Aërem agit in Aquam, & per eam nutrit terram, secus comburit ac corrumpit eam, taliter & reliqua Elementa agunt in se mutuò per media, sicut de hâc mutuâ actione Chemicâ, Cornelius Drebbel singularem edidit Tractatum, ex quo plura peti possunt: sciendum autem est, Terram Ignis, Aquam verò Aëris esse nutrimentum, Aquae cum Terrâ esse conjugium, quod ergo Elementum cum sua rota à corpore solvi [debet, id vinculo suo solvatur, nutrimento suo autem relinquatur necesse est, terra agit in aquam formatione & generatione, haec verò in terram resolutione & corruptione, ita igni cum aëre negotium est, quare si utraque copula fuerit firma, ac quodlibet elementum alterius induerit naturam, facilè immota quiescent, terra enim in aquam, aërem & ignem; sic quoque reliqua elementa reduci ac alterari possunt. Verùm aqua in aërem mutata, communis aër non est, sed aqueus, quod & de reliquis elementis taliter tractatis intelligendum est, ex quibus denudò conjunctis, vinculum oritur incorruptibile verùm de his plus in sexto Titulo.”

¹⁰²⁰ Kircher cited Drebbel’s letter to King James while refuting Drebbel’s claims to have invented a perpetual motion machine, but he did not cite *On the Nature of the Elements* (in Peter Lauremberg’s Latin translation) as the text forming the bulk of his own treatment of the “magnetic faculty of the elements” in *Magnes* (Rome: Ludovico Grignani, 1641), 570-582.

¹⁰²¹ Borrichius, *De Ortu et Progressu Chemiae, Bibliotheca Chemica Curiosa*, J.L. Manget, ed. (Chouet: Geneva, 1702), 36.

Andreas Cnöffel, Christian Adolph Balduin, Johann Tackius, Gotthelf Andreas Untzer (in a dissertation defended under the aegis of Caspar Cramer), and Jan Schilperoort.¹⁰²²

This enthusiasm for Drebbel's artisanal philosophy spread far beyond semi-Ramist gymnasia and universities, particularly within the Hartlib circle. Referring to the Hartlib circle's contributions to alchemy in England, Dobbs called it "perhaps an odd quirk of history that a group clearly descended from the flaming mysticism of late-sixteenth-century Germany should have been the one to perform the task of making alchemy clear, rational, and chemical."¹⁰²³ Seen from the viewpoint of Drebbel's early reception, it makes perfect historical sense that the next generation of enthusiastic continental pansophists should have supported a clear and efficient maker's knowledge in England. Although the social platform of the Hartlib circle was not embraced by many English natural philosophers and certainly did not survive the Restoration, a heightened status of knowledge found in and for use remained in Restoration England.

¹⁰²² D.J.B., *De Spiritu Mundi Positiones Aliquot*, in Manget, *Bibliotheca Chemica Curiosa*, Vol 2, 877. D.J.B was possibly the Silesian Johann Burg, a student of Georg Wolfgang Wedel at Jena. See also Andreas Cnöffel, "Responsum ad Positiones de Spiritu Mundi, quod in se continet Reserationem Tumbæ Semiramidis" in Manget, 883, and in *Der Römisch-Kaiserlichen Akademie der Naturforscher auserlesene medizinisch-chirurgisch-anatomisch-chemisch-und botanische Abhandlungen*, 383; John Tackius, *Triplex Phasis Sophicus* (Frankfurt: Sumptibus Johannis Petri Zubrodt, & Haered. Joh. Baptistae Schönwetteri, 1673) 7, 32-3; Gotthelf Andreas Untzer, *De Spiritu Mundi Nütneriano* (Erfurt: Grosch, 1680), Thesis III, XXI; Christian Adolph Balduin, "Aurum Superius & Inferius Auræ superiores & Inferioris Hermeticum" in Manget, 859, 861. Jan Schilperoort, *De aloude bekende mogelijkheid van de sympathetische werkinge* (Rotterdam: Pieter van der Slaart, 1697), 7. On Schilperoort, see Juliette van den Elsen, "The Rotterdam Sympathy Case," *Aries* 2:1 (January 2002), 39.

¹⁰²³ Dobbs, 64.

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Drebbel, *On the Nature of the Elements*, Lauremberg's translation, (Hamburg: Carstens, 1621).

Chapter I

Deus enim exactâ temporis plenitudine, quando illi complacuit, cunctarum rerum Naturas Vero produxit. Initiò quidem, id quod erat subtilissimum, secrevit à caetera massa, factumque est Ignis elementum, occupans supremam mundi sedem, replens infinitum istud alioquin vacuum futurum spatium: circumdans Dei magnifica opera. Scilicet quicquid levissimum est, id sursum ascendit. Iam Deus iterum ab ista massa separans id quod levius, quodque subtilius, effecit elementum Aëris, cuius locus proximè sub levissimo igni,

Consimili ratione & à reliquiis seiunxit partem subtiliorem humidoremque, atque efformavit cum Tellure Aquam. Aqua verò integram terrae faciem obtegebat haud secus ac ignis aërem aër aquam. Caeterùm omnipotens Dei virtus, terras aquis immersam extulit in altum, nosque in eadem collocavit, ut eò perfectiùs contemplaremur splendorem aeviternae suae lucis, ac se amaremus, quippe qui perfectissimi eramus creati.

Sic quadripartitò divisit Deus opera sua in Ignem, Aërem, Aquam, Terram.

Intuere hoc Elementum, quàm operosè illustret Aërem!

huncque ad similem claritatem perducatur, omnes ex eo dispellens tenebras. Ita testatum facit quanta antè obscuritate oppressus fuerit aër. Insuper ab omni humore excrementitio fumisque terrenis eundem expurgat.

Exemplo & argumento est Ignis noster Culinaris, qui ligno aut cespitibus siccis enutritur, magna vi colligit, & quasi sugendo attrahit ad se aërem: eum nitidum, purum: lucentem reddit, sibi que assimilat penitus: Quod ipsum tam avidè tamque impensè facit, ut si fortè intercludatur, subtracto & intercepto aëre (id est quoties suffocari eum contingit) mox intermoriatur ac tenues evanescat in auras:

Kircher, *Magnes* (Rome: Ludovico Grignani, 1641), 570-582.

Ens igitur entium Deus Opt. Max exacta temporis plenitudine, quando illi complacuit, cunctarum rerum naturas verbo produxit, ac primo quidem ex primigenia illa confusionis massa, seu infinito rerum chao, id quod subtilissimum erat productio ignis atque levissimum secernens, lucem sive elementum ignis condidit; hinc omnipotentis virtutis iussu. . . . Iterum Deus à prima illa hyle, idquod levius erat, & subtilius separans, elementum aëris, cuius locus immediate sub igne levissimo, producit. . .

Porrò consimili ratione, & à reliqua massae parte Deus, id quod subtilius erat, & humidius separans, efformavit cum tellure aquam, & haec quidem cum non secus, ag ignis aërem, aër aquam, inconvenienter terram circumdaret, ea in alveos inclusa, tellurem aquis immersam in altum extulit. Ad proprios vsus viventium, hominumque theatrum.

Ita quadripartite divisit Deus opera sua; videlicet in 4. elementa,

Quis non videt quam mirificè hoc elementum aerem illustret?

huncque ad similem claritatem, ad similem subtilitatem omnis crassitiei expertem ac quaeuis penetrantem, omnibus ex eo depulsis tenebris, ab omni excrementitio humore, fumisque terrenis eundem expurgando, perducere nitatur?

certè huius rei argument est ignis noster culinaris, qui ligno aut cespitibus siccis enutritur, magna vi colligit, & quasi sugendo attrahit ad se aërem, eum nitidum, purum, lucentem reddit, sibi que assimilat penitus, quod ipsum tam avidè, tamque impensè facit, ut subtracto aut interrupto aere mox suffocatus intermoriatur ac tenues evanescat in auras;

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Finis enim cuiusque idem est ac eiusdem principium, uti testatur quotidiana experientia. Quod è Terra pullulat, ad terram revertitur, quod ex Aqua, ad aquam. Quicquid est, id initio perfectissimum fuit apud Deum, atque olim itidem ad eandem perfectionem revertetur, tum cum elementa colliquescent, & pristinum induent splendorem coram Deo. Nihil ibi perditum ibitur praeter iniustitiam.

Drebbel, Chapter 2

Nonne vides quam atrii sint carbones extra ignem? quam clari sint, quam lucentes in igne, non minus quam lucentes in igne, non minus quam ignis ipse. Tantum illis splendorem ignis impertit, ut etiam in formam penitus diversam transformentur: Tum revertuntur ad pristinam suam naturam. Etiam cinis ipse non renuit tandem mutari in substantiam vitro non dissimilem, ac postremo invisibilem

Drebbel, Chapter 3

Namque ut Ignis vita ipsa est: vivit verò in aëre, haud secus in igne vivit aër, aqua in tellure, tellus in aqua. Ignis aërem perpurgat, aër aquam, aqua terram: unumquodque sibi, suoque splendori, assimilat alterum.

Calor enim ignis, quemadmodum omnia subtilia & pura reddit, ita ex adverso frigus igni contrarium omnia condensat, constringit, aquamque quasi comprimit, resistens calori ignis, & aëris subtilitati.

Consimiliter aër ignem condensat, si illius frigiditas hujus calorem superârit. Ignis in aërem mutatur, aër in aquam, aqua in terram, ut ante fuit demonstratum.

Drebbel, Chapter Nine

Ignis nihil est aliud, quam subtilis aer; aer est subtilis aqua, aqua est subtilis terra: Terra crassus ignis, quemadmodum evidenter demonstrant superius adducta exempla.

ita finis cuiusque idem est, ac eiusdem principium, quod è Terra pullulat ad terram revertitur, quod ex aqua ad aquam, & omnia tandem ad eum ceu finem ultimum à quo originem hauserunt, redeunt. Quicquid est, id initio perfectissimum fuit apud Deum, atque ad eandem suo tempore perfectionem revertetur, tum, cum elementa colliquescent, & pristinum induent splendorem coram Deo: nihil ibi peribit praeter iniustitiam hominis. . .

Quis non videt, quam atrii ac terrei sint carbones extra ignem? quam clari, lucidi in igne, non minus quam ipse ignis? tantum [582] enim illis splendorem ignis impertit, ut etiam in formam penitus diversam transmutentur. Tum revertuntur ad pristinam suam naturam; quin imò ipsum cinerem & arenam, opaca & squalida caeteroquin corpora, ignis tandem ope in vitrum mundissimum, subtilissimum, sibi prorsus simile, diaphanum & propè *αορατον* corpus

Nam ut ignis vita ipsa est, vivit verò in aëre, haud secus in igne vivit aër, aqua in tellure, tellus in aqua; ignis aërem perpurgat; aër aquam, aqua terram, unumquodque sibi suoque splendori assimilat alterum.

Calor enim sive ignis, quemadmodum omnia subtilia, & pura reddit, ita ex adverso frigus igni contrarium omnia condensat, constringit, aquamque quasi comprimens resistit calori ignis, aërisque subtilitati.

Kircher, Caput II

Magnetica Elementorum vis experimentis ostenditur.

. . . ita terra in aquam, aqua in aërem, in ignem denique aer mutatur rarefactione, condensatione verò è contra ignis in aërem, in aquam aër, aqua denique in terram ita convertitur,

ut non incongruè ignis subtilis aër, aër subtilis aqua, aqua subtilis terra, terra verò crassus quidam ignis, & contra terra congelata aqua, aqua congelatus aër, aer ignis addensatus, dici potest. Quemadmodum experimenta irrefragabiliter demonstrant.

Chapter Six: The Booklet of Nature

Enim vero terra, seu vi ignis, seu naturae ingenita efficacia, resoluta, transmutatur in aquam, fitque sal & quaedam terrae virtus, cuius rei perfectum argumentum praebet calcinatio. Sal ipsum igni dissolutum mutatur in aquam, veluti videre est ex destillatione aquarum fortium: Aqua porro vi Ignis soluta sit aer, aer fit ignis. ut jam ante dictum. Hoc pacto crass obscuraque terra convertitur in subtilissimum, pellucidissimum, splendidissimum ignem, qui non solum penetrat, illustraque omnia, sed & facit, ut ipsa penetrandi, illustrandique potestatem nanciscantur.

[From this point, Kircher does not quote Drebbel verbatim, but his “experiment” could well be compared to Drebbel’s demonstration. They demonstrate the same “magnetic” attractive quality of the elements.]

Drebbel, Chapter Four

Id oculis & manu palpabimus, si Cornutae vacuae ore frigidae aquae imposito, ventrem igni superposueris, actutum videbis, vbi primulum calfactum fuerit vitri corpus, egressuros eo illius, non sine strepitu, flatus qui in bullas concitabunt aquam, idque eò impensius, quò aër incaluerit fiet, & proinde minor, vitrumque aqua opplebitur illâ sui parte quam antea aër calfactus & expansus occupaverat. . . .

Itidem sphaera aenea intus cava, cuius aliquod latus foramen habeat. Si haec incalescat validè, perque foramen aquae gutta instilletur, statim ea augebitur, & instar venti efflabit ex sphaera.

Nam terra seu vi ignis, seu naturae ingenita efficacia, resoluta, transmutatur in aquam, fitque sal, & quaedam terrae virtus, cuius rei perfectum argument praebet calcinatio; sal ipsum igni dissolutum mutatur in aquam, quam metamorphosin prodit aquarum fortium distillatio. Aqua verò vi ignis soluta fit aër, aer fit ignis, ut iam saepè dictum est, & paulò post experientia ostendetur, vides igitur qua ratione terra crassa, obscuraque conueratur in subtilissimum, pellucidum splendidissimum ignem, qui non penetrat, illustratque solùm, sed & facit, ut ipsa penetrandi, illustrandique facultatem nanciscantur,

Fiant duo vasa unum ex aere, alterum è vitro, sintque A,B, quae syphone C coniungantur hac tamen lege, ut vas A syphonem sibi ferruminatum ita recipiat, ut aër intrare nuspiam possit, quo facto per foramen a liquore vas aliquousque repleatur, clausoque suppone ignem, aërque rarefactus per syphonem C, ampliorem sibi locum quaerens, atque in vas B aquae plenum receptus in bullas abibit, remoto verò igne, aër vasis A paulatim crassescens, dum minorem locum petit, nec habeat, quo aliud sibi corpus substituat, ex laborantis naturae necessitate, aquam vasis B violento motu per syphonem C attrahit. huc pertinet omnis generis, Thermoscopia, quibus vitreis syphonibus, ampullis inclusis ex raritate, aut densitate caloris, frigorisque intensionem, aut remissionem exploramus.

Ita in Aeolia pila aqua igni supposit [586] fervefacta per vehementes flatus in vapores soluitur . . .

In England, Drebbel's activities, but not his texts, were frequently cited by members of the Royal Society. This was not because Drebbel's works were unavailable in England, although they were never published in English or in England.¹⁰²⁴ English members of the Royal Society cited Drebbel's activities in their own published works, in articles within the *Philosophical Transactions*, and during meetings of the Society.¹⁰²⁵ Many later English

¹⁰²⁴ Several early modern English and Scottish libraries included *On the Nature of the Elements*. Robert Burton mentioned *On the Nature of the Elements* in his *Anatomy of Melancholy*, and his annotated edition is now in the Christ Church college library, Oxford. See Nicolas K. Kiessling, *The Library of Robert Burton* (Oxford: Oxford Bibliographical Society, 1988), 482. The edition of *On the Nature of the Elements* at Yale contains the following inscription on the title-page, "H.A. Comparavi Londini 15 Feb. 1638. 1 1/2 solidis sive capitatis." The Bodleian library owns two copies with a seventeenth-century English provenance (Ashmole 557, and Savile Cc 8 (3)). According to published book catalogs, Drebbel's *On the Nature of the Elements* could be found in the libraries of William Drummond, John Webster, Michael Honywood, Isaac Newton, and Charles Bernard. See Robert H. MacDonald, *The Library of Drummond of Hawthornden* (1971), 155. Peter Elmer, *The Library of Dr. John Webster: the Making of a Seventeenth-century Radical* (London: Wellcome Institute, 1986). Clive Hurst, *Catalogue of the Wren Library of Lincoln Cathedral* (New York: Cambridge University Press, 1982), 183. K. Figala, J. Harrison and U. Petzold, "Newton's Alchemical Library," *The Investigation of Difficult Things: Essays on Newton and the History of Exact Sciences*, 53. Jacob Hooke, *Bibliotheca Bernardiana* (London: 1711), 63. Several eighteenth-century sales catalogues mention Drebbel's *On the Nature of the Elements*. *A catalogue of excellent and rare books, on all subjects, and in most languages*, (Edinburgh: NA, 1702), 7, "P Laurembergi Laurus delphica, Gal. Laurembergus de curationes vesicae, Rondeletius de urinis & Drebelius de natura Elementorum Lugd. 1621." See L. Lawlor, *Bibliotheca curiosa* (London: 1732), 48, "Lumen Chymicum, Pet. Vege Tractatus duo, Cornelii Drebellii Tractatus duo-Georgii Ripley Medulla Philos. Chimiae, Angli Canoni Manuscriptum." *A catalogue of the library of Sir Roger Meredith, Bart.* (London, 1739), 37: "Cornelius Drebelius de Natura Elementorum 1628."

¹⁰²⁵ Robert Boyle, *New Experiments Physico-Mechanicall, Touching the Spring of the Air, and its Effects* (Oxford: H. Hall, 1660), 106. Kenelm Digby cites Drebbel's activities in *A Discourse Concerning Infallibility in Religion* (Paris: Peter Targa, 1652), 60-1; *A Discourse Concerning the Vegetation of Plants* (London: Printed by J.C. for John Dakins, 1661), 65; *Of Bodies and of Mans Soul* (London: Printed by S.G. and B.G. for John Williams, 1669), 57. See John Wilkins, *Mathematical Magick* (London: Samuel Gellibrand, 1648), 229-230. Drebbel's activities were also cited in the *Transactions*. His production of sulfuric acid is discussed in *The philosophical transactions and collections, to the end of the year 1700* (London, 1722), Vol. 2, 544. Drebbel's "thermometer" is discussed in "Concerning Thermometers" in *The philosophical transactions (from the year 1743, to the year 1750)* (London, 1756). John Speed wrote the earliest account of Drebbel's perpetual motion machine in a letter to Briggs, which was later reprinted in the *Transactions*. Drebbel was also discussed at meetings of the Society. See Thomas Birch, *A History of the Royal Society I*, 119 (October 29, 1662): "Sir Robert Moray offered to the consideration of the Society a way to compare the effect of heat and cold in rarefaction and condensation of air with that of force or weight. Upon which, Dr. Goddard suggested Drebbel's method of governing a furnace by a thermometer of quicksilver"; II, 362 (May 6, 1669): "Mr. Daniel Coxe mentioned, that Cornelius Drebbel pretended to have a certain liquor, to supply the want of fresh air in the boat, which head had made to go under water with; and which boat was so framed, that it had no bottom, according to the relation given of it in the notes made upon Hernandez." 455: "Sir Jonas Moore remarked, that Sir Christopher Heydon together with Drebell long since in the Minorities hatched several hundred eggs; but mentioned not the way; but that it had this effect, that most of the chickens hatched that way were lame and defective in some part or other. He added, that Drebell had an art, by which he could produce a fly in an hour's time any where." Drebbel was praised, but the possibility of a perpetual motion machine was denied in Dr. Bainbridge's manuscript concerning longitude found in IV, 313 (July 2nd, 1684): "Mira quidem praedicantur de sphaeris

Chapter Six: The Booklet of Nature

mechanical philosophers, while finding knowledge within experiments, were eager to protect their own status as philosophers against the rival claims of the vulgar mechanics performing the experiments.¹⁰²⁶

In a 1998 article, “Closed Circles or Open Networks?: Communicating at a Distance during the Scientific Revolution,” David Lux and Harold Cook criticized recent studies in the sociology of scientific knowledge which have stressed the importance of close scientific communities for the verification of fact and the production of experimental philosophy. Lux and Cook emphasized how the loose ties of far-ranging networks serve to bring about change in a way that tight-knit communities do not. “We would even suggest,” they said, “that the success of the new philosophy depended on the proliferation of weak ties, which could be robust exactly because they were inclusive and pluralistic.” Lux and Cook went on to claim that the far ranging ties of the Royal Society of London “make it not unlike the German *Academia Naturae Curiosorum*.”¹⁰²⁷

Although members of the Royal Society did in fact enjoy expansive ties to the rest of Europe, in their publications they stressed the origins of their research within a small and mostly still living circle. By contrast, Central European Academicians cited an eclectic mix of

Archimedis, Posidonii, et Drebelii, nostrorum temporum mechanici solertissimi: at motum perpetuò aequabilem nec illi fecerunt, nec facient posterì; hunc solum efficiet sapientissimus mundi $\delta\eta\mu\omega\sigma\gamma\omicron\varsigma$ primusque coelorum motor Deus. “ IV, 356 (July 2nd, 1684): “A letter of Mr. Musgrave to Mr. Aston, dated at Oxford, January 12, 1684/5, was read, . . . In this letter of Mr. Musgrave was inclosed a paper, found in the study of Dr. Speed, late of Christ-church, Oxford, and said to have been written by his father to Mr. Briggs. It seemed to be a description of one of Cornelius Drebbel’s inventions, and was as follows. . . .” Vol 1, 437.

¹⁰²⁶ See Shapin and Schaffer, *Leviathan and the Air-pump*, Shapin, *A Social History of Truth*, and Kathleen Ochs, “The Royal Society of London’s History of Trades Programme: An Early Episode in Applied Science,” *Notes and Records of the Royal Society of London* 39: 2 (Apr., 1985), 129-158. Ratcliffe discussed how Fellows of the Royal Society defined themselves in opposition to courtier-inventors such as Morland, Drebbel’s Restoration equivalent, in J.R. Ratcliffe, “Samuel Morland and his calculating machines c.1666: the early career of a courtier-inventor in Restoration London,” *The British Journal for the History of Science* (2007), 40: 159-179. Marika Keblusek follows the career of another Drebbelian inventor, de Son, among members of the society in “Keeping It Secret: The Identity and Status of an Early-Modern Inventor,” *History of Science* 43 (2005), 37-56.

¹⁰²⁷ David Lux and Harold Cook, “Closed Circles or Open Networks?: Communicating at a Distance during the Scientific Revolution,” *History of Science* 36 (1998), 202.

sources stretching both across Europe and far back in time.¹⁰²⁸ Rhetorical differences in practices of citation might seem irrelevant to real historical change, yet they point to who was granted the status of philosopher in differing regions of Europe.

The differences were also clear in the period. In his section on the new academies in *Journey to a New World Without a Ship or Sail*, Holy Roman Imperial Academy member Johann Daniel Major complained for many pages (127-135 in the 1683 edition), that the English Royal Society members insulted the Germans' copious manner of citation, calling them mere compilers ("Compilatores"). Yet, books were central to the practice of innovation. Before claiming to invent something new, must you not first look around and see if it had been written about before? If the English cared so little about books, why were they so proud of having the most famous library in the world ("die Heutiges Tages in der gantzen Wellt aller-Berühmteste kostbahrste Bibliothec")?

The Holy Roman Imperial Academy, founded in 1652 as the "Academy of those Curious about Nature," has typically not ranked among its peers – the Royal Society and the Académie des Sciences – in the vanguard of progress. This has been because the pages of the Academy's journal, from its first issue in 1671, often contained studies of the grandest arcana.¹⁰²⁹ As R.J.W. Evans has argued, the Academy fell within a German tradition of associations for the pursuit of the occult dating to the beginning of the century.¹⁰³⁰

¹⁰²⁸ For the pluralism of late seventeenth-century German natural philosophy, see Christiana Mercer, "The Vitality and Importance of Early Modern Aristotelianism," in *The Rise of Modern Philosophy: The Tension between the New and Traditional Philosophies from Machiavelli to Leibniz*, Tom Sorell, ed. (Oxford: 1993), 33-67 and "Mechanizing Aristotle: Leibniz and Reformed Philosophy" in *Studies in Seventeenth Century European Philosophy*, M.A. Stewart, ed. (Oxford, 1997), 117-152, and Ku-Ming Chang, "Fermentation, Phlogiston and Matter Theory: Chemistry and Natural Philosophy in Georg Ernst Stahl's 'Zymotechnia Fundamentalis,'" *Early Science and Medicine*, 7:1, (2002), 61-3.

¹⁰²⁹ Mason Barnett, "Medical Authority and Princely Patronage: The *Academia Naturae Curiosorum*, 1652-1693 (Ph.D. thesis, University of North Carolina, Chapel Hill, 1995).

¹⁰³⁰ R.J.W. Evans, "Learned Societies in Germany in the Seventeenth Century," *European Studies Review* 7:2 (1977), 129-152.

The members of the Holy Roman Imperial Academy integrated a long-lived alchemical corpus with other currents in natural philosophy, such as Cartesianism, and with the latest articles in peer journals such as the *Transactions* of the Royal Society. Their publications, however, did not travel westward in the same way. By and large, English members of the Royal Society discussed the phenomena, but not the literature, produced in Central and Eastern Europe.

To some extent, practical realities forced the Academy to depend on weak ties – they, unlike the Society, had no central meeting place, and depended upon contributions from a vast region. Yet the tendencies towards openness and integration in the *Ephemerides* of the Academy surpassed what such practical considerations would require. Contributors to the *Ephemerides* re-interpreted an expansive corpus of literature to fit a growing body of experimental evidence. This entailed a citation and interpretation of sources far more extensive than that found in English plain style. The Academy did not share the stylistic penchant implied by the Royal Society's motto (*Nullius in Verba*). Such rhetorical differences make the Holy Roman Imperial Academy appear less “modern” than its English counterpart. Members of the German academy presented their research as part of a continuing tradition, while members of the Royal Society presented their work as a break with tradition.

One long-lived tradition alive and well in the Academy was the “magnetic” philosophy. The search for chemicals bearing latent fiery qualities such as light and heat continued through the century, and encouraged research into various types of phosphors – understood literally in the period as “light-bearers.”¹⁰³¹ This was a subject of investigation of

¹⁰³¹ There has been much debate as to who first isolated the chemical substance considered the element of phosphorus today, and the consensus lies with the Hamburg alchemist Brandt. For the early history of the discovery, as well as its identification a century later as a “chemical element” in support of antiphlogistic theory,

great interest to all scientific societies in the period, including the Royal Society. Only in the *Ephemerides*, however, do we find the search for phosphorus presented as part of a long-lived, eclectic alchemical philosophy. For its German inventors, the artificial production of phosphorus was the centerpiece of a thoroughgoing investigation of how chemical change occurred and supported life.

Drebbel's "living instruments" and other discoveries, such as his invention of a submarine and a quintessence of the air to revive its inhabitants, a chemical scarlet dye, and a process for producing sulfuric acid, were discussed in the *Transactions* of the Royal Society and in other works written by members of the Society. Yet Drebbel's own explanations - his written natural philosophy - were not cited within the *Transactions*. By contrast, chemical philosophers of Central Europe interpreted Drebbel's "living instruments" in context of his own written works and an expansive body of literature stretching back to Fernel and beyond to Hermes and Aristotle.

Furthermore, they also integrated the details of Drebbel's activities reported by English philosophers into their over-all understanding of Drebbel's philosophy. This interpretation changed over time to fit new literature or new phenomena. Thus, the continuing practice of synthesis and re-interpretation in Central Europe kept older works "current," even as it made newer literature seem at best eclectic and at worst outdated.

For example, Boyle, in his 1660 *New Experiments Physico-Mechanicall Touching the Spring of Air*, described the liquor which Drebbel kept closed up in a glass and opened within his submarine to revive his languishing submariners. Boyle's friend Edmund Dickinson hypothesized that this was the luminous life-giving liquor which Noah had used to feed the

see F. Krafft, "Phosphorus: From Elemental Light to Chemical Element," *Angew. Chem. International Edition*, 8:9 (1969), 660-671.

animals in the Ark.¹⁰³² Those seeking a life-supporting spirit above and beyond the elements seized upon the British reports of Drebbel's liquor.¹⁰³³ In his 1673 work, *Triplex Phasis Sophis*, Holy Roman Imperial Academy member Johann Tackius cited Drebbel, "a Chymical Philosopher of great renown, who is still famous. . . for the invention of the perpetual motion," concerning his theory of the quintessence.¹⁰³⁴ In the third part of his book

¹⁰³² Edmund Dickinson, *Physica Vetus et Vera sive Tractatus de Naturali Veritate Hexaemeri Mosaici* (Hamburg: Christian Liebezeit, 1705), 488-9. "Et quicquid operis nutritii à me tribuitur isti luminoso liquori, quem Moses indicat vocabulo Tsohar, id omne potius, ad arcanum Magisterum à Noa confectum, referre: cujus fumi (nam suppono cuncta animantia in Arca per fumos istius magisterii nutrita fuisse) cum pulmonibus & cordi gratissimum fuerint, & per omnes Arcae contignationes amicissime spirarent, habitudines omnium animantiam sacras atque vegetas servabant. At illuminantes isti liquores (à Noa parati in usum Arcae) quamquam forte nutriti fuerint, non tamen ulla animantia nutrire potuisse credendi sunt, eo, quod in vitreis aut crystallinis inclusi, ac obturati, nihil exspirabant, nisi quod, aequae acumen ipsum, tenue atque subtile fuit. Adhaec à viris admodum scitis atque probis, & omni fide dignissimis audivi parabiles esse quodam spiritus, qui defectum recentis aeris suppleant, ita ut eorum ope diu in angustis locis, atque penitus oclusis vivi possit: Idque aiebant fuisse viri celeberrimi Cornelii Drebellii Belgae experimentum, ad Londinum in fluvio Thamese factum; ubi non pauci viri sub aquis in opera Nave diu subsistebant; & quoties illis respiratio difficilior aut aegrior fieri caeperit, mox aperto vitro & exhalante paulisper eo spiritu, redintegrata fuit spirandi libertas, aequae ac si recens aer intrasset. Si vero sic se res habeant, facile credamus ex admirando fulgentis atque radiantis istius liquoris halitu, quo omnes Arcae contignationes impletas fuisse concipio, cuncta animantia liberum semper, etiam in exacte clausa Nave, spiritum duxisse."

¹⁰³³ Robert Boyle, *New Experiments Physico-Mechanicall, Touching the Spring of the Air, and its Effects* (Oxford: H. Hall, 1660), 106. This was quoted again and again, and informs the eighteenth-century and nineteenth-century view of Drebbel. See Samuel Reyher, *Dissertatio de Aëre Praeside Samuele Reyhero D. et P.P. Disputabit Ericus Wildesbauden Hamburgensis* (Kiel: J. Reumann, 1669), Iverso; J. N. Pechlin, *De Aeris et Alimenti defectu, et Vita sub aquis* (Hamburg: Schulen, 1676); M. Etmuller, *Operum omnium medico-physicorum* (Venice: Combi & La Noù, 1695), 722; Christian Friedrich Garmann, *De miraculis mortuorum libri tres, quibus praemissam dissertationem de cadavere & miraculis in genere. Opus physico-medicum curiosis observationibus, experimentis, aliisque rebus, quae ad elegantiores literas spectant* (Dresden: J. Christoph Zimmermann, 1709), 57; E. Dickinson, *Physica Vetus et Vera sive Tractatus de Naturali Veritate Hexaemeri Mosaici* (Hamburg: Christian Liebezeit, 1705), 488; William Derham, *Physico-theology: or, a demonstration of the being and attributes of God, from his works of creation* (London, 1714), 5-6; John Bringle, "A Discourse on the Different Kinds of Air" in *Discourses delivered by Sir John Bringle, Bart. When President of the Royal Society* (London: W. Strahan, 1783), 10. Boyle's story was quoted in innumerable eighteenth-century reference works, including Charles Hutton's *Mathematical and Philosophical Dictionary* (1795), 391, and Chamber's *Cyclopaedia*. Garmann and Pechlin were members of the Holy Roman Imperial Academy.

¹⁰³⁴ Johann, Tackius, *Triplex Phasis Sophicus* (Frankfurt: Sumptibus Johannis Petri Zubrodt, & Haered. Joh. Baptistae Schönwetteri, 1673), 7. "Unde maximi nominis Philosophus Chymicus, Cornelius Drebbelius, qui, ob inventionem perpetui mobilis, de quo ad Jacobum Angliae, Scotiae, Hyberniae, & Franciae Regem extat Epistola, adhuc in famâ est, & cui ratio conficiendi arcanum Philosophorum non incognita fuit, prout ex incomparabili illius de *Elementis tractatu*, notum evadit, capite 5 de *quintâ essentiâ*, planè illum modum non detestatur, quin potiùs approbat, additque: medicamentum illud, sive auri quintam essentiam, ita praeparatam, ad miraculum omnes morbos sanare, praeditamque esse quibuscunque facultatibus, quintae essentiae universali virtute correspondentibus."

28. "Dicis, at impossibile est, quintam habere essentiam, cum nihil posset esse sine elementis? Respondet hic *Artificium supernaturale*: coelum esse quintum elementum, non quòd sint elementa quinque; sed quatuor tantum, quorum purior substantia divis est à Deo supernaturaliter, in coelumque ad unionem redacta & impurior mansit inferius in quatuor partes posita. Quin &, *Drebbelio* teste, impossibile est elementum separare à quinta essentia, solùm necesse est, ut quinta essentia, quae est elementorum vita, triumphet de caeteris elementis & praevaleat

(devoted to the “mystery of resurrection”), Tackius cited both Kenelm Digby’s and Robert Boyle’s accounts of the liquor which Drebbel had separated from the air, saying, “To me there is no doubt, it was the concentrated spirit of air, the life of all things. . . whose power is complete, if it is changed into earth, through whose help. . . and through a secret union with the fixed & radical humor which until now has escaped notice in the ashes, a certain resuscitation of things is procured.”¹⁰³⁵

Drebbel’s liquor proved popular across Central Europe among those supporting the role of nitre (over other substances such as mercury) in respiration, combustion, motion, and life. Other Central European natural philosophers not affiliated with the Academy also picked up on Drebbel’s liquor. For J. J. Becher, Drebbel’s liquor offered proof that the air was saturated with a life-giving nitre. In his *Hermetic Duo*, J. J. Becher elaborated a system of nitre and salt (or air and sea). He cited Boyle’s account of Drebbel’s liquor, saying that Drebbel did not reveal to anyone how it was made, yet “it suffices that I have demonstrated before the whole world, & publicly documented, that there lies hidden in air the single kindling principle of life & health, and in the whole sea, in so far as it is salty, there lies hidden the principles of riches, especially of gold and of silver, in inexhaustible quantity.”¹⁰³⁶

ignis, qui est elementorum vitae domicilium. Lux enim habitat in igne, ignis in aëre, aer in aqua, aqua in terra, nec unquam haec omnino separantur; quin potius, purificata cum luce triumphant.”

¹⁰³⁵*Ibid*, “Mysterium Resurrectionis rerum sive Phasis III spei mortalium ad immortalitatem & incorruptilitatem consecratus,” 32-3. “Mihi dubium non est, fuisse spiritum aeris concentratum, rerum omnium vitam, aquam in mari mundi versantum, caelum Philosophorum, cujus pater est Sol, mater Luna: rem, per quam in triplici regno, animali, vegetabili, & minerali fiunt adaptationes mirabiles, cujusque virtus integra est, si versa fuerit in terram & (quod in praecedentibus saepius iteratum) cujus beneficio & secreta unione cum humido radicali & fixo, quod adhuc in cineribus latet, rerum procuratur resuscitatio quaedam.”

“To me there is no doubt, it was the concentrated spirit of air, the life of all things, spinning the water in the sea of the world, the heaven of the Philosophers, whose father is the Sun, whose mother is the moon, a thing by means of which wonderful adaptations occur in the triple kingdom, animal, vegetable & mineral, and whose power is complete, if it will have been changed into earth through whose help. . . and through a secret union with the fixed & radical humor, which until now has escaped notice in the ashes, a certain resuscitation of things is procured.”

Recall that according to Fernel, the innate heat burned in a union with spirit and the radical humor.

¹⁰³⁶J. J. Becher, *Centrum Mundi Concatenatum, seu Duumviratus Hermeticus sive Magnorum Mundi Duorum productorum Nitri & salis textura & anatomia Aeris nempè & Maris consideratio*, Friedrich Roth-Scholtz, ed. (Nürnberg and

Leibniz too found it believable, on the strength of Drebbel's quintessence of the air, that the "air is impregnated with nitre the same way the sea is impregnated with salt."¹⁰³⁷

In the early issues of the journal of the Academy, we find two works arguing that the spirit of the world could be found within nitre. One, "Certain Positions on the Spirit of the World" was published under the initials D.J.B. D.J.B. listed eight qualities that had to be satisfied by the "visible subject" containing the "invisible subject," the spirit of the world.¹⁰³⁸ These included having such contrary qualities as being both hot and cold, and having a magnetic attractive power. Nitre contained the destructive "fire" of gunpowder and acid,

Altdorf: Tauber, 1719), 73-4. "Hoc praevidens sagacissimus Cornelius Drebbel (cujus filiam jam senem etiamnum Londini vidi, maritatum olim cum Kuefflero *coloris scarletinae inventore*) cum navem suam construeret, quae infra aquam progredereetur; quamque proinde ubique locorum probè obturate debebat, & si hospitibus suis liberi aeris pabulum praescindere cogatur, sine quo vivere & consistere non poterant diu, ille magno ingenio, hanc *aeris essentiam* concentravit, & contraxit, vitroque inclusit. Quo aperto, in navicula sua incluso aeri tantum essentiae rursùs tribuit, quantum voluit, atque hospitibus suis inclusis ad refocillandum & vivendum necessarium judicabat. Sed *extrahendi & hunc spiritum* concentrandi *methodum* Cornelius Drebbel nec *monstravit*, nec ullum docuit; nec mihi licet margaritam indifferenter prosternere porcis. Sufficit quòd coràm toto orbe demonstraverim, & publicè docuerim, latere in *universo aere vitae & sanitatis unicum & principalem fomitem & in universo mari, quatenus salsum est, latere divitiarum, auri praesertim & argenti, principia inexhaustibili quantitate. Bibat, qui potest; Lavet, qui vult; Turbet, qui audet. Bibite Fratres & Vivite.*"

¹⁰³⁷ G.W. Leibniz, "Theoria motus concreti, Seu Hypothesis de rationibus phaenomenorum nostri Orbis," *Philosophische Schriften*, 215. "Credibile enim est, ut mare sale, ita aërem nitro quodam impraegnatum esse. Unde aër semel haustus nisi recenti mesceatur, novo hausti est inutilis, idque et Drebellii experimento confirmatur, qui essentiam quandam aëris parabat, quae aëri etiam torpido et insalubri instillata, vivificam quandam refrigerationem confestim praestabat."

¹⁰³⁸ The "visible subject" containing the invisible subject (the spirit of the world) had to satisfy eight conditions according to D.J.B. See D.J.B., "Spiritu Mundi Positiones aliquot" in Manget's *Bibliotheca Chemica Curiosa*, Vol. 2 (Chouet, Geneva, 1702), 878.

1. Una tantùm, vilis, omnibusque nota materia, à natura producta, non verò arte Composita.
2. In se continens notabilem ac insignem vim attractricem & magneticam.
3. Summam caliditatem, summamque frigiditatem.
4. Albedinem & rubedinem.
5. Et est rex & leo.
6. Draco & aquila
7. Resolubilis in liquorem suae naturae, in quo latet omnium metallorum resolutio, coagulatio, & fixatio, omniumque morborum curatio.
8. Atque in Clave 3. à Basil. Occultatâ & tacitè consignatâ Basil. De nat. & supernat. C. 3.4.6. & magn. Lap. Clav. 10. p.m. 122 & Cl. 5. p. 77. &c.

but also the life-giving heat of fertilizer. By breaking saltpetre, one could also create artificial cold.¹⁰³⁹

The contrary qualities of nitre led Robert Boyle to argue against the aerial nitre as the vital part of air.

I know that divers learned Men, some Physicians, some Chymists, and some also Philosophers, speake much of a *Volatile Nitre*, that abounds in the Air, as if that were the only Salt wherewith it is impregnated. But though I agree with them, in thinking that the Air is in many places impregnated with Corpuscles of a Nitrous Nature; yet I confess I have not been hitherto convinc'd of all that is wont to be delivered about the Plenty and Quality of the Nitre in the Air: For I have not found, that those that build so much upon this volatile Nitre, have made out by any competent Experiment, that there is such a volatile Nitre abounding in the Air. For having often dealt with Salt-peter in the Fire, I do not find it easy to be raised by a gentle Heat; and when by a stronger Fire, we distil it in close Vessels, 'tis plain that what the Chymists call *Spirit of Nitre*, has quite differing Properties from crude Nitre, and from those that are ascribed to the volatile Nitre of the Air; these Spirits being so far from being refreshing to the Nature of the Animals, that they are exceeding corrosive.¹⁰⁴⁰

However, as we have seen, contrary qualities were precisely what those looking for the subject containing the spirit of the world were looking for.

Researchers into the “fire of nature” sought a substance which could conceal contrary qualities simultaneously. The paradox of contrary qualities proved that the substance was not of a crass, elementary nature, with all of its qualities manifestly available to the senses, but that it held within it occult properties. Those looking for the “fire of nature” were especially interested in finding a substance that promoted a vital heat, and thus had nutritive and generative properties. Yet, they were also seeking a fire whose power was much greater than elementary fire, and could perform, for example, as an alkahest. Thus the

¹⁰³⁹ As Libavius wrote about halonitre in “De Extract. Essent. & Elixyr. Lib IIX” in *Syntagm. Arcan. Chymic.* (1613), 469. See Chapter Five.

¹⁰⁴⁰ Robert Boyle, *General History of the Air*, 41-2.

“exceeding corrosive” nature of the spirit of nitre, employed in the *aqua regia* to dissolve gold, offered further proof that it contained the “fire of nature.”

In his article, D.J.B. offered a typical “concordance” of alchemical opinion, showing how a range of authors from Hermes and Cicero to Paracelsus, Basil Valentine, Heinrich Nollius, and Drebbel agreed concerning the “fire of nature.”¹⁰⁴¹ However, D.J.B. argued that

¹⁰⁴¹ D.J.B., “Spiritu Mundi Positiones aliquot,” reprinted in Manget’s *Bibliotheca Chemica Curiosa* Vol. 2 (Chouet, Geneva, 1702), 876-7. “But the spirit of mercury is the spiritual essence in the air and flying from there it is the first root of metals & minerals, by which all metals & minerals are resolved into their prime matter and by which men [corrected to homines] and animals are renewed, and everything is completely cured from disease. Basil. C. 3. l.c. & p.m. 34.35. 44. This balsamic mercurial spirit is otherwise called the fire of nature, the spiritual and invisible fire, and by Cicero in *On the Nature of the Gods*. It is vital and healthful, which preserves, nourishes, enlarges, and sustains everything, while spread and diffused by the air through the entire universe, the hidden food of life (as Sendivogius says) is attracted by the inferior things. This spirit is a single thing or that monad of Hermes, by whose adaptation everything arises, that is, through a magnetic attraction, and as it were, according to the meaning of the Greek word, from a conjugal bond. And in this neither Paracelsus nor Basil differed in anything from the truthful Hermes. The spirit of mercury is the little bird of Hermes, and although it flies invisibly around in the air and rests naturally in water & earth, it is not to be sought in the elements, since the elements produce it and pose it visibly before our eyes, in a single well known thing. Basil. De nat. & supernanat. [sic] c. 2. 3. de Magn. Lap. P. m. 37. The basis and foundation of the entire philosophic work consists in the knowledge of a visible and corporal subject, since this invisible, endless and celestial spirit chooses for itself a home. Many prefer maydew, which is considered coagulated air, and called expressly by the Ulmann brothers the “nihil” of the Philosophers. Thus Nollius discovered various salts in may dew, a most sweet spirit and a most fiery oil, which through its smell alone could revive the weak and those on the brink of death. Dotardingus in his treatise on potable gold, firmly attests that he himself through the volatile salt of may dew had dissolved gold, no different than ice melted in hot water. Johann Wolfgang Dienheim prepared the Universal medicine from rain water, through which he acquired the greatest praise & ample rewards, as is witnessed in his own Treatise. Have not quite a few often visited the inmost parts of the earth with Drebbel? Since they had learned from Alsted that all earth and water contain within those little fires, which true Philosophers seek.”

“Est autem spiritus mercurii essentia spiritualis in aëre hinc inde circumvolitans prima radix metallorum & mineralium, quâ omnia metalla & mineralia in suam primam materiam resolvuntur hominis [sic] & animalia renovantur, omnesque omninò morbi curantur Basil. C. 3. l.c. & p.m. 34.35. 44. Hic spiritus mercurius balsamicus alias dicitur ignis naturae, ignis spiritualis ac invisibilis, & Ciceroni de Nat. Deor. Vitalis ac salutatis, qui omnia conservat, alit auget, sustinet, dum mediante aere per totum universum dispersus ac diffusus tanquam occultus vitae cibus (ut ait Sendivogius) ab inferioribus attrahitur. Hic spiritus est res una sive monas illa Hermetis, à quâ omnes res natae sunt adaptatione (συναρπεία) hoc est, attractione magneticâ, & veluti nexû quodam connubiali ex vi Graecae vocis. Atque in hoc nec Paracelsus, nec Basilius quicquam ab Hermete veridico discedunt. Spiritus mercurii Avicula Hermetis, etsi in aëre invisibiliter circumvolat in aqua & terra naturaliter quiescit, tamen in elementis quaerendus non est, quia elementa jam eum produserunt & visibiliter ob oculos posuerunt, in una tantùm re valdè cognita Basil. De nat. & supernanat. [sic] c. 2. 3. de Magn. Lap. P. m. 37. Basis ac fundamentum totius operis Philosophici consistit in cognitione subjecti visibilis & corporalis, quod hic spiritus invisibilis, incomprehensibilis ac caelstis, sibi tanquam domicilium elegit. Multis placuit ros maiialis, qui habetur pro aëre coagulato, & à fratre Ulmanno expressè dicitur nihilum Philosophorum. Sic Nollius in rore majali deprehendit diversa salikla, suavissimum spiritum & oleum flagrantissimum, quod solo odore infirmos, ac morti vicinos mirabiliter recreare potuit. Dotardingus in suo de auro potabili tractatu, constanter affirmat, se mediante sale volatili roris maiialis dissolvisse solem, non secus ac glacies dissolvitur in aqua calida. D. Johannes Wolfgangus Dienheim ex aqua pluviali praeparavit medicinam Universalem, qua sibi egregiam laudem & dona ampla comparavit, uti testatur proprio Tractatû. Nonnulli cum Drebelio visitarunt interiora terrae? quod didicissent ex Alstedio omnem terram & aquam continere in se igniculos illos, quos quareunt veri Philosophi.”

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the universal spirit could be found more in some visible subjects than others, and while he did not reject Drebbel's injunction to look within the earth, he preferred to track down the spirit of the world within what Basil Valentine called "the spirit of mercury" - which he interpreted as nitre. The next article in the journal, by the Polish doctor Andreas Cnöffel, rebutted D.J.B.'s interpretation of Valentine, but in so doing also cited Drebbel as a philosophical opinion.¹⁰⁴²

In Christian Adolph Balduin's *Gold of the Wind*, first published in 1673, and subsequently in the *Ephemerides* of the Academy for 1674 (printed in 1676), we find a much more extensive account – indeed, a complete chemical philosophy.¹⁰⁴³ Balduin interpreted an even wider range of authors as supporting his position in favor of nitre, including Drebbel. The crowning glory and proof of his nitre-based magnetic philosophy was his discovery of a "hermetic phosphorus" or "light magnet." Balduin's phosphorus is not considered a phosphorus at all today, but a calcium nitrate. Yet in early modern terms, the light magnet was one of the first artificial "phosphors" to garner wide acclaim.¹⁰⁴⁴

Balduin, a member of the Holy Roman Imperial Academy, sent a specimen of the light magnet to Oldenburg in London in 1676, and by February 1677, he had been elected as a member of the Royal Society as well. Balduin, or to give him his Academic cognomen, Hermes, then published a work in 1680, the *Curious Hermes*, celebrating his stature as a

¹⁰⁴² Andreas Cnöffelius, *Responsum ad Positiones de Spiritu Mundi, quod in se continet Reserationem Tumbæ Semiramidis* in Manget's *Bibliotheca Chemica Curiosa* Vol. 2 (Chouet, Geneva, 1702), 880-7. "vide Nuysement, de spir. & sale mundi tr. 2. cap. 2. pa. 65. Drebbel. De element. Natur. Cap. De terra. Basil de lap. Phil. Pag. 16.17. & Clav. 5. p. 33 it. De generat. Metall. C. 13."

¹⁰⁴³ See Christian Adolph Balduin, *Aurum Auræ, Vi Magnetismi universalis, attractum per Inventorem Anagrammatizomenum* (N.A.: N.A., 1673) and "Aurum Superius & Inferius Auræ Superioris & Inferioris Hermeticum," *Miscellanea Curiosa sive Ephemeridum Medico-Physicarum Germanicarum Academiae Caesareo-Leopoldinae Naturæ Curiosorum Annus Quintus et Quartus* (Frankfurt: Fritzschi, 1676). It was also published as *Aurum Auræ, Vi Magnetismi universalis, attractum per Inventorem Anagrammatizomenum* (Cologne: Völcker, 1674) and *Aurum superius & inferius Auræ Superioris & Inferioris Hermeticum* (Amsterdam: Waesberge, 1675) in Manget's *Bibliotheca Chemica Curiosa* Vol. 2 (Chouet, Geneva, 1702), 856-875.

¹⁰⁴⁴ Brandt's "phosphorus," discovered in 1669, was not known until 1676. See Krafft, 662.

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member of both academies and detailing the wonderful machines he built with his light magnet for both Emperor Leopold I and King Charles II. These included such wonderful phosphoric automata as a Hapsburg eagle which could rise and glow with the sun, a luminescent imperial orb glowing with the name “LEOPOLD,” and a barometric, time-telling perpetual motion complete with an artificial sun, highly reminiscent of Drebbel’s devices.¹⁰⁴⁵ An informant assured Balduin that Leopold was so impressed with the eagle that he had it placed in his *Kunstammer* or ‘Treasury,’¹⁰⁴⁶ while the demonstrations performed at the Royal Society with Balduin’s phosphorus were some of the most spectacular displays ever seen at the Royal Society.¹⁰⁴⁷

In *Gold of The Wind*, Drebbel appeared in Balduin’s canon of authors who discussed the spirit of the world.¹⁰⁴⁸ Balduin also cited Drebbel for his magnetic account of the

¹⁰⁴⁵ Christian Adolph Balduin, *Hermes Curious sive, Inventa et experimenta physico-chymica nova* (N.A.: N.A., 1680).

¹⁰⁴⁶ “. . . & S. Caesaream Majestatem, suis mihi Literis referebat, Experimentum ejus Rei sumsisse haud raro, eoque Gazophylacio suo jussisse inferri, ut ibi Caesareas inter Raritates perennare & fama autoris perpetuo splendere valeat.”

¹⁰⁴⁷ J. V. Golinski, “A Noble Spectacle: Phosphorus and the Public Cultures of Science in the Early Royal Society,” *Isis*, 80:1 (Mar., 1989), 11-39.

¹⁰⁴⁸ Balduin (1673), 19-20. “Possum hic nominare complures, qui istius Humidi radicalis Mundi in scriptis suis passim meminerunt non tantùm: è quorum sanè numero non postremus occurrit *Bernhardus G. Penotus. deinde Gerh. Dorn. Papinius in dissert. De pulv. Symp. Oswald. Crollius in Basil. Chym. Mich. Sendivogius in XII tract. D. Petrus Joh. Faber, in Pall: Spagy. Hydrogr. Spag. in Myroth. Spag. Hercule Pio-Chym. & Comp. Secret. Chym. Corn. Drebbelius de Nat. Elem. Robert de Fluctibus c.f. l.1. de Vromantia Caesar. Reniera in suo, de Mundo magico, Tractatus, Italicè confecto, lib. 1. Job. Poppius in Hedog. Chym. D. Olaus Borrichius de Ortu & Prog. Chym. Job. Verem. Rbumel Basil. Chym: Job. Rudolph. Glauberus in Pharm. Spag. Job. Lud. Gottfried in Arboniol, Chosmica, atque alii: sed & integrum hac de re Commentarium dedit Job. Robtmannus, cui, de Anima mundi & Spiritu Universi, titulum fecit.”*

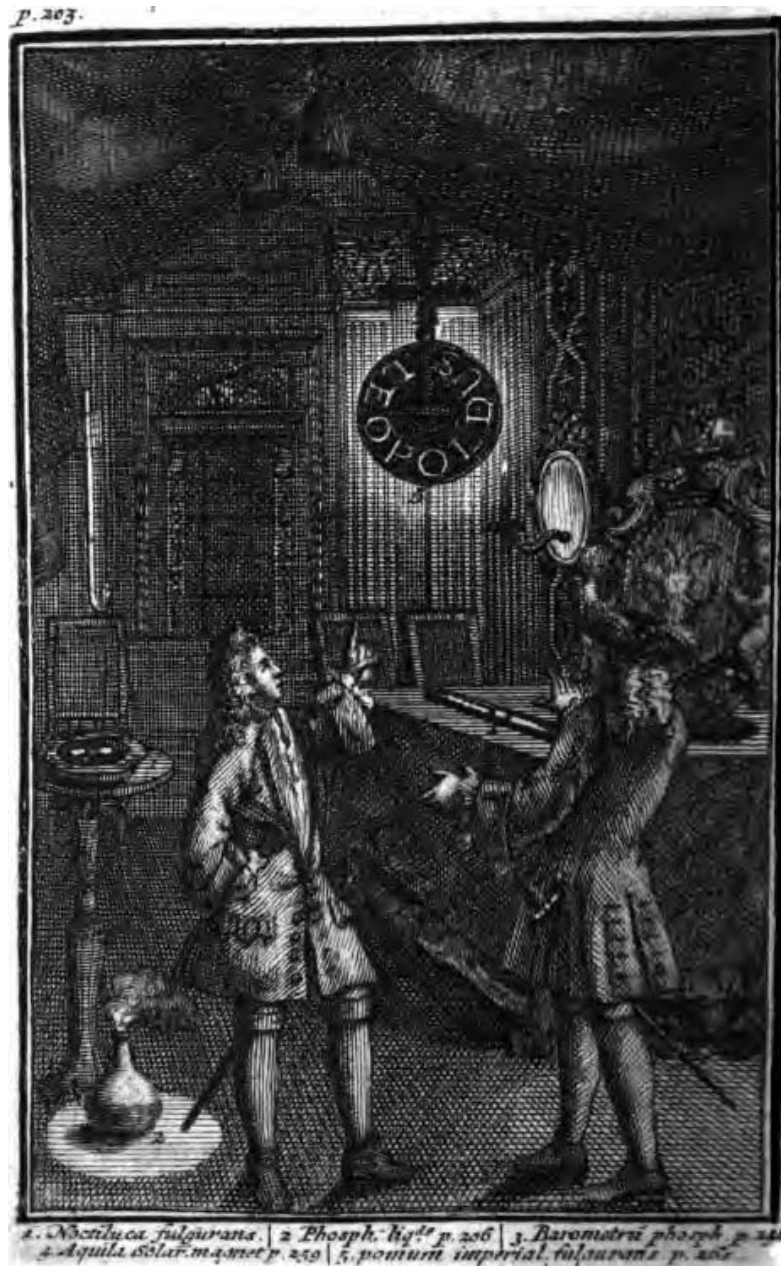


Fig. 2. Balduin's glowing inventions, from Cohausen's *Lumen*, 203, including the phosphoric barometer, the solar-magnetic eagle, and the glittering imperial orb.

transmutation of the elements, which he said Drebbel proved with examples.¹⁰⁴⁹ He argued that this revolution of the elements held and carried nitrous particles, which could be

¹⁰⁴⁹ *Ibid*, 6-7. "Vivit Aër in igne, hic in aëre, in Terra Aqua, in Aqua Terra, & denique Aqua in Aëre. Purgat Aërem Ignis, Aquam Aër, Terram Aqua; quolibet, ignis beneficio, caeteris claritatem sui communicante. Cumque, Elementa qui quaesierit pura in Mundo, oleum perditutus juxta & operam sit, quid, quò credere

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extracted from the elements. This could be proven by a chemical process for attracting the spirit of nitre or vitriol out of the air.¹⁰⁵⁰

This experiment was ascribed in the *Transactions of the Royal Society* to Robert Boyle in his *Celestial Magnet*.¹⁰⁵¹ In that work, Boyle referred in an off-hand manner to “some of the mysterious writers about the Philosopher’s stone.” To him, their writings were useful since they discussed phenomena not considered “either by the Scholastic, or even the Mechanical, Philosophers.” Boyle said he did not intend to involve himself with the “theories of the Chymists,” but to use their term of magnet to describe a phenomenon, without accepting the theories that such a term implied.¹⁰⁵² He also did not plan himself to build celestial

minus liceat, impedit: esse id, quod Aërem dicimus, Aquam tenuem, Ignem item Auram tenuem, similiter Aquam Terram tenuem, istam autem, Ignem crassum? Et è contrario: terram coagulatam aquam, aquam aërem congelatum, aerem ignem addensatum? Vid. Alphonsi Regis Clav. Sap. In Theatro. Chem. Vol. 5. p.m. 861. Hic aër sit Lympha, ea Lymphâ sit terra, & ex terrâ sit aqua. Quae singula exemplis probat *Drebbelius, De Natur. Element. Tractatus.*”

¹⁰⁵⁰ *Ibid.*, 9. “Si enim, postquam è Vitriolo vel Nitro spiritum extraxeris Colcotar ejus [uti vocant] ponas sub dio, ibique dimittas paucis diebus, & mox in Retorta reponas, adhibitis ignis gradibus novum eundemque efficaciorum spiritum elicies.”

“If after you have extracted the spirit from vitriol or nitre, and you place the Colcotar (as they call it) in daylight, and leave it there for a few days, and then put it back in a Retort, if you heat it to the proper degree, you will obtain more of that very effective spirit.”

¹⁰⁵¹ “An Account of the Increase of Weight in Oyl of Vitriol Expos’d to the Air,” *Philosophical Transactions* Vol. 14. (1684), pp. 496-506. Drebbel himself had long before brought to England an improved process for increasing the weight of vitriol without exposure to the air, but with exposure only to the spirit of nitre. See Ephraim Rinhold Seehl, “A new improvement in the art of making the true volatile spirit of sulphur,” *Transactions* (London, 1744), 42-3; Benjamin Rush, College of Physicians Ms. 10a 176 v. 2, Lecture 15, 9-10, Robert Dossie, *The laboratory laid open, or, the secrets of modern chemistry and pharmacy revealed* (London, 1758), 162.

¹⁰⁵² See Robert Boyle, *Tracts containing I. suspicions about some hidden qualities of the air: with an appendix touching celestial magnets and some other particulars: II. animadversions upon Mr. Hobbes’s Problemata de vacuo: III. a discourse of the cause of attraction by suction.* “Some of the Mysterious Writers about the *Philosophers-stone*, speak great things of the excellency of what they call their *Philosophical Magnet*, which, they seem to say, attracts and (in their phrase) corporifies the *Universal Spirit*, or (as some speak) the *Spirit of the World*. But these things being abstrusities, which the Writers of them profess’d to be written *for*, and to be understood only *by*, the *Sons of Art*; I, who freely acknowledge I cannot clearly apprehend them, shall leave them in their own worth as I found them, and only, for brevity sake, make use of the receiv’d word of a *Magnet*, which I may do in my own sense, without avowing the receiv’d Doctrine of Attraction. But this it may suffice to have glanc’d at, it not being here my purpose to meddle with the mystical Theories of the Chymists; but rather to intimate, that, without adopting or rejecting them, one may discourse like a Naturalist about Magnets of Celestial and other Emanations, that appear not to have been consider’d, not to say, thought of, either by the Scholastic, or even the Mechanical, Philosophers. Whether, as I think it no impossible thing, that *Nature* should *make*, so I think it no unpracticable or hopeless thing, that *Men* should *find*, or *Art* should *prepare*, useful *Magnets* of the exotic Effluvioms of the lower region of the Earth, or the upper of the World: It would much distress me to give any other answer, than that I think it extremely difficult, and not absolutely impossible; and therefore I would not discourage any curious or industrious Man from attempting to satisfie himself by Experiments, because even a seemingly

magnets, but he did not wish to hinder others from doing so, suggesting various observations which could be noted if such a magnet were constructed.

In comparing the works of Boyle and Balduin on the celestial magnet we find a striking difference of style. Boyle was quite open about his decision to extract the phenomena he found interesting – such as magnetism- from the chymical philosophers without the theoretical baggage such phenomena usually carry. For his part, Balduin embraced a wide range of literature, from Vranckheim, Nollius, and Libavius to Descartes. Descartes, said Balduin, had described the air as a congeries of terrestrial particles moving in a motion following the orbits of the heavenly bodies, thus supporting the idea of the spirit of the world (although Balduin conceded that Boyle interpreted this passage differently).¹⁰⁵³ And while, in his *Celestial Magnet*, Boyle suggested that the curious might consider attempting to build aerial magnets, Balduin, in a lengthy passage in *Gold of the Wind*, listed the many chymists who had already done so - from a specialized instrument which the German poet

slight discovery in a thing of this nature may be of no small use in the investigation of the nature of the Air, especially in some particular places, and of the Correspondency, which, by the intervention of the Air, the superfici., and only advertise you, that several bodies, which experience has assur'd us do imbibe or retain something from the Air, as some calcin'd Minerals, some Marchasites, some Salts, as well factitious as natural, &c. may be fit to be often exposed to it, and then weighed again, and farther diligently examined, whether that which makes the increment of weight, be a meer imbibed moisture or also somewhat else, and likewise whether it be separable from the body or not, or however have endowed it with any considerably Quality; and if you chance to meet with a good Magnet, you may then vary Experiments with it, by exposing it long to the Air in Regions differing much in Climat, or Soil, or both, by exposing it by day only, or by night, at several Seasons of the Year, in several Temperatures of the Air, at several considerable Aspects of the Stars and Planets, by making it more or less frequently part with what it has gain'd from the Air; and in short, by having regard to variety of Circumstances, which your Curiosity and Sagacity may suggest.”

¹⁰⁵³ Balduin (1673), 15. “In Aurâ etiam Materia Hermetica, sive Spiritus Mundi volitat. *Cartesius part. IV. Princ. Phil. N. 48. Lipstorpian p.3. specim. Philos. Cart. C. 2.* asserere videntur: aërem nihil aliud esse, quam congeriem particularum terrestrium, tam tenuium, & a se mutuo disjunctatum, ut quibuslibet motibus globulorum coelestium obsequantur. Licet Dn. Robertus Boyle, in *Experimentis de Aere, Exper. 1. Cartesium*, aliter interpretetur. Credendum tamen est, naturam, cui peculiaris semper fuit cura, ut indefessum Coeli ac Terrae commercium, velut admirabilis harmonia totius mundanae machinae perduraret, à primò mundi ortu etiam coelestem quandam substantiam vel materiam per universum orbem disseminasse. “

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Johann Rist built out of whalebone for capturing the spirit of the world to an experiment performed by Drebbel's sons-in-laws, the Küfflers, in London in 1658.¹⁰⁵⁴

Balduin's own "light magnet" or "phosphorus" fell within a tradition of invention of chymical magnets. He added a "certain type of earth" to the spirit of nitre, when lo and behold

On the 15th of September, 1673, at 11 o'clock during a full moon. . . after my magnet had been exposed to the air for three hours, it showed a figure corresponding exactly to a circle, remarkable in its white round margin. The body was very hard, of a yellow color, corresponding to a star, decorated inside with rays.¹⁰⁵⁵

Balduin's "light magnet" was made of nitric acid and chalk. Unlike elementary fire, it could burn cold, within water, and without air. It did display a curious relationship to air, since air turned it to a liquid. One of the main features distinguishing Balduin's phosphorus from other phosphors was considered its most important asset to its inventor, and its greatest weakness to its detractors. The light magnet could not shine on its own. It only shone when exposed to sun, candlelight, or warmth. This, to Balduin's way of thinking, was evidence of its "magnetic" qualities. Its light lay hidden within it until called forth through a sympathetic relationship with other fiery entities.

¹⁰⁵⁴ This is found in the version of *Gold of the Wind* published in the *Miscellanea Curiosa*. In this edition, Balduin added several examples of celestial magnets not included in 1673. See *Aurum superius & inferius Aurae Superioris & Inferioris Hermeticum*, Chapter Five, "De Magnete Universali, Aurum ex Aura attrahente." I cite from Balduin (1702), 864. "Quàm mirum autem earumque instrumentum istud est, cujus, Cucurbitae instar, è poroso Balenae osse, (rationem conficiendi, in *Phoenice Philosophica*, praescripsit J.R.H. *Joban. Ristius*, ex communicatione D. *Joach. Morsii Bibliothec.*) attracturum haud dubiè magneticâ vi, si chalybis scoe silicibus in pulverem redactis, extractoque è gammaris fluvialibus succo, antè macere probè. . . .Memorantem *Londini* Anno à N.C. 1658 & *Kifflerum*, D. duos, accepimus, fuisse, qui speculi caustici operâ, Solis radiis sic silices calcinarent; quas cum in edito sive monte sive turre aeri pariter libero, infundibulo contentas exposuissent, & ipsas copiosissimam, virtute magnetica, aquam attraxisse ex aere, rubeam illam quidem, ante Solem exortum; orto, albam. Quod experimenti *Doct. Frid. Clodio* literis communicavit *Jobann. Morian, Arnheimensis*, scriptis d. 20. April 1658, quarum, praecipuam partem excerptatum facta nobis copia est."

¹⁰⁵⁵ Balduin (1702), 865. "Contigit hoc A. AE CIC DC LXXIII d. 15. Sept. quem excipiebat, hora 11 noctis, plenilunium. Effusus, quô dixi, post meridiem, dic, Magnes meus aeri commitebatur, cùm effluxis omninò tribus horis, exactissimè respondens Circulo, margine & ipso orbiculari albo notabilis, se figura exeruit [*vid. Tab. XI Fig. I*]. Durissimum corpus, colore luteo, stellam referens, radiis intùs distinguebatur."

The practice of contriving forms of “icy fire” was more than a bid for patronage and fame through the construction of spectacular machines. It was part of an investigation into how chemical action could sustain life, and it drew on a large corpus of alchemical literature. Like Balduin, the Hamburg alchemist Henning Brandt discovered his form of phosphorus, what is today recognized as the true element phosphorus, while reading old alchemical texts and attempting to follow a process for the philosopher’s stone.¹⁰⁵⁶

The various phenomena exhibited by different phosphors supported different chemical philosophies. Drebbel’s perpetual motion machine had, in the early seventeenth century, been considered proof of the spirit of the world for containing within itself its own principle of life and showing a correspondence with the sun. Similarly, the particular phenomena of Balduin’s light magnet supported his version of the magnetic philosophy. Displaying his easy ability to incorporate new phenomena into ancient traditions, Balduin slipped “light” into the time-worn phrase “fire of nature.” As he wrote to the Secretary of the Royal Society, Henry Oldenburg, his light magnet contained “the most secret soul, the fire & light of nature.”¹⁰⁵⁷ Others who agreed that a vital fire burned hidden within the elements also praised Balduin’s phosphorus. The Helmontian Johann Cohausen, for instance, who believed that life depended upon the aerial nitre, praised Balduin’s phosphorus repeatedly throughout his 1717 *Lumen Novum Phosphoris Accensum*.¹⁰⁵⁸

¹⁰⁵⁶ See Leibniz’s history of the discovery of phosphorus, published in the first issue of the journal of his Berlin academy, and discussed in Krafft.

¹⁰⁵⁷ “Extract of a Letter Written to the Publisher, Concerning a Factitious Stony Matter of Paste, Shining in the Dark like a Glowing Coal, after it Hath Been a Little While Exposed to the Day-or Candle-Light” *Philosophical Transactions*, Vol. 11 (1676), 788. “Latet in Phosphoro isto ignis & luminis Naturae realis scintillula, imò secretissima anima, proindeque intrinsecus atque invisibilis Sophorum ignis, visibilem Solis ignem magnetica ratione attrahens, splendoremque ipsius vicissim in Tenebris emittens ejaculansque.”

¹⁰⁵⁸ For Cohausen discussion of Balduin’s phosphorus, see *Lumen*, 169-171 and 209-218, and of Balduin’s automata, see 258-262. Like many others, Cohausen’s belief in the aerial nitre may have been re-inforced by the story concerning Drebbel’s submarine. Cohausen cited this story in his satire *Hermippus Redivivus* (1742), translated as *The Sage’s Triumph* (London: Nourse, 1748), 141. “I could mention another Preparation from the Vital Part of the Air itself, which is a great Secret amongst these Philosophers, and is perhaps, the White Dove, often mentioned in the Writings of Philalethes, of which thus much is certain, that when the Air is once spoiled

To those who did not support a magnetic theory of the elements, such as Kunckel, the “constant” phosphorous of Brandt was the far superior to Balduin’s precisely because it did not need the presence of another form of light to shine.¹⁰⁵⁹ Similarly, Boyle argued for the superiority of Brandt’s phosphorus to Balduin’s due its constancy. Boyle too devised his own phosphorus in 1680, made, like Brandt’s, from copious amounts of urine. In contrast to Balduin’s light magnet, which did not need air to shine, and Brandt’s phosphorus which shone constantly, Boyle’s phosphorus did need air to shine. In fact, it was not even his phosphorus which shone, but upon contact with the air, his liquid emitted an “effluvium” and it was that “effluvium mingl’d with the admitted Air” which shone.¹⁰⁶⁰ Boyle used this phenomenon to explain light itself in mechanical terms. He argued that the particles of the air agitated the surface of his phosphorus, thus producing an effluvium which we see as light.¹⁰⁶¹

of this Principle, it is no longer fit for Animal Respiration, and it was by a Contrivance of this Kind, that the famous Cornelius Drebbel made that Liquor, which supplied the Place of Air in the Machine he contrived for carrying on a Kind of submarine Navigation. This Medicine, which is, as I have said, extracted from the Air, is whiter than Snow, colder than Ice, and so volatile, that if the Quantity of a Nutmeg be exposed to the Air, it is ascrib’d thereby in the Space of a few Seconds.”

¹⁰⁵⁹ See for example, Caspar Cramer, *Specimen Inaugurale De Spiritu Mundi Nitneriano* (Erfurt: Grosch, 1680). “Sunt, qui *terram Adamicam* ita dictam magnificiunt, illam viscosam, limosam, pinguem, arenosis particulis remixtam, rubro colore conspicuam, unde etiam nomenclaturam habet: Contagium Martiale saepè adest, id quod illam ignobiliorem facit. Haec terra hoc singulare habet, ut metallica corpuscula, plantulas & animalcula, in universalis insiti typi argumentum sponte sua parturiat. Alii hujus indolis terras metallicas & auríferas eligunt: Recte Drebbelius: Si modò terram attenderent Chymici, subjecti artis anxie quaerendi causa, non amplius fatigaretur, *tr. de Natura Elementorum*. Antithesis Joh. Kunckelii, insignis Chymici in *Observ. Chym. cap. 5*. non moror.” Kunckel had denied that the sun could act upon the fire held within the *terra Adamica* for the spontaneous generation of life in *Nütliche Observationes* (Hamburg: Schulte, 1676), (C4). “Von der so genandten Terra Adamica und dem Spiritu Mundi. . . . Der in der Natur hocherfahrne Philosophus Helmontius wil/ dass die Erde nichts contribuiren zu den Gewachsen. . . .” Kunckel was made a member of the Academy in 1693, under the name of Hermes III. See Ferguson, 485.

¹⁰⁶⁰ Robert Boyle, *Aerial Noctiluca*, 8. Boyle deposited his process with the Society. See Robert Boyle, “A Paper of the Honourable Robert Boyl’s, Deposited with the Secretaries of the Royal Society, Octob. 14. 1680. and Opened Since His Death; Being an Account of His Making the Phosphorus, etc.” *Philosophical Transactions (1683-1775)*, Vol. 17. (1693), 583-584.

¹⁰⁶¹ Boyle argued that Krafft’s phosphorus (ie the phosphorus discovered by Brandt) did not need agitation by air to burn since it was kept so closely packed within its vessel so that it could agitate itself and so break off particles of air to illuminate itself with. See Boyle, *Aerial Noctiluca*, 38-9.”

When it came to devising forms of chymical light, the members of the Academy such as Balduin, who drew not only on extensive chymical techniques but an expansive theoretical literature, were far more advanced than those employing mechanical explanations in the Society. Yet, as we can see from the review of the issue of the *Ephemerides* published in the *Transactions* of the Royal Society, members of the society were not interested in Balduin's theoretical framework, skipping completely over the content of *Gold of the Wind*, and describing instead the short text Balduin included after *The Gold of the Wind*, which listed the phenomena seen within the light magnet.¹⁰⁶²

Drebbel offered an optimistic vision of easy, delightful, and instant knowledge of nature through the construction of physico-mechanical devices. The Hartmann school, based on Johann Ernst Burggrav's own eye-witness testimony, celebrated the universal autopsy offered by simply playing with Drebbel's machines. In a Hermetic universe in which what was above was the same as what was below, central European alchemists sought the greatest mysteries of philosophy within material constructions, from Drebbel's perpetual motion to Burggrav's blood-lamp and Balduin's phosphorescent automata.

The pansophic, empiricist, and collaborative philosophical ideals already flourishing in semi-Ramist central Europe migrated to England through the activities of the Hartlib circle. There they merged with the more hierarchical program outlined by Francis Bacon. In

¹⁰⁶² "An Account of some Books: I. *Ephemeridum Medico-physicarum Germanicarum* ANNUS IV & V, Anni 1673 & 1674, &c. Cum Appendice: Fracofurti & Lipsiae, 1676," *Philosophical Transactions*, 11(1676), 744: "Some observations of Dr. Balduin; concerning 1. the Regermination of Silver, by a new artifice; 2. the Urns of the pagan *Germans*. 3. a Factitious stone, shining in the dark, after it hath been a while expos'd to the Sun, as the natural *Bolonian* stone is said to do, though that artificial one is affirmed to do it in a more excellent manner, forasmuch as, when after the imbibition of the Solar light it is cast into a glass-full of Spirit of Niter, it doth notwithstanding shine in the dark; and that more is, when 'tis taken out of the said liquor, and dried again in the dark to make it lose its light, and then put again into a glassfull of cold water, and exposed to the day-light, it will for all this resume a splendid brightness even in the cold water itself: Again, being again taken out of the cold water and dried, and deprived of its light in the dark, and then put into a hot oven, it will there recover its light, though the room be dark. There is further mention'd and described in this work Dr. *Mentzelius* his Tract, comparing this Shining stone of D. *Balduin* with that of *Bolonia*, as also, Dr. *Wedelius*'s Experiments about the Extraction of the Volatil Salt of *Tartar*; long since performed here by Dr. Daniel Cox, whom he also cites for it."

Chapter Six: The Booklet of Nature

England after the Restoration, the carnivalesque overthrow of authority by enthusiastic artisans appeared more threatening than promising. While English philosophers still participated in a vast network of philosophical interest and material exchange, they carefully cultivated the civility of a closed circle composed of sober, gentlemen philosophers.

- I: Introduction: Building Credit by Sharing Authority
- II: Bees and Spiders: Local Production and International Exchange
- III: Hunting for Intimacy
- IV: Paratexts or Pretexts?
- V: Collecting Collectors

I: Introduction

We have traced Drebbel's own claim to authority, cast before an ideal audience of strangers who shared his love for knowledge, each other, and God. We have also seen how, in a variety of media, those strangers invested their own authority in Drebbel, by taking up, citing, and re-characterizing his persona, inventions, and philosophy. Peter Lauremberg expressed this investment in his dedication to George Schumacher of his translation of *On the Nature of the Elements*.

Lauremberg compared books in general, and Drebbel's in particular, to coins. A prince takes care that his coins go out into common circulation (in vulgus) stamped with his particular emblem. We do the same with books, by means of which men of some erudition and fame circulate, to the profit of the Republic of Letters. We carefully handle, inspect, and turn over both books and coins. If they bear something memorable on their front, we read them, and we interpret them, each according to his own inclinations and talent (genius). We don't need to seek far for an example. Take this little work on the Elements by Cornelis Drebbel. Who hasn't handled it with a careful and diligent hand in the past few years?¹⁰⁶³ Unfortunately, continued Lauremberg, efforts to interpret this work have been hindered by

¹⁰⁶³ Cornelis Drebbel, *Tractatus Duo* (Hamburg: Carstens, 1621), preface. "Quod cum nummis, Prudentissime Schumachere, quos sub peculiari emblemate percussos in vulgus ire curat princeps, idem assolet fieri cum libellis, quibus viri eruditionis & famae alicuis promotum eunt emolumentum publicum rei literariae. Vtrosque curiosè tractamus, inspicimus, vertimus, & si quid memorabile prae se ferunt, legimus; quisque etiam ad arbitrium genii sui interpretamur. Exemplo esse potest (ne petam longiùs) opusculum hoc Cornelii Drebellii de Elementis, quod sollicità & diligenti manu quotusquisque non tractavit paucis retro annis?"

the fact that it appeared in Dutch, which many people don't understand, and that its first German translation was quite awful and did not follow Drebbel's own opinion (*sententia auctoris*).¹⁰⁶⁴

The comparison between the impression of coins and the printing of books was not uncommon. Henry Peacham, for instance, employed it to suggest that we find books whose contents are not original still interesting and collectible, just as we collect curiously stamped coins although they contain the same silver as any other coin.¹⁰⁶⁵ With his use of the metaphor, however, Lauremberg did not mean to suggest that Drebbel's work was an old dish "drest after a new fashion." He found the writing, and the type of author to be fundamentally new, although he did relate the work to ancient philosophy.

Rather Lauremberg pointed to the many agents involved in a process of circulation and uptake which was to the benefit of all. The author impressed himself upon his work, employing his own authority to render it a desirable form of currency. Everyone else eagerly took up the work, exercising their antiquarian skills to physically inspect the work, and applying their particular genius to its interpretation. This investment of both the particular ideas of the author and those of his readers enriched the Republic of Letters.

Yet the labor of producer and consumer which kept the currency of letters afloat could be disrupted if the workers at the "mint" were not equally invested. They were responsible for minting a coin that was both physically attractive, clearly intelligible, and an

¹⁰⁶⁴ *Ibid.* "Hoc solum faciliiori eius intellectioni obstare videbatur, quod Belgicè esset conscriptum, quam Dialectum non omnes aequè capiunt. Itaque inventus est haud ita pridem qui cum libellum Germano habitu produxit in scenam; sed infelici prorsus & ridiculo conatu. Nam neque sententiam auctoris assequutus est, ubi nervus & ipse succus ac spiritus argumenti delitescibat, neque omnia transtulit, neque satis dilucidè aut Germanicè."

¹⁰⁶⁵ Henry Peacham, *The Compleat Gentleman* (London: Francis Constable, 1622), Preface to the Reader. "But as rare and curious stamps vpon Coynes, for their varietie and strangenesse, are daily enquired after, and bought vp, though the Siluer be all one and common with ours: so fares it with Bookes, which (as *Meddailes*) beare the Pictures and deuices of our various Inuention, though the matter be the same, yet for variety sake they shall bee read, yea (and as the same dishes drest after a new fashion) perhaps please the tastes of many better."

accurate impression of the prince's authoritative emblem. If they did not do their work properly, the collectors would either not be interested in the piece, or they would base their own interpretations on a misrepresentation of the prince.

The work of translation was especially important, since the translator was a reader whose interpretation would form the basis for the interpretations of all others. If his own genius was deficient, or if he was insufficiently careful, he acted as a counterfeiter, issuing a false likeness instead of the valuable imprint of the prince. The circulation, investment of identities, and collaborative exchange structuring the Republic of Letters depended upon the translator and all other members of the "mint."

While in previous chapters, I have followed the prince (Drebbel) and his collectors (*liebhebers*), here I draw attention to the importance of literary agents. We have already encountered Johann Ernst Burggrav and Joachim Morsius, These were but two of the many individuals invested in producing the over twenty editions of Drebbel's works. Literary agents felt as invested in associative ideals as the *liebhebers*, and indeed, also described themselves as *liebhebers*. By transferring ideals drawn from the Republic of Letters to alchemy, such agents helped to put in circulation new currencies, investing authors, readers, and themselves in building a new *res publica chymica*.

II: Bees and Spiders: Local Production and International Exchange

In her wonderful study of the dense world of science in Elizabethan London, Deborah Harkness has shown how print might obscure the socially diverse networks that produced knowledge locally. When authoritative individuals offered the honey of natural philosophy as their own, a buzzing hive of scientific activity faded from view. Harkness argued that "as natural knowledge became a commodity that circulated outside the social

networks that produced it, and came to be credited primarily to the author who made that knowledge more widely available through print culture, it became inextricably bound to the emerging identity of the public man of science.”¹⁰⁶⁶

Yet on an international scale, print could also serve to build and publicize exchanges taking place across vast distances and far from closely imbricated settings of knowledge production. The international public created by print allowed individuals who might be socially excluded in their own local settings to gain authority. At the same time, those individuals also shared authority with the editors, translators, and intelligencers who kept the spiderweb of international exchanges trembling with activity. The ties of these far-ranging networks should not be disregarded because they were loose.¹⁰⁶⁷

Networks of knowledge production did not end once an author decided to bring a work to the press. Printing was itself a craft requiring extensive and socially diverse relationships. Even after the book left the printers, it was the reader who chose to invest the book with authority and who decided how it should be used.¹⁰⁶⁸ In an era before print alone made a work seem credible, the makers of the book might seek to gain credit by emphasizing the artifactual nature of the book and pointing to the many agents involved in its fashioning.

In the early modern boom in alchemical publishing, we find an arena of international activity and shared authority represented in the ideal of an alchemical republic. Due to a preference for personal initiation by a master, alchemy had been slow to reach the press.¹⁰⁶⁹ In the early seventeenth century, alchemy entered the academy. In order to merit a place in

¹⁰⁶⁶ Deborah E. Harkness, *The Jewel House*, 241.

¹⁰⁶⁷ David Lux and Harold Cook, “Closed Circles or Open Networks?: Communicating at a Distance during the Scientific Revolution,” 202.

¹⁰⁶⁸ Adrian Johns, *The Nature of the Book* (Chicago, 1998) and Harold Cook, *Matters of Exchange* (New Haven, 2007), 376.

¹⁰⁶⁹ R. Hirsch, “The Invention of Printing and the Diffusion of Alchemical and Chemical Knowledge,” 115-141.

the encyclopaedia of knowledge, alchemy had to become accessible.¹⁰⁷⁰ Alchemical letters now gained the rules of intellectual commerce assumed in other liberal disciplines.

Drebbel was a fly caught in the web of international exchange. Through the seventeenth and eighteenth centuries, his extremely slender tracts saw an astonishing number of editions in German, Dutch, Latin, and French. Furthermore, these slim volumes soon grew in size. The printed editions of Drebbel's works quickly grew in girth due to two related phenomena. Academic alchemists translated Drebbel's slim vernacular writings into Latin, freighted the text with scholia, and published them within heavy scholarly folios and concordances.

The new status of alchemy also furthered claims of openness and intelligibility in print ventures outside the walls of the academy. Extramural literary agents expanded the contents of Drebbel's editions through extensive paratexts. Paratexts had long served to establish the credit of an edition by demonstrating the communities that helped bring an edition to the press.¹⁰⁷¹ Literary agents now integrated alchemical works into their publishing networks in the Republic of Letters at large. They filled the paratexts of their editions with explanations of the new accessibility and certainty required for alchemical works. In a print marketplace where many editions of popular works might be available, printers and editors had to establish their own editions as definitive.

The alchemist and editor Pierre-Jean Fabre detailed every step of producing his edition - from the initial travel that acquainted him with the source of the text, to the search for a qualified translator, the inspection of his translation, the choice of the printer, and the

¹⁰⁷⁰ Hannaway, *The Chemists and the Word*.

¹⁰⁷¹ J.W. Binns, *Intellectual Culture in Elizabethan and Jacobean England: The Latin Writings of the Age* (Leeds: Francis Cairns, 1990), 169; Hilmar Pabel, "Credit, Paratexts, and Editorial Strategies in Erasmus of Rotterdam's Editions of Jerome," *Cognition and the Book: Typologies of Formal Organisation of Knowledge in the Printed Book of the Early Modern Period*, Karl A.E. Enenkel and Wolfgang Neuber eds. (Leiden: Brill, 2005), 217-256.

inclusion of his own commentary.¹⁰⁷² It was in Antwerp in 1634 that Fabre came across a German edition of Basil Valentine and Cornelis Drebbel published in Erfurt in 1624. He decided to have it translated “faithfully” into Latin, since many people do not properly understand the German vernacular.

After many years, Fabre found a very learned German named Spiegel in Toulouse who could translate it for him.¹⁰⁷³ This appears to be the same learned Spiegel who tutored the Bishop of Lodève, François Bosquet, in Hebrew and assisted him and Joseph de Voisin in the production of the 1651 edition of Raymund Martini’s *Pugio Fidei*.¹⁰⁷⁴ Having examined Spiegel’s translation, Fabre decided to have the work printed on the spot in Toulouse, since people there were very knowledgeable about alchemical affairs and would prevent errors creeping into the text and misleading the unwary. Finally, he decided to append his own commentary to the text, so that it might appear even more beautifully upon the public stage.

Fabre emphasized the amount of work and the expenses of travel he had invested in his edition. The reader need only stay comfortably at home and read this one book, which, both compendious and clear, would serve as a key to all other alchemical writings, including his own.¹⁰⁷⁵ Fabre encouraged the reader to communicate any other worthy writings to him,

¹⁰⁷² On Fabre, see Joly, *La rationalité de l'alchimie au XVIIe siècle*.

¹⁰⁷³ Fabre’s letter to the reader in Basil Valentine, *Currus Triumphalis* and Cornelis Drebbel, *Tractatus de natura Elementorum*. “Dum igitur Autuerpiae essem anno Christi 1634. Inveni librum Fratris Basilii Valentini Monachi Benedictini, cui Titulum fecit Currus Triumphalis Antimonii. Cui uncti errant alii multi, Idiome Germanico, conscripti, hunc ergo librum habere curavi ut nacta occasione ipsum fideliter in latinam traducere percurarem: tandem post multos annos tolosae inveni doctissimum virum nomine Spigellium natione Germanum, omnia doctrina & varietate linguarum perornatum qui pretio conductione, hunc librum cum aliis omnibus sibi vinctis fideliter mihi transtulit, quo perlecto, typis excudendum illico iudicavi, ob multitudinem Arcanorum ibi latentium, ne Chymiae alumni imo & patres tanto opere frustrarentur: Et ut ornatius in lucem publicam emergeret, commentis meis, & expicationibus exornandum iudicavi.”

¹⁰⁷⁴ Bergin, *The Making of the French Episcopate*, 282-3.

¹⁰⁷⁵ “Quapropter benevole Lector, habes hoc in volumine quicquid omnes alii libri continent, & complectuntur de arcano lapide Philosophorum & de tincture metallicis, quae ad artem nostram pertinent, fideliter traductum & copiose a me ipso exornatum, variis explicationibus ad marginem appositis, ut Aenygmata chymica & gryphos enodatos habeas & tenebras ipsas chymicas sole ipso clariores elucentes videas, & ut opera etiam reliqua mea omnia intellectu tibi facillimia sint; Nam quae ibi commentatus sum & explicavi, inservire possunt intelligendis reliquis omnibus Chymicorum libris & praesertim meis.”

particularly those written in exotic languages such as Hebrew, which he could get Spiegel to translate.

He argued that interpreting the enigmas of alchemical writings, translating them out of inaccessible languages, and circulating them to all corners of the globe was necessary to defend the “*Res Publica Chymica*” against charges of secrecy and mystification.¹⁰⁷⁶ The commerce between alchemists must be free in order to prove that their discipline was indeed a noble one surpassing all other arts and sciences. He himself, Fabre claimed, had spared no expense advancing the circulation of alchemical writings.

Pierre-Jean Fabre promoted the international trade of printed alchemical works in the paratexts of his edition and pointed to all the individuals involved in the free and international commerce of alchemical letters – from those who discovered writings to those who translated, corrected, commented upon, and printed them. Yet he had little access to those who originally produced the works appearing in his Toulouse edition. Despite all Fabre’s efforts, his edition included an egregious error in the identity of the author himself. Readers were shocked at the error. As Elias Ashmole wrote,

The learned Faber (1646) bestowed much Paines and Cost in publishing to the world *Basilius Currus Triumphalis*, and others, in one *Volume*. . . . But I must needs tell the *Reader* that in pag. 338 and so to the end, he [Ripley] is by *mistake* called *Triplanus* instead of

¹⁰⁷⁶397. “Habes amice Lector quamplures Authores hoc in volumine contentos rarissimae doctrinae, & qui continent quicquid in Chymica arte exoptari potest, fideliter ex Germanico Idiomate in latinum versos & traductos a doctissimo viro Domino Spigellio natione Germano, qui iam Tolosae commoratur, & interpret est linguarum Hebraicarum, si forte fortuna Lector benevole habes aliquos codices Chymicae artis exotica lingua conscriptos, fac quaeso ut ipsos habeamus ut ipsos interpretari faciamus, ut lucem videant ampliorem, non enim omnes exoticas illas linguas, & Septemptrionales intelligent, quare in umbra & plaga Septentrionali manent sepulti & frigore obducti, necesse est ut versis Meridiem, Occidentem & Orientem pergant, ibique exalescant, & luce clariori & fortiori Illustrentur, sic Respublica Chymica, fiet locupletior & majori & multo ditiori supellectili exornabitur: Ego autem nullo pacto sumptibus parcam nec per me stabit quin Chymicae artis alumni fructibus uberrimis potiantur, sic si commercium inter chymicos liberale fiat ita ut & libri de Chymia secreti & Arcani communicentur, & in lucem prodeant, & sic quod occulti & obscurim ipsis est conscriptum, ab his qui logogryphos & Aenygmata Chymica intelligent, interpretetur, non est dubium quin inde uberimus exurgat fructus in Chymiae alumnus, & quin inde etiam Alchymiae quae nobilissima est, & caeteras omnes artes & ciencias nobilitate antecellit, ab omnibus disquiratur & exoptetur & quin calumiae omnes quae immerito illi attribuuntur, citissime evanescent, & earum loco, laudes ingentes consurgant.”

Riplaeus. There are other the like notorious faults which the *Printer* (most likely) is guilty of, as giving *Isaac Holland* the name of *Irsacus*. *Cornelius Drebbel* he prints *Tornelius*, (and sometimes *Fornelius*) *Prebellianus*;¹⁰⁷⁷

Another one of Drebbel's editors, Joachim Morsius, had a far more intimate relationship with the author. The paratexts of Morsius' editions pointed to another way in which editors argued for a more open commerce of alchemical letters. Anne Goldgar has described the eighteenth-century republic of letters as a network of personal relationships where the capture and control of information from famous men was paramount. The information gained was more important for proving a relationship to a celebrated source than for its intellectual import. The most trivial writings by literary personalities fed the appetites of a reading public eager for intimate details about the luminaries of the republic of letters.¹⁰⁷⁸ In the early seventeenth century, the literary agent Joachim Morsius satisfied such curiosity and proved his connections through the publication of personal letters and sundry small treatises.

The son of a wealthy Hamburg goldsmith, Morsius received a fine humanist education and exposure to hermetic philosophy at the hands of Eilhard Lubinus (1565-1621) at the University of Rostock.¹⁰⁷⁹ After his university studies, Morsius toyed with the idea of travelling to France and Italy for his academic peregrination, but eventually settled on the Netherlands and England instead. He selected Leiden, home to ample academic luminaries and publishing houses, as a convenient springboard into the life of a literary agent. At the

¹⁰⁷⁷ Elias Ashmole, *Theatrum Chemicum Britannicum* (London: Grismond, 1651), 456.

¹⁰⁷⁸ Goldgar, *Impolite Learning*, 144.

¹⁰⁷⁹ On Lubinus' controversial hermetic work, *Phosphorus*, see Schmidt-Biggeman, "Eilhard Lubins Begriff des Nihil." On Lubinus' atomism, see Christoph Lüthy, "The Fourfold Democritus on the Stage of Early Modern Science," 463.

time, booksellers from Holland were rapidly expanding their share of the international book market at Frankfurt, and Morsius had many printing houses to choose from.¹⁰⁸⁰

As a form of open recommendation letter, Lubinus had written a poem commending Morsius and addressed to Leiden professors Paulus Merula and Dominicus Badius in Morsius' *album amicorum*.¹⁰⁸¹ Morsius inscribed the *Album studiosorum* of the University as a student of "polymathy" in 1618. Moving between the world of the printing house and the university, Morsius rapidly built a relationship with the Marcus and other presses, editing the personal letters of great Leiden luminaries such as Scaliger and Clusius and other short tracts.

So far, there was nothing greatly unusual about Morsius' career, but it was about to take a surprising turn. Having read the Rosicrucian tracts, Morsius became excited about the possibilities alchemy offered for the reformation of knowledge. He decided to explore the world of alchemical publishing, and he chose to pursue the manuscripts of Drebbel for his first edition. Drebbel's *On the Nature of the Elements* had already appeared in two German editions, one in Leiden and one in Morsius' hometown of Hamburg.¹⁰⁸²

III: Hunting for Intimacy

Before undertaking his trip to England where he would meet Drebbel himself, Morsius pursued the literate, wealthy, and alchemically inclined associates of Drebbel's early days in Holland. He first sought out the reclusive, wealthy and highly learned alchemist Daniel van Vlierden of Haarlem (discussed in the Introduction). He visited Daniel van Vlierden at his "eremitic museum" in Niedorp in September, 1619, when van Vlierden

¹⁰⁸⁰ Chartier, "Magasin de l'univers ou magasin de la République?," 292.

¹⁰⁸¹ Morsius, Lübeck MS. 4a 25, 2, 209v.

¹⁰⁸² Drebbel, *von der Natur der Elementen* (Leiden, 1608) and *von der Natur der Elementen* (Hamburg, 1619).

inscribed Morsius' album with the version of the *Emerald Tablet* found in the pseudo-Aristotelian *Secret of Secrets*.¹⁰⁸³ A month later, Morsius had van Rietwyck sign the book as well. Around van Rietwyck's inscription, Morsius noted that Drebbel had written a letter to Rietwyck on the "optico speculo" (known today as Drebbel's magic lantern display) which had been printed by Gottfried Hegenitius, and that he owed Drebbel's *On the Quintessence* to Rietwyck.¹⁰⁸⁴

Morsius refers to a short tract by Drebbel on the preparation of various quintessences Morsius published in 1621 in Hamburg, with a dedicatory letter signed March, 1620 from Leiden. Morsius dedicated the work to the academic alchemist, Heinrich Nollius (discussed in Chapter Six). Morsius explained to Nollius how he decided to join a knowledge of nature and hermetic medicine to his study of public law, philology and sacred and profane history. He believed his new studies would benefit both himself and the public, and undertook a voyage to Britain, which was the surest way to reach the "golden fleece." The first evidence of his foray into alchemical letters was this little work of Drebbel's, which he asked Nollius to accept. He also requested that Nollius send regards to his famous colleagues at Steinfurt, Guinand Rutgers and Clement Timpler, and he further promised to send more works by Drebbel within a few months.¹⁰⁸⁵

¹⁰⁸³ Morsius, Lübeck MS. 4a 25, 2, 223v, "in Museo suo Eremitico."

¹⁰⁸⁴ Morsius, Lübeck MS. 4a 25, 4, 833v, "excusa epistola Cornelis Drebbelii ad Isebrandt Rietwyck (cui eius tractatum de quinta essentia debemus) de mirabili optico speculo a se invento in Itinerario Gotfridi Hegenitii." For Drebbel's letter to Rietwyck, see Hegenitius, *Itinerarium Frisio-hollandicum*, 73.

¹⁰⁸⁵ Cornelis Drebbel, *De Quinta Essentia* (Hamburg: Carstens 1621), Morsius' preface. "Cum juris publici, Philologiae & historiarum sacrarum, profanarum, omnium gentium studio, Excellentissime Nollii, mire mihi placuit accuratam Naturae Medicinaeque Hermeticae cognitionem conjungere. Serius quidem quam par erat, serio tamen, & ut confido non sine meo ac publico emolumento. Multum certe debeo nupero Britannico meo itineri, nec me suasore ullus ad aureum vellus petendum, famosam Colchidis insulam accedet. Cape mei in his literis profectus specimen primum, Drebbelianum Hoc Eruditissimum opusculum, mittentur ad te intra menses aliquot, munuscula eiusdem notae alia. . . Vale animae dimidium meae ac Me totum tuum esse existima, plurimumque à me salvere jube celeberrimos collegas tuos, Guinandum Rutgersium & Clementem Timplerum Dab. festinanter Lugduni Batavor. A.C. MDC XX Mens. Mart."

Indeed, a few months later, Morsius published a second edition of Drebbel's works, which now also included Lauremberg's translation of *On the Nature of the Elements*.

Lauremberg had prepared this translation a few years previously, at the request, he said, of some Hamburg physicians. Lauremberg had already dedicated the work to the Luneburg senator George Schumacher. Morsius merely appended his own dedication to Schumacher, describing how he had first been introduced to him by Heinrich Nollus. Indeed, Nollus signed Morsius' album in Hamburg (28th August, 1620). Morsius asked Schumacher to send regards to the learned Johann Adolph Tassius, and hoping that he and Schumacher might be joined in an ever closer relationship ("meque porro inter *Tuos*, quos arctius amore prosequeris, aetatem numerare perge").¹⁰⁸⁶

As it transpired, Schumacher went on to serve as an important contact for Morsius. It was he who "freely communicated" to Morsius the manuscripts of Alexander van Suchten which Morsius published in 1621. Never one to lose an opportunity to strengthen and expand his relationships, Morsius dedicated the van Suchten edition to Melchior Breler, the Hamburg physician who had been busy circulating Morsius' editions of Drebbel among his acquaintances.¹⁰⁸⁷

¹⁰⁸⁶ Cornelis Drebbel, *Tractatus Duo* (Hamburg: Carstens, 1621). "Gloriosissime vir, post discessum a patria tua urbe, cujus tu Pater immortalis tua cum adorea perpetuo appellandus, Henrici Nollus nostri laudatissimi, quo duce primum in aedes amicitiamque tuam deveni, ea in me praesentem & absentem comitate usus, ut credam te unum me elegisse, in quo humanitas tua vires suas experietur & defatiget. Quid reponam vero eximio tuo affectui, mea sedulo cuncta recensens, non reperio. . . . Exigui at religiosi pignoris loco obligati tibi aeternum mei pectoris, DREBBELIANOS hosce libellos, quos hac forma conjungendos suaserunt amici, sereno a me vultu suscipe, quorum primum a multis jam annis a praeclarissimo ejus interprete P. LAUREMBERGIO nostro, honori tuo destinatus fuit, meque porro inter *Tuos*, quos arctius amore prosequeris, aetatem numerare perge. VALE PROSPERITER

Ornamentum aevi nostri illustre, Esquisitae doctrinae virum, I. Adolphum Tassium, pl: a me saluta. "

¹⁰⁸⁷ Alexander van Suchten, *De Vera Medicina* (Hamburg: Carstens, 1621), preface. "Georgius Schumacherus noster, Reip: Lunaeburgensis Senator prudentissimus, liberaliter mecum communicavit." In Morsius' album, 4, 457, we find a letter from the nobleman Cuno de Heuniken, dated the 14 January 1623, relating how two years previously he had received two Drebbelian treatises edited by Morsius from Melchior Breler. "Annus jam unus & ferè alter est, cum Tractatui Drebelliani . . . tuâ Morsi praestantissime operâ et cura editi ex liberalitate excellentissime Breleri ad manus meas pervenerint."

In addition to *On the Quintessence* and *On the Nature of the Elements*, Morsius also published the letter Drebbel wrote to King James I describing his perpetual motion machine. He wrote yet another dedicatory letter for this short offering, seizing the opportunity to cement old relationships and forge new ones. He dedicated the work to the great “theosoph” Daniel van Vlierden, recalling how before he had set out for Britain, he and van Vlierden had enjoyed such wonderful conversation about the “mysteriarch” Drebbel at van Vlierden’s “eremital retreat.” Morsius mentioned how he had received the previous work on the quintessence from Isbrandt van Rietwyck, which he has now printed for the “common use of the supporters of genuine chymistry.” He also advertised another connection which might tempt van Vlierden. He had received the letter to King James from the famous Hungarian alchemist at London, Jan Banfi Hunyades, who was now a very intimate friend of his.¹⁰⁸⁸

In each small tract Morsius published, he spun out his web of contacts further and further. He dedicated every piece of Drebbeliana, and in each dedicatory letter he advertised how he received the piece, mentioned mutual acquaintances to the dedicatee, and suggested future collaborations. Notably, Morsius did not receive any of the texts he published from Drebbel himself, although he had met Drebbel in London in 1619.

Morsius also went beyond dedicatory letters in his campaign to advertise and extend his dizzying array of relationships. He included numerous liminary poems praising not

¹⁰⁸⁸ Cornelis Drebbel, *Epistola* (Hamburg: Carstens, 1621), preface. “Theosopho Eximio, /Dn. Danieli/ A Ulierden/ Joachimus Morsius/ S.P.D./ Saepissimè in memoriam redeo congressus nostri suavissimi, in sacro tuo secessu eremitico, ante Britannicam meam perfectionem de mysteriarchâ omnium seculorum commendatione dignissimo, Cornelio Drebbelio. Ejus *Tractatum insignem de quintâ essentia*, ab optimo & rarissimae eruditionis J. C. Isebrando Rietwyck Alcmariâ ad me directum his diebus in communem usum cultorum sincerioris chemiae produxi. Audaciae huius honestae, vel potius confidentiae amoris, autor praeclarè de me meritis, qui hactenus nihil mihi unquam denegavit, veniam quoque haud difficulter concedet. Editionis autem huic cum adjungere constituerim ejusdem praefati nostri Drebeli praestantissimi Epistolam ad sapientissimum Angliae, Scotiae, Hyberniae & Franciae Regem Jacobum, de perpetui mobilis inventione scriptam, mihi à sagaci & industrio naturae indagatore, Ioanne Ungaro Hunniadino, familiare meo carissimo, Londini oblatam tibi eam dicare mihi visum.”

Drebbel, but himself. In fact, about thirty percent of Morsius' edition of Drebbel was not written by Drebbel, but either by Morsius or by third parties praising Morsius. These liminary poets came from a diverse population, including noted alchemists such as Michael Maier, Hadrian van Mynsicht, and Johann Grassaeus, but also professors, noblemen, poets, clerics, and lawyers.¹⁰⁸⁹ Each poem was signed and dated, recalling *album amicorum* inscriptions. Indeed, the inscriptions of Peter Finxius, Ambrosius de Bruyn, and Johann Grassaeus can be traced back to the surviving three volumes of Morsius' four volume album [Fig. 1].

In making his selections of liminary poems from the hundreds he had already included in his massive album, Morsius integrated distant and varied individuals in what seemed a united chorus of praise for himself and his edition. In fact, Grassaeus was at the time engaged in a polemic with Michael Maier, yet Morsius joined the two feuding alchemists in seemingly unanimous approbation.¹⁰⁹⁰

In selecting Grassaeus' poem, Morsius might also have had another motive. He always recorded the accomplishments or publications of the inscribers in his album around their inscriptions. Under Grassaeus' inscription he noted that he was the author of a work entitled the *Arca aperta* of 1617. Morsius reproduced part of Grassaeus' inscription in his

¹⁰⁸⁹ Morsius' first edition of Drebbel's works had liminal poetry signed by professor of medicine Petrus Finxius (Phil. & Med. Doctor Professor in inclitâ Ernestinâ Rostockiâ), the Dutch poet active in London Ambrosius de Bruyn, the Polish baron and alchemical enthusiast Martin Gorasky, the famous alchemists Michael Maier (Holsatus Comes Palat. Medic. Doctor, Rudolphi quondam Imperatoris & diversorum Principum Archiater), Hadrian van Mynsicht (also a poet, Philosoph. & Medic. Doctor. P.L.C. & Illustrissimorum Brunswicensium ac Lunaeburgensium, & inferioris Saxoniae ducum Consiliarius & Archiater), and Johannes Grassaeus (also a lawyer, J.U.D. & Reverendissimi Archiepiscopi coloniensis consiliarius), as well as the cleric Gerhard Culmann, the poet Georg Heinrich Berkenduscius, and the lawyer and poet Christopher Schwanmann (JC. Sundicus Reip: Buxtehudensis). The expanded second edition contained liminal poetry signed by Schwanmann, Paulus Blocius (Rector Scholae Lunaeburgensis), Gerhard Culmann and Berkenduscius.

¹⁰⁹⁰ Erik Leibenguth, *Hermetische Poesie des Frühbarock*, 39.

editions of Drebbel's works, including his own comment noting Grassaeus' authorship of the *Arca aperta* [Fig. 2].¹⁰⁹¹

The *Arca aperta*, despite its Latin title, was, like Drebbel's *On the Nature of the Elements*, a slim vernacular alchemical work championing artisanal knowledge. Although it was very popular for making difficult alchemical concepts accessible, it was published anonymously. The printer, Johann Bringer, wrote in a letter to the reader that, having seen wonderful secrets (including the true knowledge of the Rosicrucian brotherhood) revealed openly in this little book, he had to publish it out of "Christian love." He did not know who the author was, but thought he was still alive.¹⁰⁹²

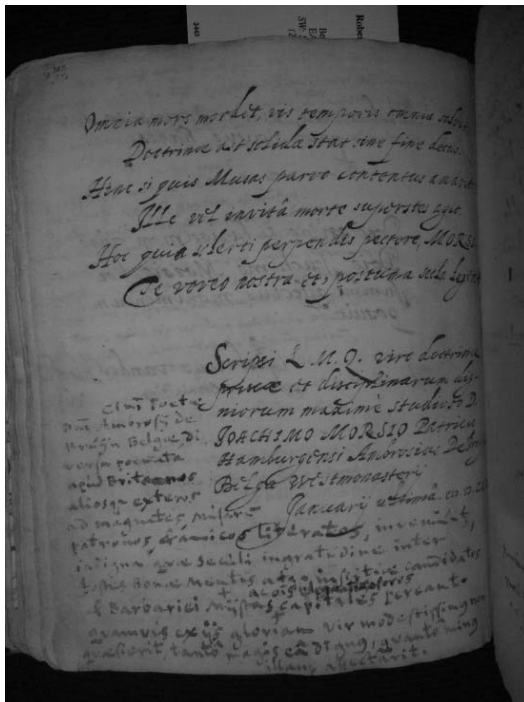
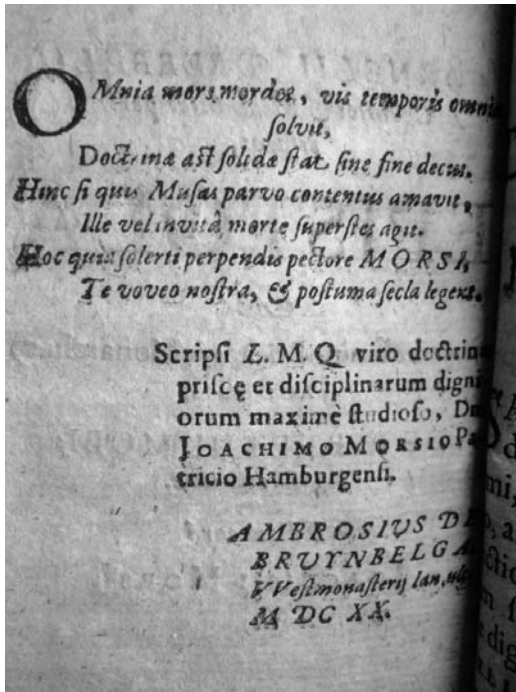
The *Arca aperta* was also similar to *On the Nature of the Elements* in its appeal for academic alchemists seeking to incorporate artisanal knowledge into alchemical curricula. Heinrich Nollus, Morsius' dedicatee, who cited Drebbel frequently and at length in his massive compilation, *The Sanctuary of Nature*, also admired the *Arca aperta* (See Chapter Six). Nollus, however, did not know the identity of its author. He referred at one point to "the author of the *Arca aperta*" and at another even more specifically to the author of the "*Arca aperta arcani artificiosissimi* printed at Frankfurt by Johann Bringer."¹⁰⁹³

¹⁰⁹¹Morsius, Lübeck, 4a 25, 2, 442v. In Morsius' first edition of Drebbel's works in 1621, Grassaeus is identified by his full name. In the second edition, *Tractatus Duo*, which included Lauremberg's translation of *On the Nature of the Elements*, Grassaeus is identified only as "J.G."

¹⁰⁹² Grassaeus, *Arcani Artificiosissimi aperta Arca*, 3.

¹⁰⁹³ Nollus, 108, ". . . auctoris, qui apertam arcam arcani artificiosissimi conscripsit, & absque omni dubio scientiam L. Philosophici habuit. . . ." and 588 ". . . arca aperta arcani artificiosissimi Francofurti ad Moenum excusa apud Ioan. Bringerum."

Fig. 1. The inscription of Ambrosius de Bruyn in the album of Joachim Morsius, and in Morsius' edition of Drebbel.



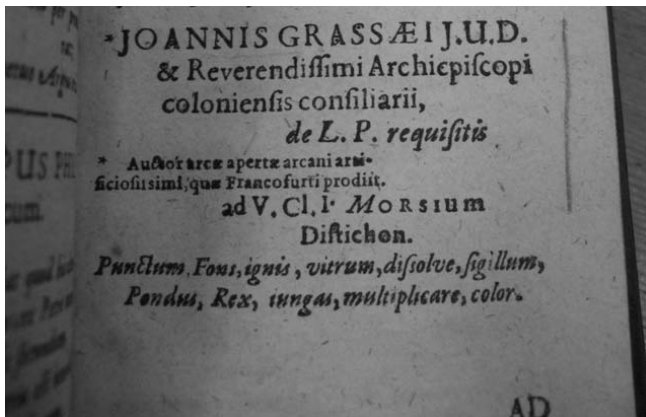
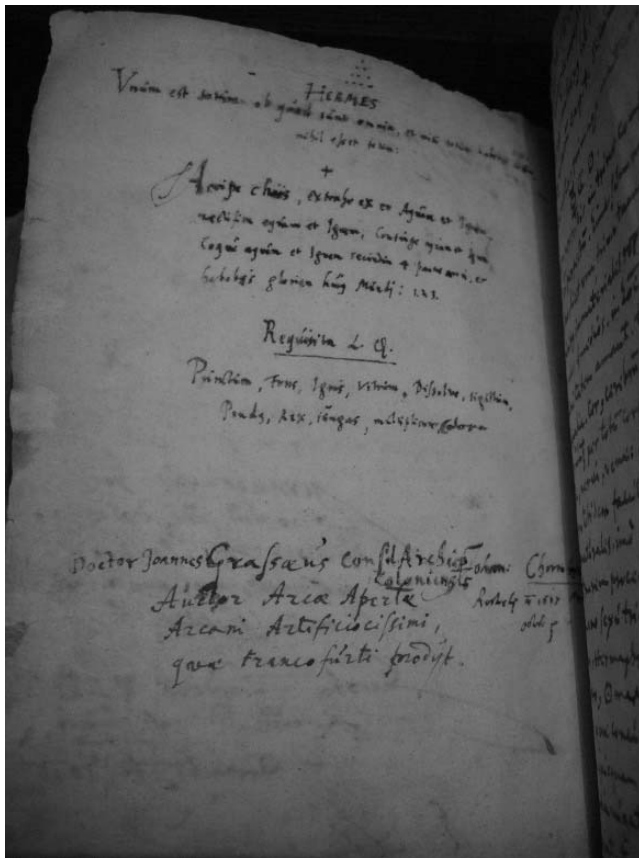


Fig. 2. Johann Grassæus' inscription in the album of Joachim Morsius, and in Morsius' edition of Drebbel.

By naming Grassaeus in the edition of Drebbel dedicated to Nollius, Morsius demonstrated his professional knowledge as a literary agent to a potential client.¹⁰⁹⁴ He and he alone had intimate access to the author of a prized work. Indeed, the authorship of the *Arca aperta* remained privileged information as late as 1657, when Olaus Borrichius learned from another agent, Johann Harprecht, that the author was Grassaeus.¹⁰⁹⁵ The alluring secrecy of alchemical practice sharpened what already were collaborative quests for elusive authorial identities in the Republic of Letters at large.¹⁰⁹⁶

Morsius concluded his first edition of Drebbel's works with a promise of future alchemical publishing ventures and a defense for his behavior. He should not be accused of theft for printing the works of others. In a letter to the reader, he argued that all of his efforts to bring the secrets of alchemy to the public were for the common good. He promised further unpublished works by such as "Johann Isaac Hollandus, Basil Valentinus, Roger Bacon, Guido Magnus [Guy de Montanor], and other most proven philosophers suppressed until now by envy." Do not, he said, "lacerate the reputation of an innocent man through slanders, but rather, stimulated by my example. . . stop lying upon discovered treasures out of malice, and instead give them as liberally as possible to posterity. . . ." There is nothing in nature that seems good which is not available to all, from the sun, to the moon, to freely flowing water. Why should only "the love of our Goddess" (alchemy) be considered "more a theft than a gift"?¹⁰⁹⁷

¹⁰⁹⁴ See also Van Vliet's library catalogue, "Grassaei Aperta Arcan Arcani."

¹⁰⁹⁵ Borrichius, *Conspectus* (1695), 35-6.

¹⁰⁹⁶ Martin Mulrow, "Practices of Unmasking: Polyhistorians, Correspondence, and the Birth of Dictionaries of Pseudonymity in Seventeenth-Century Germany" *Journal of the History of Ideas* 67:2 (2006), 219-250.

¹⁰⁹⁷ "Si conatus meos literarios, tuae in spem gratiae susceptos, favore tuo non indignos judicabis, promitto tibi propediem & in hac arte chemica, Joannis Isaaci Hollandi, Basilii Valentini, Rogerii Bacchonis, Guidonis Magnis, & aliorum probatissimorum, hactenus ab invidis suppressorum philosophorum inedita opera. Noli itaque innocentis famam maledictis lacerare, sed potius meo exemplo adhortatus, nullis obesse, cunctis prodesse studens, desiste maligno livore repertis incubare thesauris, at eas ad Dei omnipotentis gloriam &

IV: Paratexts or Pretexts?

There were those, particularly authors, who believed that such liberal communication of alchemical knowledge was indeed theft. Some writers fought back by using the term “res publica chymica” to distinguish it from other domains. While knowledge ought to be shared in the republic of letters at large, it had to be protected within the alchemical republic.

Adrian van Mynsicht was one such author who used this notion to defend esoteric knowledge. Morsius had included two laudatory poems by Mynsicht in the first Latin edition of Drebbel in 1621. The same year, Mynsicht published a work of his own, *The Golden Age Reborn*, in which he defended alchemical secrecy. He asked the reader not to be perturbed if his writings seemed at times incomprehensible, since “it is forbidden to write more exactly and clearly about this in *republica chymica*.”¹⁰⁹⁸ While in the Republic of Letters more generally, a free commerce of letters and open association of scholars allowed the advancement of knowledge, alchemy required the protection of an enigmatic literature.

Authors also complained when others claimed to occupy the high moral ground of the “Chymical Republic” while pirating works and writing polemics. For example, a student of Peter Lauremberg and Angelus Sala at Rostock as well as a cleric and a poet, Johann Rist published an alchemical text, the *Philosophical Phoenix*, in 1638. An anonymous author (a friend of Joachim Morsius, who was at the time locked up in the Hamburg plaguehouse), claimed in the 1638 *Phoenicis subreptitii in libertatem vindicatio* that Rist had stolen the *Phoenix*. Rist was one of those people who knew nothing about alchemy, but out of lust for fame

proximi utilitatem quàm liberalissimè gratae posteritati distribue. Nil rerum natura parens bonum, quod non simul quoque commune creavit. Sol oculus mundi, omnibus radios suos indulget, Luna innumerabilibus comitata sideribus, de nocte fraterni dispendia luminis suo candore reparans, etiam feras ad pabula ducit. Quid aquis dici formosius potest, in publicum tamen manant? Solus ne ergo amor nostrae Divae furtum potius, quam praemium erit.”

¹⁰⁹⁸ Adrian van Mynsicht, “Aureum Seculum Redivivium,” *Musaeum Hermeticum Omnes Sopho-Spagyricae Artis Discipulos Fidelissime Erudiens* (Frankfurt: Luca Jennis, 1625), 81.

wanted to attach their own name to a work.¹⁰⁹⁹ In a vindication, the 1640 *Nothwendige Rettung und rechtmässige Vertheidigung des Philosophischen Phoenix*, Rist in turn accused this anonymous author, whom he claimed was the real thief, of hiding behind the mask of the alchemical republic. Rist complained that thief said he published anonymously only in order to prove that he did not do so for his own honor, but for the benefit of the “Rei publicae Chymicae,” but he really did so out of fear.¹¹⁰⁰

As Anne Goldgar has shown, the rules for civility in the Republic of Letters were most often honored in the breach. With the introduction of alchemy into the academy, alchemical polemics as well entered a public forum. Peter Lauremberg engaged in a fierce exchange with Angelus Sala, championed respectively in print by Arnold Schröder and Anton Gunther Billich. In one work of 1624, Billich defended himself with a parodic ventriloquism of “Petrus Laurembergius, the rabid and mangy Scholastic Dog.”¹¹⁰¹ Mocking both Lauremberg’s assumption of moral and intellectual superiority as well as his lofty classicizing tone, Billich declared that it was no doubt necessary for the benefit of each and every citizen of the “Respublica chymica” for Lauremberg, the vindicator of true *Chymia*, the strigil of Billich’s ignorance, to scrape away all his (Billich’s) errors.¹¹⁰²

We might be tempted to believe that the *respublica chymica* served only as a pretext for plunder and polemic by print pirates. Yet Morsius himself clearly believed that print as a

¹⁰⁹⁹ “Hieher gehoret auch fürnehmlich der Idiota, welcher newlich zu Hamburg ein frembdes Büchlein für sienes/ unter dem Namen und Titul I. R. H. Philosophischer Phoenix aussgeben und dencken lassen. Dann selbiges Büchlein haben wir etwa nunmehr ins dritte Jahr in Lateinischer Sprache unsern guten Freunde einem/ welcher jetzt

Durch seines Brudern Geitz/ unnd ungerechte Hand/
Ins Gefängnuss ist gebracht/ O weh dem Harten Stand:”

¹¹⁰⁰ Rist (N.A.: N.A., 1640), 46.

¹¹⁰¹ Billich, *Adsertionum chymicarum sylloge*, (N.A., 1624).

¹¹⁰² *Ibid*, N.A. “Quod felix faustumque sit universa Reipublicae chymicae, omnibusque & singulis huius Civibus cum primis utile ac salutare, tandem prodiit in lucem ille obstetricantibus Gratiis Ac Venere Iniquae propitiâ natus, ille, inquam, Liber Laurembergii, verae Chymiae vindex, meae tum temeritatis flagellum, tum inscitiae strigil, tum absurditae tum errorumque spongia muriatica.”

medium of communication could make the anonymous intimate. In an effort to make contact with the elusive Rosicrucians, he published several open letters to the fraternity under his pseudonym, Anastasius Philaretus Cosmopolita in the fictional city of brotherly love, Philadelphia.¹¹⁰³ Morsius also published Nollius' *Via Sapientia Triuna* in 1620 under this pseudonym, as well as in 1626 a catalogue "of books and manuscripts, gathered together through many difficult travels and at great cost for the benefit of the *republica literaria* and the church." He dedicated the catalogue (which was addressed to the "amatori sophiae occultioris") to Gerhard Culmann, whose laudatory poem had been published in the Drebbel edition, and he also included a liminary poem from Nollius, drawn from his album. The same year he published a pamphlet by Culmann as Anastasius in "Philadelphia."

Anastasius' Philadelphia intersected with Morsius' world of literary contacts. Donald Dickson has written, "many authors who specified Utopia or Cosmopolis or Philadelphia as the place of publication on the title page of their works were not simply circumventing official control over printing; they were also situating themselves in an ideal locale in the republic of letters."¹¹⁰⁴ Morsius, the ultimate citizen of the *res publica chymica*, situated himself in, as it were, its virtual capital.

Unlike the buzzing hive of activity that was Elizabethan London, the citizens of Philadelphia never associated together in a single physical location. They came from diverse social and geographical spheres, and they may even have been bitter rivals. They were, however, brought together in print by literary agents such as Joachim Morsius, who deployed paratexts to extend associative networks, reveal exchange, and expand authority. In doing

¹¹⁰³ See Morsius, *Nuncius Olympicus: Von etzlichen geheimen Büchern und Schrifften/ so ein fürnehmer Gottesgelerter und hochberleuchteter berümbter Theosophus und Medicus, in Theosophia, Cabala, Magia, Chemia, Medicina und Philologia, durch viel beschwerliche Reisen unnd grosse Unkostung/ Ecclesiae und Reip. Literariae commodo zusammen gebracht/ darin die grüste Himlische unnd Irrdische Weisheit begriffen ist*, and Gerhard Culmann, *Gründliche Warhafftige Relation und Bericht*.

¹¹⁰⁴ Dickson, 4. For Morsius' choice of Philadelphia as the city of publication for his open letter to the Rosicrucians of 1617, see Dickson, 139.

so, Morsius advertised the production of knowledge as a shared affair, detailing various steps of the production of a work and many of the individuals involved. The virtual associations he built acquired an enduring and robust existence through print.

When the famous encyclopaedist Johann Heinrich Alsted added Drebbel's works to his philosophical compendium in 1626, he selected the Lauremberg translation which Morsius had published. Besides adding his own dedicatory letters and marginal keywords to Drebbel's *On the Nature of the Elements*, *On the Quintessence*, and the letter on the perpetual motion machine, he also reproduced Lauremberg's letter to George Schumacher, as well as sundry poems and anagrams praising Lauremberg which had been first printed by Morsius.¹¹⁰⁵ Subsequently, Lauremberg's letter to Schumacher was reprinted yet again in the edition of Drebbel's works printed in Geneva in 1628. As late as 1772, the translator of a new German edition of Drebbel's *On the Quintessence* decided to include some of the original liminary poetry written to Morsius, as evidence that once upon a time there was a "united society of adepts, some of whose writings still survive."¹¹⁰⁶

Publishing in the *res publica chymica* integrated artisanal writings into the republic of letters at large, investing writers such as Drebbel with authority as natural philosophers. Even as the alchemical republic pursued alluring and elusive authorial personalities, it also drew attention to the many literary investigators at work rooting up manuscripts and hidden identities for the benefit of the republic. We would not now have Drebbel's treatise *On the Quintessence* at all had not Morsius preserved it for posterity through publication.

Morsius did own other Drebbelian tracts which, ignoring his own advice, he never published. He listed Drebbel's printed works around Drebbel's inscription in his *album*

¹¹⁰⁵ Alsted, *Compendium philosophicum*, 253-95.

¹¹⁰⁶ *Neue Alchymistische Bibliothek*, 308. "Wenigstens werden sie zu einem Angedenken und zu einem Beweise dienen, dass es damalen eine ganze vereinigte Gesellschaft von Adepten gegeben hat, deren Schriften wir zum Theil noch übrig haben."

amicorum, as “little book on the four elements, on the fifth element, the letter on the perpetual motion, and the optic reflection.” He also noted that he had manuscripts by Drebbel about “marine salt and mercury, and about vitriol, as well as diverse other unedited little works.”¹¹⁰⁷ These manuscripts are all now lost.

Yet perhaps even more important than Morsius’ discovery and publication of individual texts was the work he invested in his web of paratexts. Without them, we would not know about the local individuals in Drebbel’s immediate surroundings uncovered by Morsius such as Daniel van Vlierden, Isbrandt van Rietwyck, and Jan Banfi Hunjades. Without them, we would not be able to follow the further network Morsius built, and we might have missed the reception of Drebbel’s work among academic alchemists such as Heinrich Nollius and Peter Lauremberg. Finally, in the absence of paratexts, we might not even have glimpsed the broader horizons of the *res publica chymica*, criss-crossed with the liberal commerce of alchemical letters.

V: Collecting Collectors

Through his employees at the mint, the prince offered a particularly authoritative and attractive impression of his persona to his collectors. The collectors’ desire for his currency, in turn, made it even more valuable. In later editions of Drebbel’s works, we find not only the collection of the prince and his mintmasters (*Drebbeliana* and *Morsiana*), we also find collections of collectors. Over the course of the seventeenth-century, discussions of Drebbel spread across Europe and in various genres. Such discussions were cited and excerpted in later works of Drebbel’s, lending weight to Drebbel’s slim but attractive works. By 1785,

¹¹⁰⁷ Morsius, Lübeck, 4a 25, 2, 344.”Edidit libellum de 4 Elementis, de 5a Essentia, Epistolam de motu perpetuo, de speculo optico. Extant apud me MS. eius tractatus de sale marino ac mercurio et de vitriolo cum aliquot eius operculis quibusdam ineditis.”

Drebbel's *Kort Begrip* (Short Account) had been “*vervattend*” and “*vermeerdend*” (augmented) to one hundred and eight pages. By pointing to the existence of an invested audience for Drebbel's works, the editors of new editions hoped to nurture and extend that audience.

For instance, Polycarpus Chysostomus (i.e. Georg Brendel) prefaced his 1723 edition of Drebbel with an extensive review of secondary (and even tertiary) citations concerning Drebbel. The fact that such a minuscule volume contained matters of such great weight, showed what a deeply penetrating spirit its author must have had.¹¹⁰⁸ Drebbel became a great artist in occult philosophy, physics, alchemy, mechanics, hydraulics and optics (in *Philosophia Secretiori, der Naturkundigung, in der Spagyrischen Kunst, in Mechanicis, und Hydraulicis it. in Optica ein gantz ungemein erfahrner Künstler gewesen*”), as can be shown both from his own works and those of others. Of the latter, Brendel quoted Eberhard Happelius, Petrus Servius, Johann Joachim Becher in *de Centro Mundo Concatenato*, Edmund Dickinson, Becher's citation of Dickinson in his *Weisse Narrheit*, Christoph Peller and Peller's citation of Gottfried Hegenitius' citation of Drebbel's letter to Ijsbrandt van Rietwijck, and Heinrich Nollius' citations from Drebbel on pages 61-2, 122, and 152 of *Physica Hermetica*.

Brendel then compared the content of Drebbel's thought and Nollius' remarks upon it to a slew of chemical authors, to show the harmony between them and Drebbel (damit man die Harmonie zwischen denenselben und Drebelio sehen möge”). Drebbel discovered the mysteries contained in his philosophy through his own manual exertions, and without the help of any books (“ohne menschliche Hülffe, Anweisung, mündlich Lehre Bücher noch Schrifften, durch eigenen Fleiss, Nachsinnen, Betrachten und Hand-anlegung diese grösse

¹¹⁰⁸ “Ich stelle demselben hiemit ein Werck vor Augen, welches so klein es ist, von desto grösserer Wichtigkeit ist es hingegen, und zeigt von seinem Meister, dass er eines tieff forschenden Geistes muss gewesen seyn.”

Geheimnisse entdeckt”). The harmony between Drebbel’s thought and alchemical literature proved its universal truth, just as the great Mughal in India, a merchant in Fez, a Huron in America, and a Mathematician in Europe all know on their own that one times one is one (Der grosse Mogol in Indien, ein Kauffmann in Fez, ein Huron in America, und ein Mathematicus in Europa wissen ein jeder ins besondere dass einmahl eins nur eins . . . sey”).

By citing the citations of citations of Drebbel, Brendel pointed to the wide company the readers of his own edition would join. Brendel’s attention to this readership, like Morsius’, was not merely the ploy of a savvy editor. Brendel himself published an open missive to the Rosicrucian Brotherhood. He praised Drebbel’s social egalitarianism and fusion of spiritual and natural knowledge. Drebbel was able to advance beyond the knowledge of his times, not only because of the erroneous manners of philosophizing at the time, but because people used to divide the knowledge of nature from the knowledge of God. In later times they realized that the Bible offered natural knowledge, just as all of nature taught us about God.¹¹⁰⁹ Still, Brendel remained rather pessimistic concerning the future. As he pointed out, a long time had passed since Drebbel urged people of all social orders to realize that we have all been taught equally by God. “Aber ach leider! Diese Göldene Zeiten sind freylich leichter zu wünschen als zu hoffen.”

Later editions of Drebbel’s works were designed to appeal to his *liebhebers* and to recall a more optimistic age. For example, in the 1688 edition a grotesque head [Fig. 3.] was reproduced very crudely to imitate a grotesque commonly found in early seventeenth-century publishing in general and in the original pamphlet describing Drebbel’s perpetual

¹¹⁰⁹ “Zu welcher Vollkommenheit/ sonderlich um die Zeit/ da unser Autor gelebet/ wenig Menschen gekommen sind. Allein nichts ist Ursach als die Faulheit/ und die verkehrte Ordnung zu philosophiren gewesen. Dann man hat die Gottes Gelahrheit/ und natürliche Weissheit vor 2. Disciplinen gehalten/ die sich nicht mit einander betragen könnten/ da man aber nachgehends gesehen/ dass das Buch der Schöpfung/ ja das gantze Alte und Neue Testament hierinnen einen öffentlichen Wiederruff thäten; nicht weniger auch die gantze Natur in allen ihren Würckungen bezeugte/ dass Gott und sein Geschöpff nimmermehr könnten getrennet werden. . . .”

motion machine in particular [Fig. 4]. The reproduced grotesque head could grant a *frisson* of appreciation to those collectors of Drebbeliana committed enough to recognize it.

The book was advertised as printed for the *liefhebbers* (“gedrukt voor den liefhebbers”). Likewise, the editor of the 1785 edition, assumed the existence of a community of *liefhebbers* collecting and circulating Drebbel’s works. In a note within a biography of Drebbel included in the edition, the editor solicited the “*liefhebbers*” for advice in locating Drebbel’s *Book on the Perpetual Motion* (“Boek de Eeuwige Beweging”). He did not recognize that this was in fact an allusion to the “Dedication” of the perpetual motion to King James, and told the reader that, “this work appears to have been lost but perhaps it is lying in the possession of some *Liefhebbers* (“*Dit werk schynt verlooren te zyn, dog sal mogelyk by eenige Liefhebbers berustende zyn*”).

New editions of Drebbel’s works continually included more material, some of which brought the work up to date, and some of which offered a taste of Drebbel’s era. The 1785 edition included a re-engraved copy of Jan Luyken’s 1688 titlepage (an allegorical representation of the contents of *On the Nature of the Elements*), a *Kort Verhaal van het Leeven des Beroemde Natuurkenner* (dated 1732 in a note, although actually deriving from Cornelis van Der Woude’s 1645 *Kronyck der Stad Alckmaer*), an *Afschrift Van een Brief, geschreeven van C Drebbel, aan zyn Vriend Ysbrand van Rietwyck* (deriving from Gottfried Hegenitius’ *Itinerarium*), an excerpted footnote on Drebbel from W. Derham’s *Godgeleerde Natuurkonden* (translated from English into Dutch by Abraham van Loon, and published at Leiden by Isaak Severinus in 1728, page 6, footnote 3), a seemingly unconnected story of the magician “Nacha Ree” from “*een wonderlyke en gedenkwaardige Brief*” written by one T. Abdilrahamus, Son of

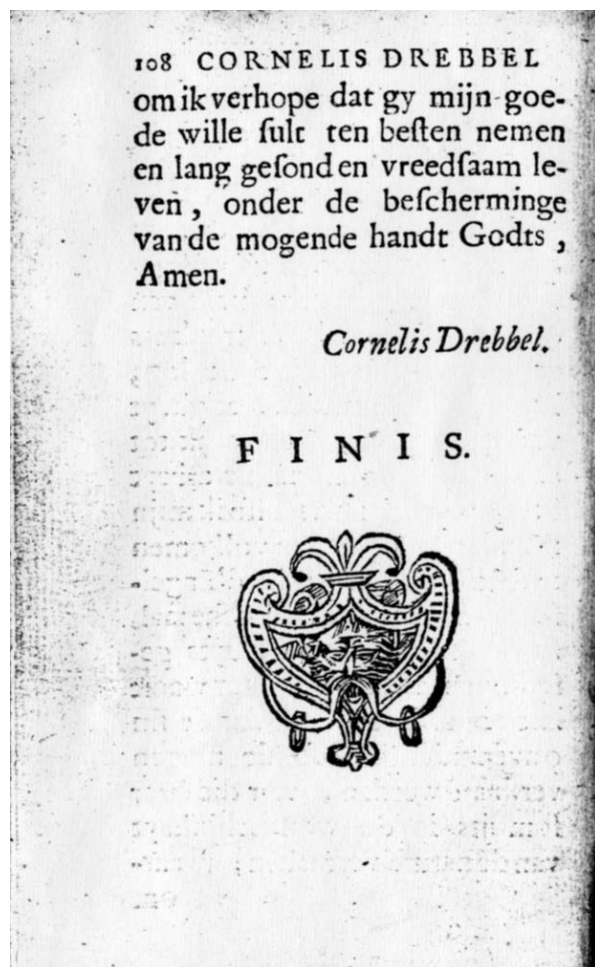



Fig. 3.

WONDER-VONDT
van de eeuwige bewegingh/die den
Alckmaersche Philosopho Cornelis Drebbeel / door een
eewigh bewegende gheest/ in een Cloot besloten/ te woghe ghe-
brocht heeft / welckers toepgeningh (int bereeren des
selvigen aen den grootmachtigen Coningh Ja-
cob van groot Brittaigen) alhier naech-
telijck vertoont wort.

Hier is oock noch de getuyghnis / die Cicero /
Claudianus / en Lactantius / gheben van de eeuwige bewegingh / die
Archimedes gebonden soude hebben. Oock upt Bartas van
Ferdinand / die oock mede een eeuwige bewegingh
aen den Turchschen Keiser / tot Wp-
sants ghesonden heeft.

Ooc mede by gevoeght een Boeck Dymander / beschre-
ven van Mercurius dycmael de grootste / die oock een Philo-
sooph en Priester / en Coningh soude in Egypten
gheweest hebben / in de tijdt van Moses.

Matheus 10.
Daer en is niet verhoeghen / dat niet gheopenbaert en sal worden / noch
niet soe hemelick dat niet gheweten sal worden.



Gedruckt tot Alckmaer, by Jacob de Meester,
Door Gerrit Pieterz. Boeckvercooper / woonende
op den hoek van de Meent / by de Waegh / tot
Alckmaer / Anno 1607.

Fig. 4.

Chapter Seven: Res Publica Chymica

Abdula,¹¹¹⁰ Drebbel's *Elements* (from Morsius), his *van de Quinta Essentia* (from Morsius), Schagen's 1607 foreword (but not the poetry and the Pymander), and finally, Drebbel's *van 't Primum Mobile*.

¹¹¹⁰ The letter of Nacha Ree was published in 1725 as 16 page pamphlet (now in the Koninklijke Bibliotheek in the Hague). It had also been published in English translation in 1680 *Aurifontina Chymica* edited by Johann Harprecht, shorn of its Orientalizing ascription, and described as a letter written to Frederick Duke of Holstein-Schleswig (Joachim Morsius' last patron). Further manuscript versions can be found in the British Library and among the Newton papers in King's College, Cambridge. See *Copia van een wonderlijke en gedenkwaardige brief* (Haarlem: Izaäk Enschede, 1725), *Aurifontina Chymica* (London: William Cooper, 1680), British Library MS. Sloane 3667 (folios 15v-16v), and Keynes Ms. 24, King's College, Cambridge.

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In 1614, the Frisian astronomer and cleric David Fabricius penned a long prefatory letter to his *Astrological Prognostication* of 1615.¹¹¹¹ Every day we see that the abilities of mankind and other creatures decline, he said. Empires and kingdoms too stand on very weak feet. Yet, God has compensated for this sorry state with his gifts, for we also see almost all the arts soaring to new heights. It seems that now, before the end of the world, we will discover at once all the hidden secrets of nature unknown to the ancients. The best astronomers all know that the study of Astronomy has never advanced so far before; the Ancients simply did not have the sophisticated instruments and methods of observation that we do.¹¹¹²

After describing thirteen observations new to such moderns as Tycho Brahe, Galileo, Kepler, and his own son, Johann, David turned to his final piece of evidence that his age has outstripped all previous eras in astronomical knowledge – the wonderful globe built by Drebbel and his musical instrument which played only when the sun shone. These

¹¹¹¹ On Fabricius, see Menso Folkerts, “Der Astronom David Fabricius (1564-1617): Leben und Wirken.” *Berichte zur Wissenschaftsgeschichte* 23:2 (2000), 127-142.

¹¹¹² David Fabricius, *Prognosticon Astrologicum Auff Das Jahr . . . MDCXV* (Nürnberg: Johann Lauer, 1614), unpaginated. Edler und Ehrnvester Herr Drost/ grossgünstiger Juncker/ ob wol mit dem jetzt lauffenden Alter der Welt/ gegen desselben end und untergang/ das vermögen/ oder die äusserlichen Kräfte/ so wol der Menschen als aller anderer Creaturen/ von tag zu tag mercklich abnemen/ und gleichfals auch die Imperia, Regna und Herrschafften auff sehr schwachen Füßen stehen/ unnd zum äussersten Fall gerichtet seyn: so lest doch der fromme Gott seine Güte dargegen in dem widerumb scheinlich sehen/ das fast alle Kunst/ und studia liberalia gewaltig zunemen/ und sehr hoch steigen. Auch viel bissher verborgene wunderliche sagen der Welt jetzt offenbar werden. Davon die alten entweder nichts gewust/ oder nur etwas allein von ferne gemercket haben. Dann es sich gantzlich ansehen lest/ als wann die Natura mundana, aetherea & terrestris, all ihre secreta, und biss dhahero verborgenen gantzen Thesaurum, jetzt für dem end der Welt/ dem Menschen gleich auff einmal entdecken/ unnd alles häufig offenbaren wolle/ wie dann solches an vielen Kunstreichen sachen/ und wunder seltsamen Inventionibus (welche täglich zu sonderlicher Ehr Gottes und erlustigung der Menschen erfunden werden und herfür kommen) zu ersehen ist. Ich will für dissmaal Kurtze halben nicht sagen/ wie hoch die Theologia, Iurisprudentia, Medicina, Alchymia, Cosmographia, Cognitio linguarum exoticarum, die Artes und Studia liberalia, zu unsern zeiten in wenig Jaren gestiegen/ wie trefflich auch die Artificia und opificia Mechanica zugenommen/ sondern fürnemlich und allein/ mit kurtzen von den Astronomischen Studijs, und darzu gehörigen oder dienen den sachen meldung thun. Dan bey allen verstendigen Astronomis kündig und offenbar/ dass das Studium Astronomiae niemals so hoch kommen/ als jetzt/ unangesehen man die fundamenta oder vil mehr Rudimenta von den alten per manus bekommen/ so ist doch fast alles unaussgepoliert/ und bey nahe wenig gewisses unnd eygentliches darauss zu machen/ wie die crassae & lato modo factae observationes genugsam aussweisen/ auss ursachen/ dass die Alten adeò exquisita Instrumenta, & tam subtilem observandi modum nicht gehabt haben/ welches alles Gott der Herr dieser gegenwertigen zeit/ auss besondern Gnaden gleich zu guter letzt reservirt hat.

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wonderful inventions, which seem nigh incomprehensible, will make it easy for his audience to accept the excellence of the current state astronomy, and the belief that astronomy will only improve until it reaches its full perfection, including the proper understanding of astrology and Cabala.¹¹¹³ Fabricius' friend Kepler agreed heartily with this account of Drebbel's perpetual motion.¹¹¹⁴

Jan Amos Comenius did not agree with Fabricius and Kepler. He did not think that Drebbel's motion was really perpetual, but this did not mean that he thought perpetual motion impossible.¹¹¹⁵ Far from it. In his principal, yet never completed work, the *De Rerum*

¹¹¹³ Note that Fabricius' account recalls that given by Vranckheim; indeed, the message and content of Fabricius' letter as a whole resembles Vranckheim's. "Ich wil jezt kürtze halben von andern wunderbaren Speculationibus keine meldung thun/ als von dem Globo verè mirando & memorando dess Kunstreichen Jacobi Drebbel von Alckmar auss Holland bürtig/ welche sich verborgner weiss aequaliter & perpetuò, absque machinis interioribus beweget/ daran vil sachen mit grosser verwunderung zu sehen/ wie dann auch sein Instrumentum musicum gemeinen Verstand übertriffet/ als welches durch der Sonnen stralen gleich lebendig gemacht wird/ unnd zu spielen anhebet/ so bald aber die Sonne sich verbirgt/ alsdenn auch zu musicirn auffhöret.

Dass hab ich loco praefationis kürztlich allegirn wollen/ damit man etlicher massen sehen möge/ dass diss nostrum saeculum verè astronomicum sey/ und also billich möge genennet werden/ mit dem verhoffen/ es werde noch täglich mehr zunemen/ biss die Astronomia ihr gantze perfection bekomme. Darauff dann das studium astrologicum erst recht angehen/ und der concentus orbium platonicus, oder die schöne Lyra Orphei widerumb sol gehöret/ auch die uralte rechte Cabala (quae particula est divinae scientiae) wider an tag kommen wird/ wann es in hac ultima mundi senecta, ubi liberalitatis fontes exaescunt, an Kunstliebenden Mecoenatibus mir nicht manglen wolt."

¹¹¹⁴ Johannes Kepler, "Responsio ad Interpellationes D. Davidis Fabricii Astronomii Frisii, Insertas Prognosticis Suis Annorum 1615.1616.1617," *Gesammelte Werke: Ephemerides*, Vol. XL,1, Volker Bialas, ed. (Munich: C.H. Beck, 1983), 26. "Quae de ortu cometarum aethereo, stellis novis, lactea via, satellitibus Jovis, de Luna terrea, Venere corniculata, de refractionibus, altitudinis nubium metiendae ratione, de motu perpetuo Drebbelii Belgae musicoque ejusdem automato - ea brevitatis causa una voce transmitto: approbo; disertus es, applaudo."

¹¹¹⁵ "Mundus artificialis," *De Rerum Humanarum Emendatione Consultatio Catholica Ad Genus Humanum*, Vol. I (Prague: Academia Scientiarum Bohemoslovaca, 1966), 869. "Nostro seculo Cornelius Drebbel globum construxit vitreum, aquâ semiplenum, qui lampade sub ejus basi ardente in Cistula, spatio 24 horarum circumagebatur, Caeli conversionem ad vivum sic repraesentando. Sed neque hoc fuit (quanquam hoc videri voluit) perpetuum : quia oleo absente cessare debuit. Quaeritur ergò adhuc Motus perennis imitatione Caeli, qualem narrant fuisse Archimedis." Comenius drew this view from Petrus Mormius' *Arcana Totius Naturae* (1630). See Comenius, *De Arte Spontanei Motus*. Koninklijke Bibliotheek, the Hague, Constantijn Huygens Papers, Vol. 47, 134-144. While Comenius did not approve of Drebbel's perpetual motion, he did cite Drebbel as an authority at several points in *De Rerum Humanarum Emendatione*. See "Mundus Materialis," 513. "Spiritus Mineralium crudi, exuti corpore, et privati animâ suâ, impatientes sunt, ideòque materiae appetentissimi, et in eam violenter operantes, id est eam corrodentes: ut patet in Aquis fortibus. Vid. Drebbel. In quint. Essent. C. 2. p. 181." "Mundus artificialis," 865. "Rubrum et Viridem esse mediae temperaturae, praeter Sensum ostendit Natura ipsa. Plantae enim et Vegetabilia ab optima temperatura viridem producunt. In homine verò succus Vitalis, Sanguis rubet, ut et quinta essentia, ex quocunque Corpore extracta. Drebbel. C. 4. sub. fin." 701. "Quinta essentia rebus extract si talis est qualem describit Drebbel (non frigida ad sensum, non calida, non humida, non sicca, et tamen summè frigefaciens, calefaciens, humectans, exsiccans) mirandum Entis infiniti

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Humanarum Emendatione, Comenius described how we might bring about a golden age through the reform of all things. The great instauration would include the perfection of the arts, or what Comenius called the artificial world. Such perfection would require deciding what arts were possible, and which were to be desired. Comenius surveyed all the parts of the artificial world, supporting the possibility of the seemingly impossible.

There were two ways to decide whether an art was possible. Whatever was possible for nature was possible for art. Thus, if it could be found in nature, it had to be possible. Alternatively, as Bacon had suggested, if an example of something similar could be drawn from history, then it could be proven to be possible.¹¹¹⁶ Comenius disregarded those naysayers like Cardanus, who believed perpetual motion to be impossible. Don't we see perpetual motion in the heavens and in the constant round of the elements? Don't we see a perpetual fire in the sun?¹¹¹⁷ If we want to build a globe showing the heavenly motions, we know that we can from the examples of Sabor and Archimedes. Artificial light also belongs in our catalog of *desiderata*, since we know that rotten wood glows in the dark.¹¹¹⁸ Just as Fabricius listed observations and instruments to indicate what else might be possible,

speculum, cujus natura simplicissima, ad omnia tamen sufficiens. ” “Mundum ideatum Aeternum,” 1294. “Quomodo hoc adumbretur in natura, ostendit Drebbel de quinta essent. C. 3. item exemplo Vitri, cujus Substantia ex Corruptibilibus tandem incorruptibilis facta vi Ignis – Annon etiam Splendor ille Caelestis obsignabit incorruptibilitatem nostram?”

¹¹¹⁶ “Mundus artificialis,” 688. Videantur Verul. a pag. 229 ad 246. exinde ostendatur, discenda esse non solum moderna sed et antiqua Verul. p. 33. infra. Non solum jam inventa, sed et invenienda: atque hoc ponantur selecta è Verul. p. 34. . . . Unde autem Possibilitas cognoscitur? Responsum: Non ex vaga experimentatione. . . sed ex Ideae consideratione, sive illa in Naturalibus jam exstat, sive in arte, similis alicujus effectus.

¹¹¹⁷ *Ibid*, 687. Quidquid possibile est Naturae, possibile est Arti. Quâ enim praeitur, eâ iri potest. Hoc non attendunt quidam, illicò impossibile clamantes, cujus rationem non vident (aut qui Naturam inimitabilem clamat). Ut Cardanus negat motum perennem arte construi posse. At videmus Naturam ostendisse perennis Motûs Ideam in Caelorum conversione, Elementorumque Circulatione varia. Datur in Natura Lux inextinguibilis, Sol: nolim ergò Laternam perpetuam pronuntiare impossibilem.

¹¹¹⁸ *Ibid*, 705. “Describenda potissimum Sphaera Saboti [sic], in cujus medio sedens speculabatur rotationes Orbium. Item Archimedis, quam descripsit versu Claudianus Nam si lignum putridum, Cicindela, Carbunculus in tenebris luscent: annon excogitari possit aliquid noctu Conclave illustrans? Sed hoc inter Desideratorum Catalogum.”

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Comenius collected the particulars of art and nature hoping that his “Artificial World” would become the world of tomorrow.

Johann Daniel Major too, in his *Journey to a New World without a Ship or a Sail* of 1670, considered the future as a collection of particulars gathered from all places, periods, and sorts of people. Appetite, not reason, drove the collection and communication of these particulars. Assembling the future intimately engaged the past, since the fame of past personalities whet the appetite of the *Kunstliebhabern* (art lovers) and demonstrated what might be possible. A history of all of art and nature collected through travel, exchange, and association would reveal laws of innovation and make the New World a reality.

For a century, Drebbel served as an example of how the impossible could become possible. During his lifetime, he became a modern “common place” who could compete with the lost ideal of Archimedes. For the later seventeenth-century, Drebbel set a new standard challenging philosophers and artisans alike, from Boyle to Becher and Leibniz to Papin. Largely forgotten by our own aggressively technological age, Drebbel was once the subject of a debate concerning the ability of man to understand and master nature through art. At a critical juncture spanning the turn of the seventeenth century, Drebbel served as a crux upon which the possibilities of human art turned.

The idea of Drebbel as a universal wonderworker was as widespread in the seventeenth century as the idea of Einstein as a genius is today. A look at early modern Europe from a Drebbelian perspective sheds light on both the practice and idea of building new futures in the seventeenth-century. Paula Findlen has argued that “toppling those Carnival deities, Nature and Folly, became an important symbol of the ascendancy of new experimental and mathematical philosophies, both of which embraced theological and philosophical seriousness (combining strictures about faith with Stoic admonitions about the

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disciplined mind).”¹¹¹⁹ Control, reason, and professionalization would eventually exclude enthusiastic characters such as Drebbel. Any attempt to see in Drebbel the persona of a sober, “diffident,” mechanical philosopher such as Boyle would and should fail.¹¹²⁰ Yet we need not be more socially conservative than our sources, and assume that because of his social status, Drebbel was “shadowy” or marginalized in his own time. This was far from the case. Drebbel’s fame was extensive and potent, both for those who cited him and those who neglected to do so.

Drebbel will always be marginalized in the history of science if the model of the gentlemanly philosopher built by Boyle continues to structure the narrative of the Scientific Revolution. Only by revising our view of seventeenth-century discovery and understanding the figure of the inventor in light of the emerging public for whom he performed does Drebbel and his fame begin to make sense. The discipline, social hierarchy, and exclusivity emphasized by Bacon and his followers in the Royal Society did not form the only model of the natural philosopher in the period.

Furthermore, in framing his model of the new virtuoso, Boyle owed a debt to an earlier ideal emphasizing enthusiastic, pansophic inclusivity. This study has highlighted Central Europe as an exceptional arena of interest in artisanal philosophy, autopsy, universalism, and methodical collection. It was here that the ideals of the passionate *liefhebber* merged with an appreciation for *Kunst* and a Ramist didacticism to support such pansophic

¹¹¹⁹ Paula Findlen, “Between Carnival and Lent: The Scientific Revolution at the Margins of Culture,” *Configurations* 6.2 (1998), 261.

¹¹²⁰ Such as Naber’s response to Jaeger’s deflation of Drebbel. See Naber, “De Hollandsche Archimedes,” *De Hollandsche Revue*, (April 1925), 287-296, where Naber accused the Koninklijke Akademie van Wetenschappen te Amsterdam of calling Drebbel a “mystisch bespiegelende geest” “die verre achtstond bij Galilei en Kepler” and complains that Jaeger has written a book in which Drebbel “wordt nu geschetst als een tweijfelachtig echtgenot, een slecht vader, een bier-entoebackdrinker, eengeluckzoeker, een ‘blageur’ of opsnijder. ‚Vlot instrumentkaer’ is alles wat er van Cornelis Drebbel overblijft. In hem was niets dat (volgens Prof. Jaeger) recht geeft op den titel, ‘ware zoon der wetenschap.’”

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collaborations as the *res publica chymica*, the *ars apodemica*, fraternal societies, the *album amicorum*, and encyclopaedism. The border-crossing nature of early modern hybrids would fade as new orders arose through the separation of art and science. Yet the very professionalization of science depended on an idea of expertise and progress requiring accumulation, collaboration, and technical training rather than the individual exercise of reason or judgment.¹¹²¹

What role did the various forms of “collecting” Drebbel studied here play in this information culture? In his *History of Curiosity* Justin Stagl has connected the phenomena of collecting, commonplacing, travel, and invention.

“. . . the *ars apodemica* provided a programme of general education and advancement of knowledge whose principal means was autopsy; the travelers therefore were instructed in how to profit from visiting foreign collections and how to lay out their own. In this way travelling and collecting became systematizing activities. Like the mind of the humanist traveler, like the place system in his note book, a collection was intended for structured growth. Early modern collecting replicated the rhetorical arrangement of discourse: by judiciously arranging the collected objects, lacunae between them were revealed, which had to be filled by the collector by means of “inventing” (ie tracing out and purchasing) new specimina.”¹¹²²

We find a similar relationship between commonplacing, collecting, travelling, eye-witness reports, and the formation of lists of *desiderata* (wishes or lacunae) for the reformation of the world. All offered a means of looking about the world as a collection of fragments, and noting how to improve that collection for the future.

There were important distinctions between these various genres. The commonplace for instance, specifically did not locate authority in the vividness of an eye-witness report,

¹¹²¹ Paul Oskar Kristeller argued in “The Modern System of the Arts: A Study in the History of Aesthetics Part I,” *Journal of the History of Ideas* 12:4 (Oct., 1951), 526.

¹¹²² Justin Stagl, *A History of Curiosity: The Theory of Travel, 150-1800* (Chur, Switzerland: Harwood Academic Publishers, 1995), 113.

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but in the acceptance established by widespread, impersonal circulation and repetition. Yet it furthered a view of the world as a historically contingent collection of fragments which must be noted, rather than a providentially ordained cycle whose structure must be deduced. This was especially so following its sixteenth-century vernacularization and the inclusion of contemporary works of nature and of art in commonplacing. The yoking of humanist methods and empiricism directed collecting towards the rediscovery of the lost ancient world and the invention of a new one through the practice of *Kunst*.

Such attention to material details spread from the rhetorical commonplace to philosophical practice, spectacularly so in the case of academic alchemy. In this new hybrid discipline, we find a great respect for artisanal constructions and writings and their use in academic philosophy. Johann Ernst Burggrav's description of Drebbel's perpetual motion machine beautifully illustrates the nexus between travel, collecting, commonplacing, and artisanal philosophy in the period. Burggrav travelled to England where he saw Drebbel's microcosmic perpetual motion installed in a collection of machines at Eltham Palace. Burggrav's eye-witness account provoked the clash of the academic titans, Johann Hartmann and Andreas Libavius in the disputing halls of the University of Marburg and the Coburg Gymnasium.

Burggrav also described the machine to his friend Marcel Vranckheim, who used this account as the basis for his lengthy tribute to modern innovation in his *Epistola*, favorably comparing Drebbel's achievements to those of Archimedes. Burggrav too, in the preface to his German edition of *On the Nature of the Elements*, followed his eye-witness report of Drebbel's machine with an extensive collection in Latin of the classical *loci* concerning the Archimedean sphere.

Conclusion: The Artificial World

Both Burggrav and Vranckheim drew on the heurematographic tradition praising past founders and discoverers and directed it towards the future. As Burggrav argued in his work on “electric” weapons, the *Achilles Panoplos*, wonderful devices such as Drebbel’s machine should give skeptics pause. Many other writers on new or suspect arts such as Johann Staricius, Petrus Servius, and Elias Ashmole cited the commonplaces of the greatest inventions, including Drebbel’s machine, as evidence of what had been proven possible in the past and thus as a token of what could be achieved in the future. Those attempting to decide whether to place such arts on lists of *desiderata* or *impossibilia* attended to the past examples of invention. Vranckheim’s *Epistola* became a classic of this literature, cited by Jakob Bornitz and others and recommended by John Webster.

The comparison of Drebbel to the ancients began with Drebbel himself in his own comparison to Archimedes and Aristotle. In this Drebbel presented himself as a fulfilled ancient *desideratum*, and he was thus eagerly collected in the period. As the seventeenth-century sources discussing Drebbel accumulated, they themselves became the stuff of collection. Citations accumulated and were added to snowballing editions of Drebbel’s works. In this the work of the *liebbebers*, by whom and for whom such editions were printed, becomes evident.

Drebbel’s fame, constructed between the appealing persona Drebbel presented and the passionate investment of his enthusiastic *liebbebers*, points to a growing public. This public provided the arena for the accumulation and exchange of facts, fragments, and personal “Ana” which Drebbel himself did not collect. In this, the modern meaning of the Dutch *liebbeber* as a “fan,” has preserved the function of this active and invested consumer in a way that the word “*amateur*” has not. As the idea of the public continued to expand, so too would publicity, celebrity, and fandom.

Conclusion: The Artificial World

Across Europe (and even in the New World) many individuals discussed, inquired, collected, exchanged painted, engraved, wrote, copied, and read Drebbeliana. If we think about Drebbel's world in his terms, we might ask, "What is the source of the movement?" Where did all the energy come from that pushed the figure of Drebbel around the world through a constant cycle of circulation?

Within the arena of the *liefhebers*, Drebbel was able to build a socially radical and a highly charismatic persona tailored to fit widely held desires. This exceptionally skilled artisan and radical philosopher encountered a deeply invested, well-traveled, hard-working, and sociable populace of readers, poets, artists, clerics, princes, philosophers, economic advisors, Utopian visionaries and enthusiastic fraternists. The combination between Drebbel and his *liefhebers* was an explosive one, the *primum mobile* empowering a cultural phenomenon. Love did indeed make the world go round.

Appendix

Appendix I: Drebbel's "Dedication" of the Perpetual Motion to King James I

Wonder-vondt/van de eeuwigh bewegingh/die den Alckmaersche Philosoph Cornelis Drebbel/ door een eeuwigh bewegende gheest/ in een Cloot besloten/ te weghe ghebrocht heeft/welckers toegereningh (in't bereeren des selvigen aen den grootmachtigen Coningh Jacob van groot Brittangen) alhier naecktelijck bertoont wordt.

Hier is oock noch de getuyghnis/ die Cicero/Claudianus/ en Lactantius/ gheven van de eeuwige bewegingh/ die Archimedes gevonden soude hebben. Oock uyt Bartas van Ferdinand/ die oock mede een eeuwige bewegingh aen den Turkschen Keyser/ tot Bysants ghesonden heeft.

Ooc mede by gevoeght een Boeck Pymander/beschreven van mercurius driemaal de grootste/die oock een Filosoophe en Priester/ en Congingh soude in Egypten gheweest hebben/ in de tijdt van Moses

Mattheus 10.

Daer en is niet verborghen/ dat niet gheopenbaert en sal worden/ noch niet soo heymelijck dat niet gheweten sal worden.

Ghedruckt tot Alckmaer, by Iacob de Meester,

Door Gerrit Pietersz. Boeckvercooper/woonende op den hoeck van de eent/ up de Waegh/tot Alckmaer/Anno 1607.

That research into the light of Nature is very tasty, and full of profound and useful qualities attest not only various learned men, but it is known to each person through the experience in all things. It is also apparent that the seven liberal arts tend towards the great advantage of mankind, but they should hardly be considered the first principles of the perpetual motion with which the Philosopher Cornelis Jacobszoon Drebbel of Alkmaar has honored the might King James of Great Britain. After the fore-mentioned Drebbel had given me a copy of the Dedication of the perpetual motion to King James to read, that reading was very tasty and pleasing to me, and made me think it a wonder above wonders, and I was immediately inclined to make it known to all Netherlandish art lovers, since the sweetness of this was so tasty to me that it made me pity that the entire world might not taste of it. So I thought it good to let this Dedication be published in print and to dedicate it once again to your honor, since I was meditating who I might choose as patron, and I could not think of any more fitting than such a once, who so excelled in astronomy since astronomy (according to my opinion) cannot be known completely without this invention. If this knowledge was common among astronomers, one would not require so many theorems in calculating the planets and other stars, but astronomy would be easy and Copernicus would prosper, since he demonstrated (with reason) that the Earth goes around every 24 hours, but this Alkmaarian philosopher can demonstrate the same not only with reason but also with living instruments. Therefore we should greatly thank the almighty through Jesus Christ that such a discovery (which surpasses all natural wonders) comes to light in our time. And furthermore that it has sprung out of this city of Alkmaar, although it is a little unfortunate that we may

not speak in person with the inventor of this (as we were accustomed to). O wonderful time in which everything that was hidden begins to come to light. Who has ever heard that there were ever any new stars except now in our time? except around the first coming of the Messiah in salvation of the entire world. Did not the first appear in Cassiopea in the year 1572. Which your honor observed with understanding eyes (both its end and beginning). Was it not in the same tide that his Drebbel was first born? How little did your honor think that the latter would have gone [*ghedrebbell*] so far. Is not now the fifth year since the new Star in the Swan lasted in a similar magnitude? And still presently it continues unchanged in breadth and length over which all astronomers may well wonder. Has not the new star that appeared in the year 1604 or 1605 in the Caput Serpentis disappeared in the sign of Orion (*schutter*)? May God grant that also all the equipment and weaponry of the militias (*schutter*) not only in the Netherlands but over the entire world (just as now has already begun in England and France) may disappear so that Zion may flourish and all the Kings and Potentates may enjoy themselves in the sweetness of the arts. Although many have tried for the perpetual motion, nobody knows for sure if it has ever been discovered: Therefore I have sought out their books that which Cicero and the poet Claudianus, Lactantius, and Bartas have testified concerning Archimedes, and I have let it be printed alongside here so that your honor and all readers may come to a judgment concerning that. That is also why this has been dedicated to your honor. Actually, (since it is unheard of) I might fear not only to appear with a risible proposition but myself to be derided. We have certainty enough that the mockers' derision serves only as evidence of their ignorance, now since King James has honored the inventor of this with great gifts, about one could speak at greater length. But since our goal tends to things and not words, I will leave off here and awaiting this wish your honor, in all humility, much success. At Alkmaar in December of the 1607th Year of our Lord.

G.P.V.S.

Dat het ondersoecken in't licht der Natueren seer vermakelyck vol diepe en nutte eygenschappen is betuygen niet alleen verscheyden geleerden: Maer t'is deur d'ervaringh in allen aen elken bekend. T'is oock openbaer dat de seven vrye consten tot grooten voordeel der Menschen zyn streckende maer mogen naulycx de beginselen gheacht worden van de eeuwigh bewegingh daer den Philosoph Cornelis Jacobs. Drebbel van Alckmaer den grootmachtighen Coningh Jacob van groot Brittangen heeft mede vereert. Naedien de voorsz. Drebbel de Copy van de Dedicatie oft toeeygheninghe van de eeuwigh bewegingh aen Coningh Jacob my te handen bestelt heeft om te lesen: die selve lesende was my seer vermakelyck en aenghenaem en docht my wonder boven wonder te zyn, was terstont genegen om hier van alle Nederlantsche Konst-beminders to verwittigen: want de soeticheyte van desen was my soo smaeckelyck dattet my jammert dat niet de gantsch Weerelt daer van soude smaek-monden. Soo heeft my goet ghedocht die selfde Dedicatie ofte toeeygheningh in Druck te laten uytgaen ende U.E. noch eenmael toe te eyghenen want ick overdenckende was wien ick daer als Bescherm-heer over uytuycken soude heb geen bequamer connen bedencken als een soodanigen die uytmuntende was in de Sterkonst om dat de Sterkonst (nae myn meeningh) sonder dese vindigh niet volcomen can gheweten worden. Soo dese wetenschap onder de Sterkondigers ghemeen was soo en soudemen niet behoeven soo veel stellingen en rekenigh der Planeten en ander Sterren maer de Sterkonst soude licht zyn en Copernicus soude bloeyen: want die bewyst (met reden) dat het Aerdrÿck alle 24. uren ront

om gaet: Maer desen Alckmaersche Philosooph cant selfde niet alleen met reden maer oock met levendige Instrumenten bewyſen. Daerom moghen wy den almachtigen door Jesum Christum wel hoochlyck dancken dat soodanighen vondt (die alle natuerlycke wonderen overtreft) in onsen tydt aen den dagh comt: jae dat meer is uyt dese Stadt Alckmaer ghesproten is hoe wel een weynigh ongheluckich zyn dat wy nu met den vinder van desen (als wy plachten) mondeling niet moghen spreken. O wonderlycke tydt in welcke al wat verburghen was begint aen den dagh te comen. Wie heeft oyt gehoort datter eenighe nieuwe Sterren ayn gheweest dan nu in onsen tydt? behalven een tegens de eerste toecomst van Messias en Heylandt aller Weerelt. Is niet de alder eerste verschenen in Cassiopea? int jaer 1572. Die U.E. met verstandighe oogen (soo wel zyn eynde als begin) aenschout hebt: wast niet in de selfde tydt dat desen Drebbel eerst gheboren was? hoe weynich dacht U.E. doe dat desen soo vordt ghedrebbelt soude hebben. Ist nu niet het vijf ofte seste jaer dat de nieuwe Ster in de Swan heeft in eender grootte gheduert? en noch teghenwoordich onverandert in breedte en lenghte staet waer over alle Stercondighers haer wel mogen verwonderen. Is niet de nieuwe Sterre die int Jaer 1604 en 1605 in den Slangen-dragher openbaerde int teycken van den Schutter verdwenen? Godt gheve dat oock alle Schutters gereetschap en oorloghtuych niet alleen in Nederlandt maer ooc over de gantsche Weerelt (gelucky nu alree in Engelandt en Vranckryck begonnen is) mach verdwynen op dat Syon mach bloeyen en alle Coninghenen en Machtigen haer mogen vermaken in de soeticheyte van de konsten. hoe wel veel nae de eeuwige bewegenis ghetracht is soo weet men niet sekens of die oyt ghevonden is: soo heb ick t'geen Cicero en de Veerse-dichter Claudianus Lactantius en Bartas van Archimedes getuygen uyt haer boecken ghesocht en hier laten by drucken op dat U.E. en alle Lesers moghen beslyuten wat daer van is. So is nochtans dese soodanigh als U.E. hier toegeygent wordt. Yeghelucky (om dattet ongehoort is) soude vreesen niet alleen met een lacherlyck voorstel te verschynen maer selfs oock belacht te worden. Nu op dat der spotters schamp tot getuygh haerder onwetenheyte strecke wy hebben daer sekerheyte genoeg af: want Coningh Jacob heeft den vinder van desen met groote gheschenken vereert daer af men wyder en breeder soude connen segghen. Maer want ons eynde tot saken strecke niet tot woorden sullen dese verlatende, ende die verwachtende, U.E. in alle oot moedighe eerbiedingh veel ghelucx wenschen. Wt Alckmaer in December des 1607. Jaers onses Heeren.

G.P. V. S.

The sweetness enjoyed in the exploration of the nature of the Elements, O King, has alone impelled me to write to your Majesty. For I have seen many wonders, both pleasant and incredible, most useful for knowing God from the nature of things. For were not all these things created through God's power and merciful wisdom in praise of God and for our service? Therefore what can move us more to know, love, and honor our Creator, than the true knowledge of things? in which he shows as though with a divine finger his wisdom, goodness, and power. We should not be ungrateful for the holy Scriptures, but should always consider them of great value. But also divine Nature is that which teaches us, just as God himself, without belief. Since do we not learn from the various natures of things to know the unity of God and to praise his wisdom in various manners? Why? If we do not know what we see, hear and feel, how will we know, love, or honor God, whom we neither see nor hear, other than through the true knowledge of things? Wherefrom we will bestuyten/ that it is God's will, and serviceable to us, that we understand the Nature of things, as much in order know, love, and serve God as ourselves. Therefore, O King, a few years ago I undertook to investigate the cause or Nature of things with great diligence.

Finally in order to know our gifts rightly, I continued on to the Human nature and found in myself what I had loved or hated in others. But having seen our foolish unpracticed will, our little power, our blind error, our happy and sad lives and our mournful deaths, I noticed that that lack of understanding is the cause of the various wills, lots, and lives of Men. But further noting the virtue of the divine gifts as they have been created in us by our Creator, and how God as the father of Nature used a natural wisdom in all his work, my heart was filled with much happiness, and therefore I undertook to investigate the cause of the *Primum mobile*, feeling that that was the first principle of God's work, and therefore an entry into the true knowledge of Nature. But although I used the greatest diligence for a long time, I discovered nothing at all useful for this *scientia*, and therefore I lost the sweet hope of its discovery, since the Nature of all things let me know the impossibility of discovering this. But noting how all things have been created, nourished, and maintained, and how through them there have been for us the ceaselessness and immortality of God, the infinite height, the bottomless depth, the joyful light, and the melancholy darkness, and furthermore all the wonders of the world, so I undertook to investigate their Nature and effects, in which my time was not misspent, for I had noted that these were the doors to the to the right knowledge of things. Therefore I tackled the nature of water with great diligence, wishing to make it clime upwards due to her own nature, through various vats and pipes (bent in strange manners). But it was all for nothing, since it would not raise by a hair's breadth, but according to its nature it always went downwards. Nonetheless I made various enjoyable little fountains so that in various ways, once its own water had declined for a time, it shot upwards to the height of twenty or more feet. But this movement was soon dead, which the water had again made living through falling waters; hence my sweet hope was again lost, and I completely believed that the cause of the *primum mobile* was impossible for man to comprehend. But investigating with great diligence the hidden cause why the water always went downwards, I understood that at last by discovering the wonderful nature of fire. From this, O King, I was not a little overjoyed, since I understood why I had erred for so long, and what the wonderful cause was of the *Primum mobile*, and also how it moves the heaven, and all the stars, planets, water, and earth. And how or through what cause the earth is carried in the middle of the air, why the water encircles the Earth, why all things fall towards the center of the Earth, except fire. And on the contrary, how the Sun, Moon, and all the Stars are born aloft, and also the cause of the rain, the wind, the thunder, lightning, the tide, and how all things are fed and multiply. Truly (O King), I could demonstrate this as well with living instruments, as with natural reasoning, and thus I would have no need to write much. Since it is well known to me that most of the clever wits will not believe that we can comprehend these hidden causes with our reason, therefore as proof that I understand the cause of the *Primum mobile*, I make a sphere that can move perpetually following the course of heaven, roundabout once every four and twenty hours, or as many times more as is necessary. Furthermore it will not falter once in a thousand years, showing us the years, months, days, hours, the course of the Sun, the Moon, all the planets, and stars, whose course is known to Men; also I make all sorts of instruments, which perpetually play on their time, and *in summa* whatever can be made to be for a time through falling weight, or through springs, through running waters, through fire, can through this knowledge be made perpetual. But the costs are alone the reason that it is unprofitable to use it for a great force. And further as proof how I understand why the things rise upwards, or fall downwards, or through what cause the Earth is carried in the middle of the Water, and the Water in the middle of the air, I also hang in an enclosed glass the earth in the middle of water, and the water in the middle of air, and the air in the middle of fire, one embracing the other, and by the themselves making

a circle, so that it as wonderful and pleasurable to see as anything in the world. Or on the contrary I hang the air in the middle of water, as round as a sphere, and the water in the middle of the earth, one embracing the other just as we the air does to the Earth. And thus I make high as low, low as high, the light as heavy, the heavy as light: and I make standing water rise upwards to the height of ten, twenty, a hundred or more feet. Furthermore since I understand the cause of the wind, I make instruments which give a powerful wind, and through the knowledge of the ebb and tide, I make an instrument which perpetually ebbs and floods twice high and low between day and night, showing through precise markings the months, hours, and other things. Just as (O King), in the present instrument, all who please may see and test the truth of my writings. This is a little twig of the perpetually-moving tree, grafted upon the true knowledge of the Elements, a goal of all the investigators of things, in perpetual remembrance, for those who will come hereafter, that they may understand the wonder of nature, and what is possible through her gifts. Wherefore I am also prepared to show other proofs, hoping thereby to make many men taste the pleasing sweetness of the hidden cause of things. Since discovery teaches me, that no sweetness can be compared to the true knowledge of nature, which also teaches us to understand the complete goodness, wisdom, and power of God. Hence I do not wish to do as many have done before me, praising their wonderful things, proposing the proof thereof with unusual names, and strange processes, well knowing that if they would show their thinking with naked reason, all men would become aware of their foolishness, and thus they would lose their great name. Therefore I do not wish to demonstrate only with reasoning and examples, but also to explain the examples according to the truth. And first I relate the cause of the fire, and afterwards its nature and effects. Also the quality of the other elements, and following after that what the cold is, what the cause is of the *Primum mobile*, what the cause is of the sun, how it moves the heaven, all the stars, the moon, the sea, the earth, what the cause is of ebb, of tide, of thunder, of lightning, of rain, of wind, and how things grow and multiply, hoping through things to show others the way, which I discovered after much error, so that they through little work may bring wonderful things to light. Since I declare through the living God, that neither the writings of the ancients, nor of any man, have helped me the least in this, but I have discovered this by myself, through constant noting in the investigation of the elements. For we also have no evidence that this knowledge was known to the ancients, although many have attempted it. Cicero writes that Archimedes made a sphere, which he could move perpetually following the course of heaven, but that through destructive war, both the master and his instrument were destroyed in a single day, whence the proof of truth was lost. There were many processes of the *Mobile* written by the ancients, but they are the greatest nonsense of the world, misleading many, but procured by none. If the processes of the ancients were god, the ancients would have known it, and left us it in remembrance. Wherefore I wish to warn all the lovers (*liefhebbers*), and show them a better way. Praying the beneficent God to enlighten all kings and regents with his merciful wisdom, so that all men (O King, just as we, your subjects) should taste of the true pleasure of divine peace. Since I am enjoying through your Majesty the greatest beneficence to be wished from the wisest regent, I do not know what gratitude I ought to show, thinking how most kings let themselves be misled by blind greed, seeking the expansion of the kingdom through bloody war, not thinking how that is impossible to achieve without greater loss and further suffering from their faithful subjects, who most adventure, life, goods and blood therefore. What clever understand will compare his life alone by a perishable good? Wherefrom might be known the fruit of bloody war, and the wisdom of the peace-loving kings, who seek to prevent misdeed through good laws, and to punish even righteously through *Justitia*, thinking

that justice does not wish the punishment to outweigh the crime, but rather that the punishment should be lightened through moving compassion, so that all men may taste the pleasing fruit of the wise regents, and in place of cruel war, shall enjoy the sweetness of the arts. As an opening for this I have begun this work of mine. But since I cannot fully render my meaning either in English or Latin, I have written it in Dutch, and had it translated word for word, so that they many understand the sense unchanged, and enjoy themselves for a time in the wonder of nature. Whence I hope that my good intention will be taken for the best, and that I will live a long, healthy, and peaceful live, under the protection of the mighty hand of God. Amen.

Dedicatie Ofte toeschrijvinghe/ van den diepsinnigen/ ende int licht der Natueren seer eervaren Philosoph Cornels Jacobsen Drebbel/ van Alckmaer/ aen den Machtigen Coningh Jacob van groot Brittangen

De soeticheyt/ soo ghenoten int ondersoecken van de Natuere der Elementen/ beweegt my allen/ o Coningh/ aen uew M. te schrijven/ ghesien hebbende veel genuuechlijcke en ongelooflijcke wonderen/ seer bequaem om Godt te leeren kennen/ uyt de Natuere der dinghen: Want zijn niet door Gods moghende ende goedertieren wijsheyt/ alle dese dinghen tot lof van Godt/ ten dienst van ons geschapen? Hierom wat can ons meerder bewegen/ om onsen Schepper te kennen/ beminnen/ ende eeren/ dan de ware kennis der dinghen? in den welcken ons wijst/ als door den Godlijcken vinger/ zijn wijsheyt/ goedtheyt/ ende mogenthey. Wy en moghen niet ondancckaer zijn voor de heylighe Schriften/ maer moeten die altijdt in goeder waerden houden: Also oock t'gene onse sonder het gheloove/ de Godtlijcke Natuer wijst/ als Godt selver. Want leeren wy niet uyt die verscheyden Natuer der dinghen Gods eenicheyt kennen/ ende zijn wijsheyt loven/ op verscheyden manieren? Waerom? soo wy niet en kennen dat wy sien/ hooren ende voelen/ hoe sullen dan Godt kennen/ beminnen oft eeren/ die wy noch en sien noch en hooren/ anders dan door de ware kennis der dinghen? Waer uyt sullen bestuyten/ dattet is Godes wil/ en ons diesntigh/ dat wy de Natuere der dinghen verstaen/ om soo wel onsen Godt/ als ons selven te kennen/ beminnen en dienen: Hierom o Coningh/ hebbe voor eenige Jaren met goden yver voorghenomen/ de oorsaek oft Natuer der dinghen te ondersoecken: Eyndelijck/ om onse gaven recht te kennen/ ghegaen tot de Menschelijcke Natuer/ en essen in my gevonden/ wat in anderen bemint oft ghehaet. Maer ghesien hebbende/ wat onsen sotten ongheoeffenden wil/ onse cleyne macht/ onse blindtwilighe dolingh/ ons blijdt en droevigh leven / en ons treurigh sterven/ soo heb ick gemerckt/ dat onverstandt is de oorsaek van den verscheyden wil/ oordeel en leven des Menschen:Maer voorder merckende de deught van de Godtlijcke gaven/ soo van onsen Schepper in ons geschapen/ en hoe Godt als een Vader van de Natuer/ in alle zijn werck een natuerlijcke wijsheyt ghebruyckt/ soo is mijn hert met meerder blijfschap vervult/ en daerom voorghenomen te ondersoecken die oorsaek vant Primum mobile, dat ghevoelende/ het eerste beginsel van Gods erck/ en daerom een inganck tot ware kennis van de Natuer: Maer hoewel langh hier in seer neerstigh was/ recht niet met allen uyt/ tot dese scientia dienstigh/ gelijk oock veel voor my/ waerom die soete hoop van ondervinding verloren: want die Natuere van alle dinghen gaf te kennen/ die onmogelijckheyt van dit te ondervinden. Maer aenmerckende hoe alle dinghen uyt de Elementen geschapen/ gevoedt en onderhouden worden/ enjoe ons door haer gewesen/ die eeuwichheyt ende onsterffelijckheyt Gods/ die oneyndelijucke/ hooghte/ ongrondelijcke diepte/ het blijde licht/ en het droeve duyster/ en voorts alle wonderen des Werelts: Soo

nam voor/ haer Natuer en werck te ondersoecken/ waer in mijn tijdt niet qualijck besteedt: want heb haeft gemerckt/ dat dese waren de deuren/ tot rechte kennis der dinghen: Waerom met goeden yver die Natuer des Waters aenghegrepen/ willende dat uyt zijn selfs natuer/ door vrscheyden vaten ende pijpen (op vreemde manieren geboghen) opwaerts doen climmen/ mater twas al voor niet: want ten wilde niet een hayr breedt rijsen: Maer gelijk zijn natuer/ liep altydt nae beneden/ hebbe niet te min verscheyden lustige Fonteynkens ghemaect/ soo op verscheyden manieren/ een tijdt langh doort dalen van haer eyghen water/ opwaerts straelden/ op die hooghte van twintigh oft meer voeten: Maer dese beweeghnis was geringh doot/ ten water wederom door vallende wateren levendicht gemaect: waerom mijn soete hoop/ wederom verloren: En volcomen gelooft/ dat die oorsaek vant Primum mobile, voor den Mensch onmoghelijck was te begrijpen. Maer ondersoekende met groote neersticheyt die verborghen oorsaek/ waerom het water altijd nae beneden liep/ soo hebbe dat ten lesten verstaen/ doort ondervinden van de wonderlicke natuer des vyers. Daerom o Coningh/ my niet wynigh verblijdt: want doe verstondt/ waerom soo langh ghedoolt/ en wat de wonderlijcke oorsaek was/ vant Primum mobile: Alsoo oock hoe den Hemel beweeght/ alle de Sterren/ die Planeten/ het Water/ die Aerde: en hoe oft door wat oorsaek die Aerde ghedraghen wordt/ in't midden van de Lucht/ waerom het Water hem Circkel-rondt om den Aerdtbodem sluyt/ waerom alle dinghen dalen naet midden der Aerden/ uytghesondert het vyer. Ende ter contrarie/ hoe die Son, die Maen/ en alle die Sterren/ in de hooghte gehdragen worden: Also oock de oorsaek van Regen/ van Wint/ van Donder/ van Blizem/ van Vloedt/ en hoe alle dinghen ghevoedt worden/ en haer vermeerderen: Ten waer (o Coningh) dit so wel conde bewijzen met levendige instrumenten/ als met natuerlijcke reden/ soo en soude niet hebben bestaen dus veel te schrijven: Want my is wel bekend/ dat meest alle clocke verstanden niet willen ghelooven/ dat wy dese verburghen oorsaken met onse vernunft moghen begrijpen/ waerom tot bewijs daat verstaet die oorsaek van't Primum mobile: So maect een cloot/ die hem eeuwelijck bewegen can/ nae den loop des hemels/ alle vierentwintigh uren eens rontom/ of soo veel malen meer asl van nooden: Also dat in duysent jaer niet eens falieren wil/ ons wijsende/ Jaren/ Maenden/ Daghden/ Uren/ den loop van Soon/ van Maen/ van alle Planeten en Sterren/ wiens loop den Mensch bekend: also oock maect allerley Instrumenten/ die eeuwelijck spelen op haer tijdt/ en in summa wat voor een tijdt ghemaect can werden/ door dalene gewicht/ of door springh-veeren/ door loopende wateren/ door wint/ oft door vier/ dat can ghemaect worden door dese kennis/ voor eeuwelijck. Maer die costen alleen/ zijn die oorsaek/ dattet onprofijtelijc/ om te gebruycken voor groot gewelt. En voorder tot bewijs/ hoe versta/ waerom die dinghen opwaerts rijsen/ fot nederwaerts dalen/ oft door wat oorsaek de Aerde in't midden van't Water/ en het Water in't midden van de Lucht ghedraghen werden: soo hangh alsoo/ in een besloten glas/ de Aerde in't midden van't Water/ en het Water in't midden van de Lucht/ ende de Lucht in't midden van't Vier/ den een den anderen omvangende/ en haer selven soo ront makende/ als eenigh dingh op die Weerlet/ sser wonderlijck en ghenuechlijck om sien. Oft ter contrarie/ hangh die lucht in't midden van't Water/ so ront als een cloot/ en het Water in't midden van de Aerde/ den een den anderen omvangende ghelijck wy sien doen de Lucht den Aerdtbodem. En maect aldus/ hoogh als laegh/ laechg als hoogh/het licht als sawer/ het swaer als licht: en doe het staende water opwaerts rijsen: tot die hooghte van thien/ twintigh/ hondert / oft meer voeten. Voorts also verstaet die oorsaek des Windts/ maect Instrumenten die geweldelijck windt gheven/ en door de kennis van ebbe en vloedt/ maect een Instrument/ dat eeuwelijck evt an vloeyt/ tusschen nacht en dagh tweemaal hoogh en leegh/ wijsende door scherpt opmercken/ Maenden/ uren/ en andere

dingen meer. Ghelijck (o Coningh) in dit tegenwoordige Instrument meught (is this second person?) sien en proeven/ all nae lust/ die waerheyt van mijn schrijven: dit is een twijchken van den eeuwigh-bewegenden Boom/ ghegriff op de ware kennis der Elementen/ een wit van alle ondersoekers der dinghen/ tot eeuwigher gedachtenis/ voor den ghenen soo nae comen sullen/ op datse souden verstaen die wonderlijckheyt van de natuere/ ent wat door haer gaven vermoghen: waeromme ben also oock bereydt die andere proeven te vertoonē/ verhopende daer door veel Menschen te dooen smaken die aenghename soetheyt van de verburghen oersaeck der dinghen: want ondervindingh leert my/ dat geen soetichē by Natuers ware kennis te verghelijcken/ also ons leert verstaen die volmaeckte goetheyt/ wijsheyt en moghentheyt Gods: waerom wil niēt/ gelijk veel voor my ghedaen/ haer roemende wonderlijcke dinghen/ stellende het bewijs daer van met seltsame name/ en vreemde processen/ wel wetende wanneer haer raem met naecte reden souden bewijsen/ dat alle Menschen haer sotheyt souden gewaer worden/ en also haren grotten nam verliesen. Hierom wil niet alleene bejisen met reden en exempelen/ maer ooc die exempelen verclaren nae de waerheyt: En voor eerst vertellen die oorsaeck des viers/ daer nae zijn natuer en werck: Alsoo oock die eyghenschap van d'andere Elementen: En voorts achtervolgende wat die coude is/ wat die oorsaeck van't Primum mobile, wat die oorsaeck van die Son/ hoe die beweegt/ den Hemel/ alle Sterren/ die Maen/ de Zee/ den Aerdtbodē/ wat die oorsaeck van Eb/ van Vloet/ van Donder/ van Blixem/ van Regen/ van Wint/ en hoe alle dinghen wassen en vermeerderen/ verhopende hier door anderen den wegh te wijsen/ soo ick nae veel dolingh gevonden/ op dat sy door cleynen arbeydt/ wonderlijcker dinghen soudē int licht brengen: Want verclare door den levendigen Godt/ dat noch die schriften van de Ouden/ noch eenighen Mensch my de minste hulp heir in ghedaen heeft: maer heb dit alleen ghevonden/ door gestadich opmercken/ in't ondersoeken van de Elementen: Want wy hebben ooc geen getuygenis/ dat de Ouden dese wetenschap bekent is geweest/ hoewel daer veel nagedracht. Cicero schrift / dat Archimedes had een Spheer gemaekct/ die hem eeuwelijck na den loop des Hemels condē beweghen: maer soude door't verderflijcke Oorlogh/ beyde den Meester en zijn Instrument op eenen dagh vernielt zijn/ waerom het teecken van waerheyt verloren. Daer worden wel verscheyden Processen van het Mobile by den Ouden beschreven/ maer t'zijn die grootste beuselen van de Weerelt/ wonder veel verleydt/ maer niemant yet uytgerecht: waren die Processen goet/ die Ouden soudē die ghemerckt hebben/ en ons in ghedachtenis ghelaten/ waer van wil alle Liefhebbers waarschouwen/ en haer een beter wegh wijsen: Biddende den ghenadigen Godt/ alle Coninghen ende REgenten te verlichten/ met zijn godertieren wijsheyt/ op dat alle Menschen (o Coningh/ gelijk wy uwe Ondersaten) soudē smaken die waere wellust van de Godlijcke vrede/ waerom door uwe M. genietende/ de grootste weldaet die van den wijsten Regent te wenschen/ so wete niet wat danckbaerheyt sal bewijsen: overdenckende/ hoe meest alle Coningen haer laten verleyden van de blinde begheerte/ soeckende door't bloedighe Oorlogh vermeerderinghe des Rijcx/ niet ghedenckende/ hoe dat onmoghelijck te vercrijghen/ sonder grooter verlies ende elendigh verder van haer ghetrouwe Ondersaten/ die lijf/ goedt/ bloedt/ daer voor moetenavontueren: wat cloeck verstandt wil zijn leven alleen verghelijcken by eenigh verganckelijck goedt? Waer uyt moghen bekennen die vrucht van het bloedighe Oorlogh/ ende die wijseyt an de vreedsamighe Coningen/ welcke door goede WETten soecken te verhoeden die misdaet/ en het quaet door Justitia rechtveerdelijck te straffen: ghedenckende/ dat rechtveerdicheyt niet wil/ dat straf de misdaet sal overwegen/ maer liever dat straf door beweghelijcke barmherticheyt soude verlicht wordne/ op dat alle Menschen soudē smaken die aenghename vrucht van de wijse Regenten/ en in plaets van't wreede vittere Oorlogh/ haer vermaken met de soetichē van de Consten/

Appendix

waerom tot een inleydingh dese mijne arbeydt begonnen: Maer alsoo mijn meyninghe niet en can volcomen uytbeelden/ noch in de Engelsche/ noch in de Latijnsche tael/ so hebbe dat in Duyts geschreven/ en van woordt tot woordt laten oversetten/ op dat den sin onveranderlijck soude moghen verstaen/ en haer somtijts in de wouderlijckheyte van de natuere vermaken/ waeromme verhope dat mijn goede wille sult (is this second person) ten besten nemen/ en langh ghesont en vreedsaem leven/ onder die bescherminge van de moghende handt Gods/ Amen.

Cornelis Drebbel.

Appendix II: Drebbel's *On the Nature of the Elements*

I have translated from the 1608 German edition as the earliest edition available. The 1621 Haarlem Dutch edition might be identical to the now lost 1604 original, but there is no way to know. I have indicated points of difference between this edition and Lauremberg's 1628 Latin translation and the 1621 Dutch edition in the notes.

Ein Kurzer Tractat von der Natur Der Elementen Und wie sie den Windt/Regen/Blitz und Donner verursachen/und war zu sie nutzen Durch Cornelium Drebbel in Niederlandisch geschrieben unnd allen der Naturliebhaberen zu nutz ins Hochteutsch getreulich uber gesetzt. Gedruckt zu Leyden in Hollandt/ Bey Henrichen von Haestens im jahr Christ 1608.

Vorrede

Von den Elementen.

Gunstiger leser/ wan dir dieser gegenwertiger Tractat zu handen kompt/ magstu frei glauben/ das ich ihne zu deinem nutzen/ und nicht zu meiner ehr geschrieben dan mir wol bewust der eitele rhum dieser Weltd/ sein wir nicht unschuldig und demutig von Gott geschaffen? welche unschult wir durch hochmutig unnd misbrauch verlohren/ daher haben wir mannigerlei urtheil/ und meinung einer von andern/ wie wol wir ein ander nicht kennen, wan wir dan den hochmuth hassen/ sein wir dan nicht unschuldige weiss unnd demutigreich? ¹ sein wir nicht all Bruder? was haben wir das wir uns rühmen? darumb wehe uns/ so wie uns etwas zu sein achten/ und lassen unsern Bruder dar bey/ lasset uns die güthte Gottes betrachten/ wie uber schwenglich er uns mehr gibt/ dan wir bitten/ lasset uns uns selber prufen/ sein wir nicht Könige des köstlichsten kleinodts so Gott geschaffen? haben wir nicht allen reichtumb der Welt zu unserm dienst? wan wir die Welt verlassen müssen/ wirdt uns nicht Gott die unvergängliche Himlische gaben geben die tausent unnd tausent mahl grösser sein? derowegen leber leser warumb liebstu nicht deinen negsten/ gleich du von Gott geliebt wirst? bin ich unverstandig/ bistu nicht unverstandiger gewest? mus ich deswegen gebrech leiden? bistu nicht mehr gebrechlich ohn Gott? Warumb lehrestu mich nicht/ der du reichlich von Gott gesegnet bist? Sol ich dich darumb hasse? keines weges so ich dich hasse/ hasse ich nit mich? Dan wie du bist/ bin ich auch/ sol ich mich dan rumen, nein: demütiggen. Kennen wir uns anders rumen/ den in Gott? der uns alle liebet. Darumb die ruhm süchen/ haben die nicht Gott verloren? aber der sich demütigt erlangt der nicht ehr? dieses sahe ich in meiner demüht/ meine ehr war mein elendt/ mein elendt der stachel des Todts/ der Todt mein sieg/ mein sieg meine sehle/ meine sehle mein rechtumb/ mein rechtumb Gott/ auss welchem/ war das ich bin/ und in welchem essein entschaft nehmen wirdt/ was sollen wir aber zur danckbarkeit thun? Sollen wir Mirhen oder Weirauch opfern? sollen wir uns lassen beschneiden/ oder den bartt scheren? sollen wir unsern stuel erhöhen/ und in weissen oder schwartzen Kleideren Predigen? sollen wir grosse Bücher schreiben, Gott dar mit zu loben? Ist es nicht eittelheit? Lieber Bruder, was können wir Gott geben/ der alles hat? was sollen wir dan thun? Danckbar sein und von Gottes Sohn

¹ In the Dutch translation, 1621, this is, "soo schijnt ghy my, ende ick u, wel wat anders dan wy zijn, also oock dat ick u, noch ghy my niet en kent: als wy nu achteloosheit hatten, ende 'tgoede oeffenen: zijn wy dan niet onnoosel-wijs."

Latin, 1621. "Caeterùm pravitate & desideria in super odioque habitis, si rebus bonis & honestis exerceri coeperimus, an non etiam in simplicitate illà sapientes futuri sumus? in humilitate & submissione illà divites? Et nunquid tu mihi, ego verò tibi, instar fratrum sumus? Quid invenis penes te, quod non gratis, & saltem commodatò tibi sit indultum? aut quid essent in me, cur glorià memetipsum dignarer? Vae nobis si pluris quàm par est nos nostraque fecerimus, fratrumque nostrum egere illis patiamur."

lernen demüth und das kleine gesetz Liebet Gott über alles/ und eweren nechsten/ wie euch selbst/ Dis ist das gesetz und lehr aller Apostelen und Propheten/ wie uns dan auch Gott solches in der Natur lehrt.² Derowegen wie ich sahe/ wie der hochmüt den menschen verführet unnd ihne verhinderet die Natur zu verstehen/³ wardt ich bewegt die lehrende Natur zu lieben und Gott auss seinem geschopf/ das ich mit verwunderung sahe/ zu kennen. Ich ersuchte die Elementen/ die mich lehrten die Natuur der Erden/ Ihren Christallin Geist sahe ich/ wie einen Nebel, ihre gefarbte Sehle/ wie ein bluth/ ihren standtfesten leib/ wie Christal/ den Geist sahe ich fechten und über winden leib und Sehl/ welche doch sich vereinigten. Der leib diente dem Geist/ und der Sehlen vor ein feste wonung/ der Geist erleuchtete den leib und die Sehle wie ein Christaliner Himmel/ die Sehle ziehrte leib und Geist mit ihrer Himlischer Rubin rother farb. Ich sahe Tödt/ auferstehung und die unsterblichkeit vor augen/ ich war meinem Gott danckbar/ und liebte die Natur/ und understundt mich gegenwertiges Buchlein deinert wegen lieber leser⁴ zu verfertigen/ verhoff du werdest es nicht mit unverstant verachten noch mich verdencken das ich dis mein schreiben mit den alten scribenten nicht beweisse und bekrafftige/ dan ich/ die warheit zu sagen/ keinen hieruber gelesen/ sondern ich gebe dir solches/ wie ich es von der Natur empfangen habe/ ich vergewisse dich/ das du alhie finden wirst/ das vor vielen verborgen ist und so du mich nicht recht verstehest/ so ist dir unbekant/ war zu es dienstlich/ welches ich deines unverstands wegen verschweige/ damit ich mich nicht zu viel blos gebe/ aber wan meine Sehle meinen leib wirdt über wunden haben/ hoff ich/ es solle offentlich an den tag komen. Es ist nichts neues/ sonder vor Tausent Jahren gewesen/ dero wegen wil ich schreiben von den gemeinen Elementen/ wie sie dir best bekant sein/ da mit du das ubrige nemlich die Erde erkennen lernest/ dan die Erde ist nicht so simpel as Feuer/ Lufft unnd Wasser/ sondern ist der unreine rest/ dan man findet volkomlich vier Elementische Naturen in der Erden/ unnd ihrem gewächs damit wir unser werck volbringen/ das Feuer/ Wasser/ unnd Lufft seindt diener der Erden/ das Feuer wercket in den Lufft/ der Lufft im Wasser/ das Wasser wirckt in der Erden die feuchtichkeit/ wie ich hernach weitlaufftiger erzehlen wil/ meinen anfang nemendt von der Schöpfung/ und die selbige an zu deuten/ so viel wir dar von auss genaden Gottes verstehen mügen.

Dear reader, when this current treatise reaches you, may you well believe that I have written it for your use and not for my honor, since I well know that the fame of this world is vain. Are we not created innocent and humble by God? The which innocence we lost through insolence and misdeed, and therefore we have many judgments and opinions differing one from another, and we do not know each other, but if we hate insolence won't we be then innocent, wise, and humble? Are we not all brothers? what do we have that praises us? Therefore we flatter ourselves when we consider ourselves to be something, and desert our brothers and thereby we neglect to consider the goodness of God who is bountiful and gives us more than we pray for. Let us test ourselves, are we not created by God as Kings with the costliest jewels? Do we not have all the riches of the world for our use? When we must leave the world will not God give us the imperishable heavenly gifts which are a thousand times greater? Therefore beloved reader why do you not love your neighbor just as you will be

² Dutch version continues (7), "op dat niemant den tweeden doodt soude smaken."

³ Dutch version continues (7), "als oock, den swaren arbeydt die ghedaen wordt, om ,tghene dat weynich ofte niet waerdich was."

⁴ Dutch version adds (8), "in plaetse van quade oeffeninghe."

loved by God? If I am ignorant are you not more ignorant? Must I therefore suffer a handicap? Are you not more handicapped without God? Why do you not teach me what you have been liberally blessed with by God? Will I therefore hate you? Certainly not. If I hate you do I not hate myself? Since as you are I also am, shall I therefore glorify myself? No, rather I should humble myself. Can we glorify ourselves other than in God, who loves us all? Therefore those who seek glory have they not lost God? But he who humbles himself, does he not obtain honor? This I saw in my humility, my honor was my sadness, my sadness the sting of Death, Death my victory, my victory my soul, my soul my kingdom, my kingdom God, out of whom it was that I am and in whose being I shall find my conclusion. What should we do in gratitude? Should we offer myrrh or sacrifices? should we allow ourselves to be tonsured or to cut our beard? should we raise our chair and preach in white or black robes?⁵ shall we write large books to praise God with them? Is that not vanity? Beloved brother, what can we give God who has everything? What shall we then do? We shall be grateful and learn from God's son humility and the short command, Love God above all and your neighbor as yourself. This is the law and lesson of all the apostles and prophets, which God himself teaches in Nature. Therefore when I saw how pride misleads men and prevents them from understanding nature, I was moved to love my teacher Nature and to know God from his creation which I regarded with awe. I investigated the elements which taught me the nature of earth, I saw their crystalline spirit like a fog, their colored soul, like blood, their steadfast body like a crystal. I saw the spirit fighting and conquering body and soul which then became one. The body served the spirit and body as a secure dwelling, the spirit illuminated the body and the soul like a crystalline heaven, the soul tinged body and spirit with its heavenly ruby red color. I saw Death, resurrection, and immortality before my eyes, I was grateful to my God and loved Nature, and undertook to finish this little book serving you, dear reader, I hope that you will not scorn it as ignorant, nor blame me for not informing and strengthening my writing with the ancient authors, since to tell the truth, I have not read any of those. But I give you just what I have received from nature. I assure you that here you will find here what has been hidden from many, and if you do not comprehend me correctly, what it is useful for will be unknown to you. About which I remain silent due to your incomprehension so that thereby I do not give myself away too openly, but I hope that when my soul has conquered my body it shall openly come to light. It is nothing new, indeed, it has been around for a thousand years, and therefore I wish to write concerning the common elements as they are best known to you so that you may learn to know the rest, namely the earth, since the earth is not as simple as fire, air, and water, but it is the impure remainder so that one finds the four elementary natures completely in the earth, and their growth, with which we bring our work to completion. The fire, water, and air are servants of the earth, the fire works in the air, the air in the water, the water creates damp in the earth,⁶ as I shall hereafter narrate more fully, taking my beginning from the Creation, and relating of that as much about it as we may understand through the grace of God.

Das erste Capittel.

Alle dinge haben ihren anfangk von Gott/ und werden in ihm ihre endtschaft nehmen: dan das ende aller dingen (wie wir taglich sehen) ist ihr anfangk/ was auss der Erden kompt/

⁵ Dutch version adds (6), "Of zullen wy die sonder Godt onwetende zijn, die onwetende met den Swaerde uytroeyen? of zullen wy Gods lof uytroepen?"

⁶ *ibid*, 10. "op behoeflijcke plaetsen."

wirt wieder Erde/ was auss dem Wasser/ Wasser/ etc. alle dinge sein ihm anfangk bey Gott vollen kometen gewest/und werden im ende wieder vollen kometen werden/ wan die Elementen werden schmelzen und sich wiederumb in klaerheit bey Gott vereinigen/ es werde nictes zu nichte oder zu gründe gehen/ dan die ungerichtigkeit/ dan wie die zeit erfullet war/hatt Gott auss unaussprechelicher weisheit alle dinge geschaffen/ unnd zum ersten von anderen geschopfen das aller subtilste/ nemlich das Feuer abgesondert/ welches seine stelle im allerhohesten genommen/ aldaes erfullet die unendliche weite/ und umfangt alle herlichkeit des Herren/dan alles was leicht ist/ steigt auffwertz. Darnach hatt Gott wieder das subtilste und leichte nemlich den Lüfft abgesondert welcher seine stelle negst dem Feuer hatt/⁷darnach blieb uberig Feucht unnd grob/ also hat Gott abermal das subtilste/ und Feuchtigste abgescheiden von dem ubrigen/ nemlich der Erden und Wasser/ das Wasser bedeckt die Erde/das Feuer den Lüfft/ der Lüfft das Wasser. Gott hadt durch seine Göttliche macht/ die Erde auss dem grunde des Wassers erhaben/ und uns gesetzt im mitten seiner geschopffe/ auff das wir deste besser sehen möchten/ den schein seiner klarheit/ und ihne lieben/ nicht wie die Engel/ sonder wegen der perfection seiner geschopff. Also hatt Gott sein geschopff in vier theil geteilet/das Feuer/Luft/ Wasser unde Erde und ein jegliches hatt seine kraft/ darnach sein subtilitet ist dar in das Feuer alle uber trifft/ und hat macht ihnen eine klarheit/ seiner klarheit gleich/ zu machen/ es gibt allen dingen leben/ und sonder im seindt alle dinge todt/ wie wir alle tag und vor nemlich im Winter sehen: sehet wie das Feuer zum ersten den Lüfft erklaret/ und ihne eine klarheyt/ der seinigen gleich/ machet/ dan es erleuchtet ihn von aller Finsternis unnd macht offenbahr/ was in der Finsternis verborgen war/ und reinigt ihne von aller vapischer Feuchtigkeit/ unnd allem irdischen rauch: es reinigt auch ihne dem Lüfft von aller grobheit/ und macht ihne alle solida durch dringendt. In summa das Feuer macht ihm den Lüfft in allem gleich/ also das kein onderscheid zwischen ihnen beiden ist/ wie wir an unserm gemeinen Feuer sehen/welches wan es mit torff/ oder holtz underhalten wirdt/ ziehet es und zeucht ansich mit grossem gewalt den Luft/ welchen es reinigt/ Clarificiert/ unnd ihm gleich macht/ Ja es ist so geneigt den Lüfft zu Clarificirn/ das wan es verhindert wirdt und solches nicht lenger thung mag/ unnd der Lüfft von ihme abgekehrt. (Das ist/ wan das Feuer beschlossen wirdt) verschwindt es/ und fahret daher es gekommen/ welches würdig ist zu mercken: Dan erstlich lehret es uns/ wie das Gottes geschöpff ihres beruffs warnehmen/ unnd arbeiden so lange sie materiam finden/ und Je mehr sie finden/ je besser Clarificieren sie/ so sie nicht verhindert werden. Auff das wir auch also unseren berueff in acht nehmen möchten/ unnd Gott unseren Schöpfer oder seine gaben/ in uns unverhindert arbeiden lassen/ damit wir auss einem liecht ins ander gehen/ unnd durch den schein seiner klarheit mochten geklarificiert werden.

The First chapter.

All things have their beginning from God and will find their ending in him. Since the end of all things (as we see daily) is their beginning, what comes out of the earth becomes earth again, what comes from water [becomes] water etc. all things were in their beginning by God perfect, and will become again in the end perfect, when the elements will melt and again reunite in clarity by God. There will be nothing which will come to nothing other than injustice. When the time had come, God out of his ineffable wisdom⁸ created all things. He

⁷ *ibid* (12): “Doen wiert het gheteperde vochtiche ende gros.”

⁸ This is an “either, or” in the Dutch (11): “want Gode heeft doen den tijdt vervult was/ oft als het sijne Goddelijcks Voorsienigheydt goedt ghedocht.”

at first separated from the other creatures the most subtle, namely the Fire, which taking its place in the sublime, filled the infinite vastness and embraced the entire glory of the Lord, since all that is light rises upwards. Afterwards God had again separated the most subtle and light, namely the air, which had its place next to the fire. Thereafter remained the rest wet and heavy, so God again separated the subtlest and the wettest from the rest, namely the earth and the water. The water covered the earth, the fire the air, and the air the water. God through his divine power lifted the earth from the depth of the water and set us in the middle of his creation so that we might better see the glory of his clarity and love him not as the Angels do but due to the perfection of his creation. Thus God separated his creation in four parts, the fire, air, water, and earth, and each had its power according to its subtlety. In that the fire exceeded everything and had the power to make them have a clarity equal to its clarity. It gives all things life and without it all things are dead, as we see every day and especially in winter. We see that fire first clarifies the air and makes it have a clarity equal to its own, and it illuminates it from all darkness and makes apparent what was hidden in darkness, and clarifies it from vaporous damp and all earthly clouds. It purifies the air also from all massiness and makes it piercing through all solids. *In summa* the fire makes the air equal to itself in everything, so that there is no distinction between the two, as we see in our common fire, when it is fed with peat or wood, it pulls and sucks to it the air with great force, which it purifies, clarifies, and makes equal to itself. It is so inclined to clarify the air, that when it is prevented and may no longer do this, and the air is cut off from it, (this is when the fire is enclosed), it disappears and goes back whence it came, which is worthy to be noted. Since first of all teaches us how God's creatures observe their duty and work as long as they find material and the more they find the better they clarify, unless they are hindered. From that we too may observe our duty and allow God our creator or his gifts to work in us unhindered whereby we go from one light into the next and through the light of his clarity we may become clarified.

Das ander Capittel.

Wie das Feuer würcket in den Lüfft/ also arbeitet es auch in Wasser/ und Erde/ welches wir sehen an torff oder holtz/ welche wie der Lüfft geclarificiet werden. Sehent an die kohlen/ wie schwartz sie sein ausserhalb dem Feuer/ und im Feuer sein sie so klar/ unnd liecht/ wie das Feuer/ und werden durchs Feuer Clarificiert und verandert in ein unsichtbare gestalt/ gehen also in ihr erstes wesen/ und die asche konte man auch veranderen/ und Clarificiern/ wie ein glas/ und darnach unsichtbar machen. Nun möchte einer fragen/ wie ist es muglich/ das das Wasser geschaffen sei von dem selbigen/ darvon das Feuer gemacht ist/ Sintemal alle dinge gemeinschaft haben mit dein dinge/ darvon sie gemacht sein/ welches das Feuer nicht thut/ darumb auch unmöglich das das wasser durch Feuer solte geclarificiert werden können. hierauff ist zu antworten/ das zwei contraria nicht können vereinigt werden sonder mittel/dan als Gott das aller subtielste/ klarste/ truckenste hatte geschieden von dem ersten geschöpf seiner geschöpfe/ da war zurstunt sein contrarium geschaffen/ das ist das aller grobste/ finsterste/ feuchteste/ und kalteste/ welche ist die grobheit der Erden unnd die Feuchtigkeit des Wassers/ welche Feuchtigkeit des Wassers war gemessigt/ durch die Truckne des Lüffts und der Erden/ also auch die grobheit unnd Truckene der Erden durch die subtilitet des Lüffts in Feuchtigkeit des Wassers/ etc. Also ist zu sehen das keine vereinigung geschicht sonder mittel. Darumb kan das Wasser nicht vereinigt werden mit dem Feuer/ ohne die subtilitet des Lüffts/ unnd truckene der Erden/ welche vermengunge ist in gestalt eines Aquae Vitae, oder Olei. O tieffe der Weisheit/ wie ungrundtlich seint deine geschöpfe/ und deine wercke so löblich/

wer solte dir nicht glauben/ der nur das licht der Natur vermercket? Wer soltte sich nicht verwunderen/ der nur die Schöpffinge vor augen sicht? Lieber wie magstu Gottes wunder sonder verwunderunge anschawen? Warumb bistu sehendt blindt/ unnd merckest nicht auff die werck Gottes? Lobest auch Gott nicht/ wan du das erste wesen sichst oder das geschöpffe seiner geschöpffe/ dar in Feuer/ Lüfft/ Wasser und Erde scheinen/ in der gestalt wie sie von Gott geschaffen sein. Merck doch wie sich die Elementen scheiden/ der Geist des Feuers steigt in die höhe/ und fuhret mit sich Lüfft/ Wasser/ unnd Erde/ welche durch die kälte des Lüffts erkaltet/ und grob gemacht werden/ unnd gehen bey ihres gleichen/ da von sie gekommen sein. Die Feuchtigkeit des Oels/ welches Wasser ist/ wierdt in einen nebel verändert/ unnd falt neider in Wasser tropfen/ die Erde steigt auff wie ein dampf und falt nieder so schwartz sie ist/⁹ der Lüfft wirdt ven sich selbst umfangen. Wer kan von diesem ursach geben/ unnd Gott vergessen zu loben? Also ist klar/ das das Feuer das leben ist von allem auch das es verklart unnd verändert alle dinge/ wie sie im anfangk bey Gott gewesen sein/ so wol Wasser/ als Erde unnd Lüfft/ aber nicht sonder mittel/ darumb mus die grobheit des wassers durch die subtilitet des Lüffts gemessigt werden/ und die Feuchtigkeit durch die truckne der Erden/ als dan ist die materia fertig und kan clarificiert und lebendig gemacht werden von dem Feuer/ dar von viel zu schreiben ware aber ich habe es mit fleis unterlassen damit wir erste eher zu unserem proposito kommen mügen.

Chapter Two

Just as the Fire works in the air it also labors in water and earth which we see in peat or wood which become clarified like air. Seeing how black the coals are outside the fire and in the fire they are as clear and light as the fire and they become clarified through the fire and transformed into an invisible form as in their first essence (“wesen”), and the ash man can also transform and clarify like glass and furthermore make it invisible. Now someone might ask how it is possible that the water is formed from the same thing from which the Fire is made, since all things share commonalities with the things from which they are made which the fire does not do, and therefore it is impossible that the water could be clarified through Fire. Here I answer that two contraries cannot be united without a medium, since when God had separated the subtlest, clearest, and driest portion from the first creation, then immediately its contrary was created, that is the coarsest, darkest, wettest, and coldest, which is the massiness of the earth and the dampness of the watter, the which dampness of the water was modified through the dryness of the air and the earth , and thus also the massiness and dryness of the earth through the subtlety of the air and the dampness of the water. Therefore one can see that no unification occurs without a medium. Therefore the water cannot be unified with the fire without the subtlety of the air and the dryness of the earth, which mixture occurs in the form of an Aqua Vita, or oil. O depth of wisdom, how infinite is your creation and how praiseworthy your work. Who shall not believe you who has only observed the light of nature? Who shall not be amazed who only sees the creation before his eyes? Rather, how may you observe the wonder of God without awe? Why in seeing are you blind, and do not remark the work of God? Do you also not praise God who shows you the first being or the genesis of his creation there appearing in fire, air, water and earth in the form as it was created by God. Note further how the elements separate, the spirit of fire rising aloft and carrying with it air, water, and earth which is cooled through the cold of the air and becomes massy and returns to that which is similar to it, from whence it came. The

⁹ *ibid*, 17, “als Swartselis.”

dampness of Oil, which is water, becomes transformed into a cloud and falls down in water drops, the earth rises off as a mist and falls down as black as it, the air becomes embraced by itself. Who can learn the cause of this and forget to praise God? It is also clear that the fire is the life of everything and also that it clarifies and changes everything as it was in the beginning by God, water as much as earth and air. But [this does] not [occur] without a medium and therefore the massiness of the water must be modified through the subtlety of the air and the dampness through the dryness of the earth, and then the *materia* is ready, and can be clarified and made living from the fire, about which much could be written, but I have omitted that, taking care that we may sooner come to our proposed subject [proposito].

Das dritte Capittel

Nu wollen wir besehen die tugendt des Lüffts bey den anderen Elementen. Dan gleich wie die drei Elementen todt sein ohne das Feuer/ also ist auch das Feuer todt ohne die Elementa/daraus die volkomne Weisheit Gottes gespüret wirdt/ welche nichts vergebens geschaffen/ dan gleich wie das Feuer das leben ist unnd lebet im Lüfft/ also lebet auch der Lüfft im Feuer/ das wasser in der Erden/ die Erde im Wasser/ das Wasser im Lüfft/ etc. das Feuer reinigt den Lüfft/ der Luft das Wasser/ das Wasser die Erden/ undt ein igliches macht die andere/ durch feuer/ gleich der klarheit seiner klarheit/ Schauet an/ wie im Somer durch die kraft der Sonnen/ das Wasser unsichtbarlicher weise auf gezogen unnd durch den Lüfft Clarificiert wirdt/ also das unter Lüfft und Wasser kein unterscheid ist/ wie wir solches täglich merken am Wasser/ welches/ so es in die Sonne gesetzt/ wirdt aufgezogen/ und bleibt subtil/ so lange es von der kelte nicht vergrobet wirdt/ dan wie das Feuer alle dinge subtilifiert/ also die kelte/ welche des Feurs gegentheil ist/ vergrobet alles/ unnd truckt das Wasser zusammen indeme sie ihme benimbt die werme des Feurs/ und subtilitet des Lüffts/ darumb fällt das Wasser in tropfen wiederumb nieder/ Welche tropfen empfangen von der Erden/ das Alimentum oder die Natur der Elementen/ unnd durchtringen also den sahen bis in die Wurtzel/ aber durch die Werme der Sonnen ziehen sie auffwartz/ bis an die eusserste theil des gewechs/ verlesst als dan Wiederumb die Geister oder Elementa der Erden/ Welche erde/ durch die werme der Sonnen der Natur/ unndt leben des gewechses wirt verändert nach der form und kraft des gewechses/ Werden also die gewechs nutriert unnd vermehret durch die stätige durchziehung des Wassers/ daraus Wir sehen die güthe ordnung und Weisheit Gottes unsers Schopfers. Aber als die kälte sehr gross ist/ Wirdt das Wasser congeliert/ und verändert in gestalt der Erden/ Wie dan die kelte/ als ein effectum der Erden/ das Wasser vergrobet unnd ihrer dickheit unnd harte gleich macht/ also vergrobet der Lüfft das Feuer/ Wan die kelte des Lüffts grosser ist/ als die Wärme des Feuers. Das Feuer Wirdt verändert in die gestalt des Lüffts/ der Lüfft in gestalt des Wassers und das Wasser in gestalt der erden/ wie zuvohr bewiesen/ Welches eine Wunderbarliche sache ist/ dar durch unsere vorige Rationes von der scheidung des ersten Wesens confirmirt Werden. Dan Wie Gott die Elementen gescheiden von seinem ersten geschopff/ also Werden die Elementen Wiederumb durch unser Feuer (als ein schatten des ersten Wesens) gebracht in ihr erste geschöpfe/ Wie Wir an einer brennenden ampel unndt allen Combustibilibus leichtlich sehen mügen/ dan so baldt die ampel agezündet wirdt/ wirt das oel durch die Element¹⁰ erklart/ also das zwischen dem oel unnd der flam kein unterscheidt ist/ ja das oel ist die flamme/ und die flamme das oel/ welches durch die flamme passiert/ und wirdt zerstant durch die kälte (als des feuers contrarium) gebracht in sein Element/ wie oben angedeutet. Darumb der die flamme mit fleis ansihet/ der mercket

¹⁰ *ibid*, 21, “door de vlamme.”

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nicht allein die reduction/ und clarification der Element in ihr erstes wesen/ sondern auch die scheidunge auss dem ersten in die Element/ welches eine uber ausswunderbarliche sache ist die wurdig ist zu notiern/ darvon wir weitleuftiger sprechen wollen zu seiner zeit.

The third chapter

Now we will observe the virtue of the air within the other elements. Since just as the three elements are dead without fire, so also the fire is dead without the elements, from which can be seen the complete wisdom of God who created nothing in vain. Thus just as the fire is life and lives in the air, the air also lives in the fire, that water in earth, the earth in water, the water in air, etc. The fire purifies the air, the air the water, the water the earth, and each one makes the other through the fire of the same clarity as its own. Observe how in the summer through the power of the sun, the Water is invisibly drawn up and is clarified through the air in such a way that there is no difference between air and water, as we note everyday in water which is set in the sun and is pulled up and remains subtle as long as it is not made massy from the cold. Since just as the fire sublimates all things, the cold which is the contrary of the fire, coarsens everything and again condenses the Water, and takes [away] the warmth of the fire and the subtlety of the air. Thus the water falls down again in drops. These drops receive from the earth the nourishment or the nature of the elements and thus the seeds penetrate and into the roots, but then through the heat of the sun they pull upwards into the top portion of the plant, where it leaves behind the spirits or elements of the earth. Through the heat of the sun, and the nature and life of the plant, the earth is transformed in keeping with the form and power of the plant. Thus the growth is nourished and transformed through the constant dissemination of the water, from which we see the good order and wisdom of God our creator. But if the cold is very great the water is congealed and changed into the form of the earth. Just as the cold, as the effect of the earth, thickens the water and makes its thickness and hardness the same [as its own], thus the air also thickens the fire, when the cold of the air is greater than the heat of the fire. The fire is changed into the form of the air, the air into the form of the water, and the water into the form of the earth as the foregoing demonstrates. This is a wonderful thing, which is confirmed through our previous *rationes* concerning the separation of the first essence (wesen). Then just as God separated the elements from his first creation, thus also the elements are once again through our fire (as a shadow of the first essence [wesen]) brought into their first form, which we easily may see in a burning torch and in all combustibles, since as soon the lamp is lit, the oil is clarified through the element [of fire], so that nothing distinguishes between the oil and the flame, nay further the oil is the flame and the flame is the oil which passes through the flame and is immediately through the cold (as the contrary of the fire) brought into its element as explained above. Therefore he who observes the flame with diligence notes not only the reduction and clarification of the element into its first essence (wesen) but also the separation out of the first into the elements which is an incredible thing that is worthy of being noted and about which we wish to speak further at the proper time.

Das vierde Capittel

Can wir betrachten/ was hier oben gelehret/ unnd das selbige wol verstehen/ so begreifen wir volkomolich die ursache des Windes/ Donners/ unnd Blitz/ dan wan die stralen der lebendichmachenden Sonnen/ ohne verhinderung/ den Lüft/ umb das dicke kalte Wasser durchtringen/ clarificieren/ unnd verwermen/ so wirdt der Luft vergrosset/ entbunden unnd verandert/ in die Natur des Feuwers/ und das Wasser in Natur des Lüfts/ dar auss

dan folget eine stetige bewegung/ welche sich verbreitet/ auss allen seiten über den Erdbodem/ denselbigen zu befeuchten/ aber das düngemachte Wasser welches schwebet über der Reflexion/ oder warmen Lüfft/ bis in den dicken/ dichten und kalten Lüfft/ wirdt wiederumb in ein ander getrongen/ vergrobet/ verkleinert/ und verändert in die Natur des Wassers/ unnd fällt mit tropfen niederwartz/ Daraus nottwendig folgen müß die stille/ gleich wir befinden wan es regent: es sei dan das die auffziehung noch wehre/ und stärker sei dan der kalte Lüfft vergrobet/ unnd zusammen getrongen hatt/ dan gleich wie die Wärme/ Lüfft unnd Wasser/ subtil/ dün/ unnd grob machet/ also vergrobet/ verkleinert/ und truckt zusammen die kälte/ als ein contrarium der wärme/ und zeucht also wieder in alle Winde/ die durch die Wärme auss gegangen wahren/ gleich wie wir klarlich sehen/ wan wir hangen eine ledige glaserne Retortam/ mit dem mundt in ein Fas mit Wasser/ unnd unter dem Bauch ein Warm Feuer legen/ wie diese Figur auss weiset unnd mitbringt. [Figure follows] Es Werden Wir sehen so baldt der Lufft im glas anfangt warm zu werden/ das winde steigen auss dem mund der Retorten und das das wasser voller blasen wirdt/ und dis wirdt wehren/ so lange der Lufft je lenger je warmer wirdt/ aber wan du die retort vom Feuer nimbst/ unnd der Lufft anhebt zu erkalten/ so wirdt der Lüft wider in der Retort in einander gehen/ grob und dicke werden/ also das das glas wirt mit Wasser erfüllet¹¹ werden/ weil der Luft/ der zu vor heiss/ entschlossen unnd Rarificirt war durch das Feuer/ dan so fern du das glas sonder brechen gar heiss machen kanst/ so wirdt die Retorta wan sie kalt wirt/ mit Wasser erfüllet sein/ darumb ist eine steinerne Retorta viel bequemer/ aber die verfüllung zu sehen/ ist eine glaserne viel besser/ unnd je mehr das Wasser schwehret unnd grober ist dan der Luft/ desto mehr wirt es durch die werme entschlossen unnd ergrosset/ ja viel tausent mahl mehr/ wie wir solches sehen/ wan wir einen apfel braten/ wie die wind aus gehen/ und wir gleich wol kaum einige vermindering der feuchtigkeit vernemen/ Also auch wan wir einen Eisenen hafn oben wol verlutiern/ unnd ein loch dar in lassen/ wan wir/ nach dem der hafn heiss gemacht/ einen tropfen Wassers durch das loch tropfen lassen/ so wirdt zurstundt das Wasser vergrosset werden/ und wie ein schneller tauschender wind zum loch herauss fahren.

The Fourth Chapter

If we consider what was taught above, and understand it well, we will completely comprehend the operation of the wind, thunder, and lightning. Since when the rays of the enlivening Sun unhindered penetrate the air around the thick cold water, clarifying and warming it, then the air is expanded, rarefied, and changed into the nature of fire, and the water into the nature of air. Thereafter follows a constant movement which spreads over all the Earth to moisten it. But the thinned water which sails above the Reflection or hot air into the thick, close, and cold air will be again be minimized and changed into the nature of water and falls downward with drops. Then the quiet must follow just as we find when it rains, unless the upward pulling [or evaporation] is longer lasting and more powerful than the cold air's coarsening and condensing. Since just as the heat makes the air and water subtle, thin, and large, the cold as a contrary of the heat also coarsens, reduces, and condenses. Thus it pulls back in again all the wind which through the heat had gone out, just as we see clearly when we hang an empty glass retort with the mouth in a vessel with water and we lay a hot fire under the belly as this Figure illustrates. We see that as soon as the air

¹¹ In the Dutch version, there is a contrast with the water filling the glass here being filled “een groot deel” (24), versus in the next sentence where it is “by-nae gheheel met water vervullen,” suggesting that the greater the heat, the more the glass will be filled with water (25).

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in the glass begins to be made hot, the wind shoots out of the mouth of the retort and that water is filled with bubbles. This continues as long as the air continues to be warmed, but when you take the retort from the fire and the air begins to cool, the air inside the retort will be condensed again, and becomes coarse and thick so that the glass will be filled with water, after the air was before heated, released and rarified by fire. If you could heat the glass very hot without breaking it, then the retort when it cools again would be full of water. For this a stone retort is much more suitable, but in order to see the filling a glass one is much better and the more heavier and thicker than the air the water is, the more it will through the heat be resolved and enlarged, yes many thousand times more as we see when we roast an apple how the wind shoots out and yet we see almost no lessening of moisture. Also when we wish to lute an iron oven, we leave a hole in it and after we have made it hot we let fall a drop of water through the hole, the water will immediately be enlarged and like a fast wind pass out through the hole.

Das Fünfte Capittel

Aber wan gegen den abent die auf zziehung des Wassers durch den unterganck der Sonnen vermindert/ haben wir gemeinlich stille/ wie wol das Wasser nimmer ohne aufziehung ist/ es sei dan die kolte so gross/ das das Wasser gefreuhret/ gleich wir sehen/ wan wir eine grosse breite Schüssel mit Wasser füllen unnd in eine kühle kamer setzen/ dan nach verflussung etlicher tag werden wir befinden/ das das Wasser vermindert/ ursach das der Lüft der kammer umb etwas wermer ist/ dan das wasser/ aber wan wir des abendts keine stille spüren/ komt solches daher/ das wir weit von dem ohrt/ dar das wasser unnd Lüft entbunden werden/ gelegen/ der windt aber folget der entbindung/ wie wir dan sehen amgethon/ das fern von uns gemacht wirdt/ dan wir horen den schall uberlang/ nach dem wir es gesehen/ darumb ob wol die starcke bewegung aufhöret/ wegen undergangs der Sonnen/ gleich wol werden wir solches wegen folgender bewegung des Lüfts lange nicht gewar/ der wegen befinden wir durch den einen windt mehr stille/ als durch den anderen/ nach gelegenheit des orts. Aber so wir nahe bei dem ort sein/ haben wir stille/ so baldt der abendt anfahet/ wir haben auch auf gewisse zeit des jahrs viel regens/ als im Martio/ April/ Maio/ September/ October/ November/ welches gleichermassen/ auss angedeuther ursach mag verstanden werden. Dan in diesen Monaten sein wir zwischen kalte/ und wärme also/ das die schwebende wolcken durch mangel der wärme zum zweiten mahl nicht können entbunden/ und vergrosset werden/ aber der Lufft ist als dan bequem die aufgezogene wolcken in regen zu veranderen/ darumb wir in diesen kalten Lenderen/ wan es am keltisten ist wenig regens haben/ dan die wolcken (eheste können in die kaltiste orter komen) fallen nieder von wegen der kelte des Luffts/ es sei dan das die auffziehung sehr gross unnd lanckwrig sei/ unnd durch den Suden windt die kelte überwunden werde/ oder die wolcken werden durch starcken windt auff gehalten/ unnd geschwindt diese örtter voruber getrieben/ unnd durch grosse kelte in schne verandert. Darumb mein Bruder was du dis im grunde betrachttest/ wirstu recht verstehen/ die vorgehende exempel vom winde/ mehr dan ich schreiben könnte/ derowegen habe ich nicht mehr geschriben/ dan zum fundament und zu dem/ das wir weiter verstehen werden/ notig.

Chapter Five

But when around evening, the evaporation of the water through the setting of the sun is lessened, we generally have quiet, although the water never is without evaporation, unless the cold is so great that the water freezes. Just as we see when we fill a large, wide pan and set it in a cold room, and then after a few days we will find that the water is lessened, the cause

whereof is that the air around the room is somewhat warmer than the water. But when we feel no calm in the evening it comes from our being far from the place where the water and air were resolved. The wind comes after the resolution, just as we see from a noise made far from us, whose sound we hear after we see it. This is why we do not hear the strong movement due to the setting of the Sun, and likewise for a long time we are not aware of the movement of the wind following it, and therefore we feel through one wind more quiet than through another depending on the situation of the place. But if we are close to the place, we have quiet, and as soon as the evening begins, and we also have at certain times of the year a lot of rain, as in March, April, May, September, October, and November whose cause may be understand from what was said before. Since in these months we are [alternating] between cold and heat, and therefore the sailing clouds cannot be released and enlarged for the second time through the weakness of the heat, but the air is then suitable to change the condensed clouds into rain, and therefore when it is the coldest in these cold lands we have little rain since the clouds fall below due to the cold of the air before they reach the coldest places, unless the pulling up will be very great and of long duration, and through the southern wind, the cold will be overcome or the clouds carried off by a strong wind and quickly sail by these places and through the great cold are changed into snow. Therefore my Brother, if you consider this in its foundation, you will correctly understand the previous example of wind, more than I could write it, and therefore I have written only what is necessary for us to understand the foundation and also the following.

Das sechste Capittel.

Es möchte einer fragen/ wie komt es dan das wir oftmal im sömmer den windt auss den wolcken fühlen/ und nicht auss dem ört da das Wasser verdunnet/ oder auffgezogen ist, welches dem vorigen zu wieder? hier auf ist zu antworten/ das die vorgehende exempel hier durch bestetigt werden. Dan nach dem die sone das wasser subtilisiert und aufgezogen bis in den kalten Lufft/ wirdt durch die kelte das Wasser ein wenig vergrobet/ unnd ziehet unter sich/ wie ein dicker Nebel/ bis an die Reflexion der Erden/ alda der Luft mercklich wärmer ist/ dardurch die Nebeliche wolcken wieder vergrosset und verdunnet werden/ also das der folgende Lufft auss ihnen bewegt wirt/ also wirdt auch der dichte/ dicke unnd kalte Lufft/ der über der Reflexion der Erden ist/ durch das sincken der dicken wolcken eingelassen/ welcher an andern örtern durch die wärme aussgeschlossen wirt/ darumb vermeret unnd erweiteret sich der windt an allen seiten/ daher auch oft die wolcken gegen ein ander ziehen/ das der kalte dicke Luft schwebt über dem warmen Luft/ bis an die kalte örter/ da erunter dem schatten oder kelte der wolcken wirt eingelassen/ unnd darnach wieder durch die wärme erwärmt/ und erhöht über die Reflexion der erden. Also kommen und gehen die winde/ und erkühlen den Erdbodem durch die weisse ordenung Gottes. Darumb fühlen wir den windt auss den ortten/ da wir sehen die schwarzen unnd dicken wolcken schweben. Wan wir sehen im Sommer einen dicken nebel auff steigen/ in Sudwest so spuren wir darnach einen Sudwesten windt/ dan einen Westen Nordwesten/ Norden/ und Nordosten windt/ etc. unnd so weiter auss allen örtern/ da wir dem nebel sehen. Also hatt es auch seine ursach warumb bis weilen die winde so starck sein/ warumb es in Hollandt und umgelegenen orten, nit dem Osten oder Sudosten windt sehr regent. warumb der Nortwesten windt so ungleich wehet/ isst mit wenigem regen eine stille/ baldt darnach starcker windt/ Item warumb in den warmen Lenderen/ die an dem Meer gelegen/ der windt des morgens und den gantzen tag auss dem Meer komt/ und des abents oder nach mitnacht von dem Lande? welche ursachen man mit naturlichen Rationibus beweisen kündte/ aber der vorgehende ursachen verstehet/ wirdt das volkömlicher verstehen/ dan

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ich beschreiben kondte. Dero wegen wollen wir den windt fahren lassen/ unnd vom Donner unnd Blitz anfangen.

The Sixth Chapter

Someone might ask how it is that in the summer we often feel the wind from the clouds, and not from the place where the water has been thinned or evaporated, which is contrary to the former account? Here I answer that previous example is confirmed through this. Since after the sun has sublimated and evaporated the water up until the cold air, it will be by the cold of the water a little coarsened and it pushes downwards like a thick fog until the *Reflection* of the Earth, where, since the air is notably warmer there, the foggy clouds are again expanded and rarefied. Thus the following air is moved by them, and the close, thick, and cold air that is over the *Reflection* also comes down with the sinking of the thick clouds and in other places through the heat it is expelled and therefore the wind multiplies and expands itself on all sides. Therefore also often the clouds push against one on another, since the cold thick air sails above the warm up to the cold places, where, under the shadows or cold of the clouds it is burdened and afterwards through the heat is once again heated and raised above the *Reflection* of the Earth. And thus the winds come and go and cool the Earth through the wise ordinance of God. Therefore we feel the wind from the place where we see the thick and black clouds sailing. When in the summer we see a thick fog rising in the southwest, we feel afterwards a southwesterly wind, then a westnorthwestern, northerly, and northeasterly wind, etc and so on out of all the places where we see the fog. This same cause is why the wind is sometimes so strong, and why in Holland and surrounding places, with the easterly or southeasterly wind it rains so much, but which the northwesterly wind it is so variable, now with a little rain, and then following a quiet a stronger wind, and also why in the warm lands which border the sea, the wind during the mornings and the entire day comes out of the sea and in the evening or after midnight from the land. The causes of these one could demonstrate with natural *rationes* but he who understands the foregoing causes will understand that more fully than I could describe it. Therefore we will leave the wind and begin with thunder and lightning.

Das sibende Capittel.

Wan es Donnert und Blitzt/ so ist der Lüfft trucken/ subtil und sehr warm/ unnd das Wasser das durch die werme der Sonnen aufsteigt/ wirdt verändert ingestalt des Lüffts/ und schwebet in der hohe uber der Reflexion der Erden/ und wirdt durch die kelte wieder vergrobet und zu sammen getrungen und wieder in Wasser verändert/ darumb sincket es wie ein nebel unnd wirdt durch den kaltten Lüfft getrieben in den subtilen/ truckenen und warmen lüft/ welches dan die grobe unnd dicke Wolcken geschwindt durch zicht/ entschleust/subtil/ und dünne macht/ und verändert es wieder in natur des Lüfts/ darumb ihr form in eim augblick viel hundert mahl vergrosset wirdt/ dar auss folgt die greuwliche bewegung/welche mit bresten und krachen den Lüfft anzundet und bewegt/ bis dar eine gleichheit ist/ in der grosse unnd dicke/ darnach ist die ruhe/ gleich wir sehen/ wan der Saltpeter gobrochen wirdt durch das Feuer/ unnd also verändert in die natur des Lüffts/ Item wan wir ein nasses tuch auff ein heiss eisen oder geschmoltzen Blei schlendren/ welches durch die entbindung oder vergrossung der hitze krachet/ und brist/ gleich dem Donner. Item wir sehen an einem Feuer zeug/ durch das geschwindt brechen des steins, die ursach der brennenden klarheit/ etc. Aber wan uberbliebene wolcken die örther/ welche durch den Donner oder entbundene wolcken vergrobet und verküet verbeigezogen/ komen sei wieder in dem subtielen unnd warmen Lufft/ welche in die höhe steige/ und sie durch

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tringt/ dün macht/ und in natur des lufts verändert/ darumb hören wir unterscheidliche schäge/ welche stätig wehren an allen örtten/ welche durch die Werme der Sonnen so sehr dün gemacht waren und die darnach wieder getemperiert unnd erkühlet sein.

The Seventh Chapter

When it thunders and lightning strikes, the air is dry, subtle, and very hot, and the water which through the heat of the Sun has evaporated, is changed into the form of air and sails into the heights above the *Reflection* of the Earth, and through the cold it becomes again coarsened and condensed and changes again into water and therefore sinks like a fog and is driven through the cold air into the subtle, dry, and hot air which quickly penetrates the coarse and thick clouds, makes them subtle and thin and changes it again into the nature of the air. Therefore their form in a blink of an eye is enlarged by many hundreds of times and thus follows the terrible movement which with bursting and cracking, rents the air and moves it until there is an equality in the size and thickness, and then there is peace again, just as we see when Saltpeter is broken by fire and changes into the nature of the air, or when we throw a wet cloth on hot iron or molten lead, which through release and expansion of the heat crackles and bursts just like thunder. Thus we see in a tinderbox, through the rapid breaking of the [flint] stone, the cause of the burning clarity etc. But when the left over clouds sail over the places which through the lightning or through expanded clouds were coarsened and cooled, if they then pass again into subtle and hot air which rises aloft and penetrates them, making them thin and changing them into the nature of air, then we hear various clangs which last continuously in all places which through the heat of the Sun were made so very thin and then afterwards were tempered and cooled.

Das achste Capittel.

Darumb befinden wir/ wie Gott uns durch die natur bewegt/ seine weisheit/ güthe/ und almacht zu erkennen und zu lieben. Schauwet an seine güthe/ unnd wunderbarliche ordnung/ welche wir in all geschopfen befinden/ merket wie Wunderbarlich (wie auss dem vorigen ursachen zuersehen) das dicke Wasser durch die Sonne unsichtbar wirdt aufgezogen/ unnd vergrosset/ in gestalt des Luffts/ dar durch zu gleich die bewegende kraft des Windes verursacht. Schwebt also unnd wirdt vergrosset über die Lender/ da auss gebrech des Wassers sonderlich keine aufziehung oder vergröbung ist/ unnd unter dessen ziehet es durch die Werme der sonnen auffwartz bis in den kalten Lufft/ über die Reflexion der Erden/ alda wirdt es wieder vergrobet unnd in ein ander getrungen/ wie ein nebel/ dardurch die stille des abens verursacht wirdt/ unnd der Lüfft nebelich scheint/ dardurch die Wolcken grober unnd dicker werden und in Wassertropfen verändert/ und befeuchtet also die durstige Erden/ die darin feulet und schmelzt und durch ziehet mit der feuchtigkeit das gewechs der Erden/ aber durch die Werme der sonnen wirdtste mit der feuchtigkeit auff gezogen/ bis an die eusserstetheil des gewechs/ unnd weil das Wasser flüchtiger ist/ dan das Nutrimentum der Erden/ verdrucknet das Wasser in Lufft/ und verledset das Nutrimentum/ welches durchs leben der dingen in die natur des gewechs verändert wirdt/ werden also alle geschopf der Erden unterhalten/ vermehret auss dieser einigen substans. Darumb werden sie durch die Putrefaction wider zu Erden verändert. Welches ein iglicher siehet aber von Tausendt ist kaum einer/ der es recht verstehet. Dann verstünden dies viel Alchimisten/ wurden sie sich so iemmerlich nicht bekümmern ihre Materiam zu wissen. Aber wan diese aufgezügene Nebel schweben in sehr warmen örtten/ verursachen sie Donner und Blitz (durch die geschwinde vergrossung) unnd den windt: Aber

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wan der Lüfft natürlich und ein wenig Warmer/ dan der nebel/ so gibt es allein windt und regen/ wie zu vor weitleuftiger angereicht.

The Eighth Chapter

Therefore we discover how God moves us through nature to know and to love his wisdom, goodness, and omnipotence. Consider his good and wonderful ordinance which we discover in all creatures, note how wonderful (as can be seen in the previous causes) it is that the thick water becomes invisible through the sun and is rarified and expanded into the form of air which also causes the motive power of the wind. Then it sails and expands over the lands, where through the lack of water there is no condensation and coarsening, and there it is pulled upwards through the heat of the Sun up to the cold air above the *Reflection* of the Earth where it is once again coarsened and condensed like a fog through which the quiet of the evening is caused, and the air which appears foggy becomes coarser and thicker through the clouds and is changed into waterdrops, and moistens the thirsty Earth, which melts and rots in it, and through the wetness the earth penetrates the plant, but through the heat of the sun the wetness is pulled up to the uttermost part of the plant and since the water is more flighty than the *nutriment* of the Earth, the water dries into the air and leaves behind the *nutriment* which through the life of things is changed into the nature of the plant and thus all the creatures of the Earth are sustained and multiplied out of this single substance.

Therefore they once again through *putrefaction* are changed into earth. This is something everyone sees, but hardly a single person out of a thousand properly understands. If this were known many alchemists would not struggle so pitifully to discover their *materia*. But when the evaporated fog again sails into very hot places it causes thunder and lightning (through the sudden expansion) and wind: But when the air naturally becomes just a bit hotter than the fog, it gives out only wind and rain as we explained previously at greater length.

Das Neunde Capittel.

Nun haben wir nach meinem beduncken gnugsam verstanden das ambt des Feuers/ Lüfts/ wasser und der erde/ welches dan dient zuverstehen/ die kraft der natur und was ein igliches Elementsei/ ist nemlich das Feuer ein subtieler Lüft/ der Lüfft ein subtiel Wasser/ unnd das Wasser eine subtielle Erde/ unnd die Erde ein grob Feuer/ wie auss unseren vorgehenden exempelen gnug mag verstanden werden. Dan die Erde/ durch des Feurs kraft/ oder Purification der natur entbunden/ verandert sich in Wasser/ wirdt saltzig und ein kraft der Erden/ wie wir in der Calcination clärlich befinden: Das saltz/ durch Feuer entbunden/ wirdt verandert in Wasser/ welches die Distilation der Aq. fort. uns gnug lehret: Darnach das wasser durchs Feuer entbunden/ wirdt verändert in Lüfft/ unnd der Lüfft in Feuer/ wie oben angezeigt/ also wirdt die grobe tunckele Erde verandert in das subtielste durch scheinendt glantzendt und durch dringendt Feuer/ welches alles durch tringt und Clarificiert/ und das andere durch tringendt/ und Clarificierent macht.

Chapter Nine

Now we have in my opinion understood enough of the occupation of fire, air, water and earth to understand the power of nature and what each element is, namely that fire is a subtle air, the air a subtle water, and the water a subtle earth and the earth a coarse fire as may be sufficiently understood from our previous examples. Then the earth, resolved through the power of [alchemical] fire or the purification of nature, changes itself into water,

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becomes salty, and a power of the Earth, as we clearly find in Calcination: The salt, resolved through fire, is changed into water which the *Distillation* of Aqua fortis shows us sufficiently. And that water then is resolved through the fire, is changed into air, and the air into fire as was shown above, and thus the coarse, dark earth is transformed into the most subtle, transparent, shining, and penetrating fire which penetrates and clarifies everything and makes anything else penetrating and clarifying.

Das zehende Capittel.

Darumb müssen wir verstehen/ das auch also was auss den Elementen geschaffen ist/ Clarificiert wirdt/ es sei Minerale Animale, oder vegetabile. Dan so wir etwas von den selben Clarificieren wollen/ mag durch keine andere mittel geschehen/ dan wie oben gesagt: Die Erden müssen wir Clarificieren durchs Feuer/ und machen sie erstlich wie Wasser/ welches ist wie saltz/ welches man Clarificiert/ und Distilliert zu einem Wasser/ wie der leib des Lüffts/ klar wie Cristal/ durch scheinendt wie der Lüfft und glantzend wie das feuer/ daran mügen wir uns vergnügen/ unnd ist keine höhere Clarificationen nötig/ ursach weil wir keine unsichtbare Spiritus bewaren können/ sie sein dan ein Corpus, sonst würden wir sie verlohren/ dan wan es Clarificiert ist in gestalt des Wassers/ so wirt es durch die Distilation verandert in gestalt des Lüfts und durch die vergrobung der kolte wieder in Wasser/ als ein sichtbare Corpus, Aber so wir es Clarificieren/ in gestalt des feuwers/ so vergröbet es durch die kelte in gestalt des Lüffts/ wie würden wir es dan gebrauchen? welches auch das leiste ist der sichtbarlichen dingen und veruns unnütz. Darumb mügen wir Clarificieren in Lüft welcher sich durch die kelte vergröbet in ein Wasser und höher nicht. Dan alle dinge die reduciert werden in ihre hoheste perfection , haben keine generation oder Multiplication. Aber wan wir dis durch Distilation Clarificiert haben in ein klar durchscheinendt Wasser Olii/ oder wie man es nennen möchte/ so sahen wir in unser Corpora ein Sperma/ welches darin verfaulet unnd Clarificiert wirdt in gleiche clarheit: Machen also von Wasser Erde/ durch kraft des Feuwers/ fahrn weiter fort/ wie die Natur/ machen die grauw Erde weiss klar/ und durchscheinendt wie der Luft doch in eine sichtbare gestalt, darnach auss der gestalt des Lüffts in eine Feurige/ klare/ saubere und unbefleckte rothe farbe als ein Rubin/ welches in der perfection alles geschöpf ubertrift: Aber so wir das klar unbeflecktes Feuer noch höher Clarificieren wolten/ mus es in sein voriges wesen wieder gebracht werden durchs wasser/ (wie gesagt) die generation damit zu unterhalten/ und also durch den gereinigten vollkommen sahmen (in kelte/ in hitze/ desen Feuer ausswendig und feuchte inwendig ist) eine generation machen in das Feuchte wasser/ desen truckene innerlich ist etc. und lassen/ sich also die natur wieder erhöhen/ unnd verbessern/ wie gesagt/ durch welche Reiteration unsere materi so sauber/ Penetierendt/ und subtil wird das er ungläbulich ist/ also das sie inkurtz alle vasa durchtringt unnd also verlohren wirdt.

The Tenth Chapter

Therefore we must understand that also that which was created out of the Elements is clarified whether it be mineral, animal, or vegetable. So if we want to clarify any of those it can only happen through the means specified above: we must clarify the earth through fire and first make it like water which is like a salt which one clarifies and distills into a water like the body of air, clear like crystal and transparent like air and shining like fire. With that we must be content, and no more clarification is necessary since we cannot keep any invisible *spiritus* unless it be in a body, since otherwise it would be lost. So that when it is clarified into the form of water, it should be changed through distillation into the form of air and through

the coarsening of the cold it should be changed again into water as a visible body. But if we clarify it into the form of fire and then coarsen it through the cold into the form of air, how would we then use it? for that is the clearest of all visible things and unusable for us. Therefore we should clarify it into air which through the cold is coarsened into water and not further. Since all things which are reduced into their highest perfection, have no generation or multiplication. But when we have clarified this through distillation into a clear, transparent water, oil, or whatever one wants to call it, then we see in our *corpora a sperma* which rots within and is clarified into an equal clarity. We also make earth from water through the power of fire, continuing only like nature, and we make the grey earth white, clear, and transparent as air. But it is still in a visible form, and thereafter from the form of air [we make it] into a fiery, clear, clean, and unbesmirched red color like a ruby, which exceeds all creatures in perfection. And so if we wish the clear, unbesmirched fire to have still higher clarification, it must be brought back into its previous essence (wesen) through water (as was said) in order to support *generation* and also so that through the purified complete seed (in cold, in heat, this is fire on the outside and wet on the inside) makes a *generation* in the moist water, which is dry on the inside, etc. allowing nature again to elevate and improve it, as above. Through which *reiteration* our *materia* becomes so clean, penetrating, and subtle, that it is incredible, and also so that in short it penetrates all vessels and will be lost.

Das eilfte Capittel

Nu mochtest u fragen/ wie ist es möglich/ die dinge also zu verbessern/ sehen wir nicht/ das alle sahmen ihres gleichen vorbringen/ etwan besser/ etwan schlimmer? wie solten wir durchs Feuer mehr Clarificieren können/ dan Gott durch die Sonne? Hier auff andtworte/ das unser Clarificieren auf eine andere weise geschicht/ dan wir nehmen die Corpora/ die Gott durch die natur gelclarificiert hatt/ unnd Clarificieren die wieder durchs Feuer unnd Wasser/ wir machen sie klar wie Cristal/ unnd reinigen sie von aller unreinigkeit/die die Natur darin gelassen/ und bringen sie in gestalt des Wassers/ darin die Natur der Erden inwendig verborgen/ inwelche wir/ wie gesagt/ unsere Corpora sahen/ und durch des saubere Wasser reinigen/ und machen eine klarheit der andern gleich/ welches in der natur nicht geschicht/ darumb bleiben alle dinge in der gestalt Wie sie Gott geschaffen/ dan der sahmen/ der in die erde gesähet wirt/ wirdt durch die erde nicht Clarificiert/ aber die erde wirdt Clarificiert/ vom Feuer/ unnd leben des samens/ weil die erde unreiner ist dan der samen/ darumb bleibt der samen altzeit in einem wesen/ und tingiert die unreine erde in seine forme. Dieses lieber Bruder habe ich von der natur geschriben/ wie ich solches mit der handt befunden/ unnd Weil mich nichts mehr zu Gott gezogen/ als der wissenschaft der natur/ habe ich müssen von natur der Elementen schreiben/ weil sie eine wongung der natur seind/ ohne welche wir die natur nicht kennen wir leben in ihnen und werden darin unterhalten das so wir sie nicht kennen/ wir weder uns noch die natur kennen. Darumb der die Elementen lehrt kennen/ der lehrnet Gott/sich unnd die natur kenne ohne welche wir Gottes Almacht unnd güthe nicht recht mögen lieben. wer zeugt von Gott über die natur? dan wir sein nach Gottes eben bildet geschaffen auff das wir durch diese dinge die Himlische gaben könnten kennen lernen/ welche wir von unserem Schöpfer neben unserer schöpfung empfangen haben/ damit wir wissenschaft dar von hetten so viel uns in diesem leben nötig ist/ zur erkantnisse Gottes und unser/ auch zu erforschung der natur. Darumb sollen wir uns vor zancken hütten/ und was wir nicht verstehen/ weder loben noch schälten/ so wirdt unsere Sehle ruhe finden/ und Gottes Weisheit schmecken/ dan wie mügen wir kennen/ das wir nicht sehen/ schmecken/ noch fülen? oder lieben/ das wir nicht kennen? ist dan

nicht nötig die natur der Elementen zu erforschen? die natur kennen zu lernen? und Gott zu lieben? welchem allein sei ehre in Ewigkeit. Hiermit nim vor lieb/ und ersuch die natur/ so wirstu hier von gezeugen/ und lernen verstehen/ was hier nach folgen wirdt/ nemlich das größte Wunder/ das wir inder natur/ in den Elementen sehen/ zu lob und ehre unsers Seligmachers Amen.

The Eleventh Chapter

Now you might ask how it is possible to improve things thus. Don't we see that all seeds bring forth things like themselves, sometimes a little better and sometimes a little worse? How could we clarify through fire more than God through the Sun? Here I answer that our clarification occurs in another manner. We take the *corpora* which God had clarified through nature, and we clarify them again through fire and water. We make them clear as crystal, and purify them from all the impurities which Nature had left inside them and we bring them into the form of water within which the nature of the earth is hidden inside and in which, as said, we see our *corpora*. Through the clean water we purify it and make the one equal to the other in clarity, which does not occur in nature. Therefore all things stay in the form as God created them. For the seed which is planted in the earth will not be clarified through the earth, but the earth will be clarified by fire and the life of the seeds, since the earth is less pure than the seed, and therefore the seed remains always in a single essence (*wesen*), and tinges the impure earth in its form. This dear brother, I have written concerning nature as I have discovered it with [my own] hand.¹² Since nothing has drawn me more to God than knowledge of nature, I have had to write concerning the nature of the elements, since they are a habitation of nature, without which we do not know nature. We live in them and are sustained by them so that if we do not know them we do not know either nature or ourselves. Therefore he who learns to know the elements, learns to know God, himself, and nature, without which we cannot love God's omnipotence and benevolence. Who testifies more to God than Nature? Since we are created in God's image through these things we may learn to know our heavenly gifts, which we have received from our Creator in addition to our creation with which we may improve our knowledge as far as we need to in this life for knowledge of God and ourselves, and also in order to research nature. Therefore we should refrain from bickering, and what we do not understand we should neither praise nor blame, and so will our soul find peace and taste God's wisdom, since how may we know what we do not see, taste, nor feel? Or do we love that which we do not know? Is it thus not necessary to investigate the nature of the Elements? to get to know nature? and to love God? to whom alone honor will be in eternity. Take this here out of love and research nature, then you will become witnesses, and you will learn to understand what will follow hereafter, namely the greatest wonder that we see here through the nature of the elements. In praise and honor of our Saviour. Amen.

¹² The Dutch version (42) stresses, "ghelyck ick selver dat metter handt bevonden hebbe."

Appendix III: Andreas Libavius, *Probabilis Investigatio Caussarum Physicarum, Aliarumque Globi Archimedaevi novi & instrumenti musici per se absque evidente motore mobilium. Illo coeli utrumque mobile cum aestibus marinis ad amussim repraesentatione: hoc suavissimam serenis diebus melodiam modulante: Utroque arte Drebeliana in Anglia mirabiliter concinnato: Ex relatione conjecturisque Cl. Johannis Hartmanni Philos. Med. & Chymiae apud Marburgenses Doctoris, nec Paracelsici, nec Galenici, Exercitii Gymnastici caussa proposita in Illustri Casimiriano apud Coburgenses. Praeside Andrea Libavio M.D. Gymn. Direct. & Professore/ Respondente Petro Ziglero Coburg Studioso pub. XIX Sept. Iuliani An. 1612 horis matutinis in auditorio majore.* (Coburg: Bertsch, 1612).

D.O.M.A.

Disputatio Physico-Chymica de Cornelii Drebbelii mechanicis in Anglia.

I. In ultima disputationum medicochymicarum Iohannis Harmanni legimus, Cornelium Drebbel Batavum in Anglia fecisse perpetuum mobile, repraesentans sempiternos syderum motus, temporumque vicissitudines, & Oceani reciprocationes ad momenta & puncta in aevum: Fecisse item Organum Musicum, coelo sereno suavissimam harmoniam nullo digito tactum edens, nubilo silens. Causa putatur esse anima mundi seu spiritus universi astralis & insensibilis, qui attractus sit in sphaeram, & instrumentum illud artificio chymico vi magnetica, quo infuso & concluso moveatur, rotetur & continuetur opus.

2. Scimus Cornelium illum edito libro de elementis, eorumque motibus & passionibus, ventis, tonitru, tranquillitate, fulminibus, misionibus, coloribus, & aliis disseruisse ad similitudinem eorum, quae in lapidis Philosophici coctione eveniunt, potissimumque in dicta fermentatione & conjunctione, cujus libri nos summam sententiamque commentariis tomo II. Syntagmatis arcanorum adjectis complexi sumus: sed quod putavit Harmannus amplius est considerandum.

3. Primum liquidius exponi debuit, essetnè illud Organum Musicum pneumaticum (Orgel) an neuroplectum, quod communiter instrumentum (ein Instrument) dicimus. Non parum est inter utrumque discriminis, quanquam utrumque vulgò clavibus constet manu artificis, qui scientiam musicae instrumentalis habeat, & cum ratione ad praxin accommodare queat, movendis artificiosè.

4. Deinde arbitramur non fortuitum quid proponi, nec magicum, sed ingenio confectum & adaptatum opus, quod certa ratione digna inquisitu constet. Aliàs rationem ponere vel quaerere ubi nulla est, non est sanae mentis. Possit esse utrumque Organum pneumaticum, ut Motus fiat in utroque ab immisso spiritu: (neque enim ut Argentinense coelum, & similia alia alibi extracta, ponderibus trahitur; nec est simile musicae mechanicae, itidem diversis ponderibus, nervis, tintinnabulis &c. constantis) qualem globum vitreum dicitur olim confecisse Archimedes; aut qualem columbam volatilem Architas; aut quod alicubi legimus, quidam artificiosam muscam ex manu evolantem, aut alius Aquilam, quae Caesarem Norimbergam usque comitata sit &c. qualia credunt machinis intus versatilibus, & infuso argento vivo, ut in horologiorum inquietudine & rota perpetuo mobili, item curru sine equis procedente, vel area sponte mobilibus tribulis frumentum excutiente & hujusmodi variis effici. Si est pneumaticum à spiritu foris immisso, ratio facti non est difficilis.

5. Si spiritus vel ex ipsa materia intus actum promit, vel assistendo movet, dicas primum, magis illa instrumenta comparanda videri rotae Ezechielis cap. 1. & 10. Apoc. 4. v. 7. ubi & de quatuor animalibus. Animalia illa quidem in unum conflata, & rotas agitabat turbo ab aquilone: & ubi erat spiritus, ibi gradiebantur animalia & rota: verum nihilominus spiritus vitae erat in illis; & sonus alarum instar strepentium aquarum & castrorum, fiebatque vox super firmamentum. Spiritus dici potest fuisse vel esse etiam in organis istis musicis isque musicae harmoniae suavissimae peritissimus, gnarus tonorum, semitoniorum & reliquorum,

quasi anima Orphei, aut Amphionis per metempsychosin ad instrumentum istud esset allecta. Res nulli Ethnico incredibilis, quando animae rationales scribuntur in bestias quoque immitti; & ut Virgilius canit, quae gratia currum (cantus) Armorumque fuit vivis, quae cura nitentes (sonora) pascere equos (plectra movere) eadem sequitur tellure repostos. Ita Archimedis manes credat Socrates quodam magnetico vinculo illigatos globo mundane. Omnino spiritus debet esse artifex, gnarus temporum, & sciens, cum nubilum est coelum, cumque serenum, fortasseque etiam alia multa, ut ille Pythonicus ex antro Delphico, quem credere potuerunt nonnulli naturalem esse, & naturali effectu vates reddere eos quos impleat, sicut vinum ebrios Melancholicos. Paracelsus haud difficulter ex suo coelo nobis Vulcanum quondam detraxerit, aut Pana vel Satyrum, qui nobis ludant illum lusum.

6. Sane spiritum in organa illatum esse confitetur disputatio, verum ille multum differt a Prophetico, qui est sanctus, natura & essentia, Deus 2. Pet. 2. 21. 26. Quis autem sit alius, jam est investigandum. Aut rationalis est, aut ratione destitutus.

7. Praeter spiritum Deum sunt angeli & daemones & animae humanae; omnes rationales & ingeniosi, qualem oportet esse illum organicum, si est vel insita forma vel assistens.

Quomodo enim alias organicam, & artificiosam harmoniam produceret in brutis machinis?

8. Anima esse non potest. Nam hujus organa non possunt esse nisi animata: naturalia: non artificialia. Est enim actus corporis organici, physici, potentia vivi.

9. Si etiam species animarum recenseas, si foret bestialis, illa organa essent bestiae: Si humana, essent homines, quorum neutrum arte potest facere Drebelius, cum sint naturae opera. Mirabiles autem illi Philosophi, qui cum nunquam in coelo fuerunt, tamen possunt quasi circino describere, astra habere formas assistentes, & motores suos genios, procul dubio non concedent eas deserto coelo, quod tunc stare deberet, in instrumentum Drebelii illabi: multo minus concedent eas, quae nihil nisi sphaeras rotare didicerunt, aut per suam naturam possunt, posse musice canere, nisi prius doctas in schola musica, ut ni ab orbium fictitio sono harmoniam acceperint, quam tamen in Drebelii instrumento inepto nequaquam imitabuntur. Quid quod tunc globus & instrumentum istud fieret astrum? Nam forma dat esse rei. forma astris assistens desertis illis ligneo organo dat operam, ex hoc astrum facit. Non etiam illa potest alterius rei esse quam forma astri aut sphaerae ejus.

10. Num anima mundi (nam & hanc donant sensu & intelligentia, annumerantque intelligentiis dictis aliqui, de quibus legere potes Platonicos, Marsilium, Theologiam Aristotelis, Zabarellam &c.) [Marsilius in Ione Platonis mentem animae mundi, ipsamque animam mundi vocat Apollinem Musarum novem praesidem. Inde affingit octo sphaeris, octo animas quas, & appellat Musas, quae dum coelum harmonice moveant, musicam pariant melodiam. Ridiculum erit Apollinem illum e coelo elicere, & organo Drebelii affingere, ut ibi moduletur solus.] Ridiculum est primum mundum integrum constantem coelo, terra & contentis facere animal univocum. Deinde si anima mundi illa Platonica est, intelligens est, & rationalis, [Iacobus Zabarella in lib. de natura coeli. cap. ult. de anima coeli foris motivo principio: Item in lib. de mente agente, cap. 11 & 12. ubi de intellectu abjuncto á materia, de angelo, daemone, intelligentia; Plato in philebo putat indignum esse nostrum (qui sumus microcosmus) corpus animam habere, mundam totum non habere. In politico scribitur vivere & sapiens esse. Lege & Timaeum & Epinomidem: item Marsilii commentationes in politicum ubi anima mundi putatur Jupiter appellari: Sic in Ione. Vide & cap. 26. commentarii in Timaeum. Ex mercurio Trismegisto, & Aegyptiorum deliramentis ea sumpta esse, satis patet. Ille enim mundum Deum, & Dei imaginem vocat in Asclepio, & coelum animal &c. Macrob. lib. 2. in somn. Scip. c.2.] atque ita ponetur tertium genus creaturarum rationalium, quod ut Theologia, ita sana Philosophia ignorat, cum etiam Aristotelis opinio, quod planetae animali motu moveantur, sintque animalia, & Platonis Dii

stellae, hactenus locum in campo veritatis non invenerint. Tertiò qua ratione illa anima illigari possit artificioso operi, atque ita ut non semper, sed serenis tantùm diebus, vel deum, vel homines, vel genios, vel bestias, & plantas Orphei delectet?

11. Posses credere Drebelium musicae intelligentiae vim in illud instrumentum immisisse, si in potestate haberet coelestes intelligentias, aut ullae essent.

12. Angeli boni psallere possunt suaviter, sed qui in instrumento Drebelii? Quibus machinis & nervis ii sunt attracti? Num optimè proportionatis chordis, clavibus, forma &c? Risu ista non argumentis sunt digna, ut David suaviter psalleret, scientia Psalterio adhibita fecit, non angeli, licet hos testes habuerit.

13. Est autem cognitum experientia Magos quandam artem profiteri, cujus vi habeant in potestate, (uti ipsis persuasum est, atque etiam simulatione patet) obsequentesque sibi suos spiritus ad officia, ut Trithemius abbas, Cornelius Agrippa, Simon Magus, Elymas &c quanquam Paracelsici, & similes magi sibi ipsis blandientes & commercii cum Diabolis excusationem fingentes, modò dicant non esse malos spiritus, sed genios naturae familiares homini, quod & liber Arbatel comprobat, modo velint esse ascendentes astrorum: ex Mercurio Trismegisto de 36. Horoscopis, quorum Princeps Pantomorphus, qui diversis speciebus diversis formas faciat, atque ideo fortasse etiam suam formam artificiosam instrumento Drebelii, si cum magis est insaniendum. Alii aliis linimentis & coloribus suam cum daemonibus societatem pingunt, licet non facile dicendum sit, quod malus genius assistat organo & suavissimè moduletur, quia eum dicitur fugare musica, nisi fortasse obscoena sit & impia, sicuti videmus penè optimas harmonias applicatas esse textibus improbissimis & spurcissimis.

14. Verum sit spiritus irrationalis, intellectu, & arte carens, quaeritur quomodo efficiat harmoniam ignarus numerorum musicorum? Num Pythagoricè, sicut sphaera in somnio Scipionis? * Fabula quidem illa est, ut demonstrat Aristoteles in 2. de coelo text 52. & sequent. Plin. lib. 2. c. 3. sed si veram opinionem opineris explosis sirenibus, affrictu attrituque mutuo debet fieri harmonicus sonus, quem qua industria consequi possit homo? Adde Drebelii fundamenta haec non pati.

*Vide quatuor prima capita Macrobiï in somnium Scipionis lib. 2. Item Argumentum Marsiliï Ficini de novem Musis in coeli sphaeris, quas & animas sphaerarum mundi vocat, & sirenes Deo canentes juxta octo tonos & unum concentum. Plato in 10. de Rep. fusum octo verticulorum fingit, quibus singulis insidens sua siren tonum unum moduletur, fiatque compositus harmonicus ex omnibus. Est autem opinio illa triplex. Nam ut patet ex Aristotele quidam corpora coelestia, stellas, motu sonum facere dixerunt: alii eum soliditati sphaerarum attribuerunt. Nonnulli sirenibus, intelligentiis, & formis assistentibus, ut sic vel harmonia illa bruta sit, vel rationalis. Hic refutatur musicorum opinio ideo rejicientium octo tonos, & plures ponentium, quia sint commentum monachorum.

15. Sit spiritus aethereus per omnia diffusus, Virg. in 6. Aen. principio coelum &c. Spiritus intus alit. Arist. In 3. Gen. an. cap. ult. de calore animali in universo, & de spiritu in humore &c. Mercurius in Asclepio de spiritu implente omnia & animas nutriente. Marsilius ex Timaeo Platonis spiritui mundi, parti scilicet alteri, quae est formalis, tribuit intellectum, sphaerae animam, intelligentiam & naturam. Alii aliter de mundi spiritu omnia vivificante disserunt. Hippoc. in lib. de flatibus spiritu implet omne quod est inter coelum & terram, de quo Plato, Virgilius, Aristoteles, & alii. Calor erit aut cum calore coelesti. Is enim est spontè orientium plantarum & animalium causa, ut volunt Physici, licet Theologi malint rerum semina olim dispersa. At hic non potest artificiosam harmoniam condere sine animae musicae interventu. Neque enim vivit actu. At vivere debet, si verum est, quod Thesis habet harmoniam edere absque ullius digituli tactu, quod ut credas, magna fide opus est. Nam

organa Musica neurospasta tactum formalem seu virtualem digiti formalis, aut materialem materialis requirunt.

16. Venti quoque item aër, ignis & alii plures vocantur spiritus, & hi quidem corporei. Sunt venti aër halitibus & vaporibus mistus, qui cum principium motus accepit & fertur, etiam satis corporaliter tangere potest, spiritibus illis aetheries & sive incorporeis, sive incorporeo proximis per omnia insensibiliter volantibus, nisi fortasse eos coagulare potuit Drebelius. Sed tunc non erunt valdè agiles & motivi.

17. Archimedes per foramen parvum potuit inspirare suum globum atque ita motus ciere. Venti quoque cum inflant diversas fistulas, sonum diversum reddunt, ut tàm in natura, quàm arte organica compertum habemus, olimque Polyphemi & Pastores Virgiliani potuerunt melodiam reddere fistula septem cicutis compacta inflata [Scaliger exerc. 302. sect. 7].

18. Si Drebelius globum & Musicum organum pneumaticum ita disposuit, ut subiens halitus motum & sonum cieat, sane nihil absonum à vero fecit. Verum tunc quomodo possit esse in Musica illa aliud quam unisonus? Ridetur chorda quae semper oberrat eadem. Si eadem quoque chordae variae semper unum sonum mistum reddunt, non is erit suavissimus. Moderatorem adesse oportet, sive homo sit musicae peritus, sive genius. Variè inspirans ventus possit aliquam excitare varietatem: sicut & si organa fistularia ita sint adaptata, ut vario motu & conversione sonum mutant. Sed neque hïc regularis & harmonica jucunditate varius erit, quia à causa bruta gubernatur, sicut Tritones turrium, nisi quis ventorum flatus sciat in potestate habere, aut ita concludere, ut pro arbitrato meent.

19. Nubilo silet ille sonus. Num ergò & flante tunc vento? Si silet seu flante, seu non flante, moto vel quiescente aere, cadit causa ventus & aër externus.

20. Vidit hoc disputator. Ideò arbitratur Drebelium in sua potestate habere astrorum & mundi spiritus, quos sciat exactissimè, in quas res, & quomodo, quamque variè ordinatè, inordinatè influant, & quibus quasi nervis, vel magnetibus virtualibus dirigantur, ut non uno modo per unisonum perstrepant, sed harmonicè per modum gutturis luscinae sonent.

21. Modus dicitur insensibilis & astralis: artificium modi, chymicum: Forma, & actus, attractio magnetica, infusio, conclusio, motus, rotatio, continuatio, quod cum vero pronuncietur consentaneum, est fabulae somnium, quod Democritus fusissimè rideret, & fors ridet ipse Drebelius, inventum esse hominem, qui magiam istam instrumentalem tam miseris revera, ad speciem phantasticè pulchellis coloribus possit pingere. Asylum stultitiae Paracelsicae id est, quod fingit non demonstrat fieri, quae fieri naturaliter & humana arte non possunt. Mirum cur non dicatur Vulcanus coelestis Paracelsi demissis funiculis & regulis in terram movere claves, attrahendo, remittendo, tardè, celeriter, ut requirit Musica Euclidis & Boëthii.

22. Inventi sunt, qui magiae tale* quid tribuerent: chymiae asscripsit adhuc nemo, neque ullus unquam chymicus tale quid est professus, cum etiam ultra omnem modum de suo lapide & aliis sint gloriabundi.

* Vid. cap. 9. lib. 15. Weckeri de secretis, ubi ex Agrippa recenset istam artem quasi magneticam, gradariam, & concathenatam per sympathias ex Iamblichio, Proclo, Synesio, famosissimis magis, qui ea arte etiam numina (sirenes Platonicas ad organum Musicum) evocare sunt soliti &c.

23. Illud aliquam probabilitatem habet, quod dicitur Musicam istam silere nubilis diebus, vocalem esse serenis, si modò non fit frigus gelans. Nam potest essentia subtilis parari, quae certis diebus intus calorem concipiat, ebulliatque ut spiritus vitrioli: Imò mare ipsum, & lacus Cirenicaeus, similesque voraginum undae, fermentatione quadam naturali commotae excitatoque spiritu tumefactae. Hinc fortasse est & repraesentatio aestus marini.

24. Vidit Drebbelius in suo vitro, in quo lapidem coxit, eiusmodi aestus & ebullitiones, vidit gyros, assurgentes nebulas, spiritus, pluvias, ventorum, tonitruorum, caeterarumque turbarum elementarium simulacra.

25. Si volumes industriale ex chymica observatione ascribere effectum, habes probabilem causam Gyrorum coelestium: habes aestus marini ex liquore mercuriali, vitriolato salinoque quibus inest suum sulphur invisibile & ignis naturae, qui liquor quia actuosus est & spiritualis, ex parva mole excitarus magnam vim habebit, ut patet in circulatione sapientum.

26. Nondum tamen patet causa instrumenti musici neurospasti sine tactu artificiosae manus artificiosam harmoniam reddentis. Silentii, tempore nubilo, soni, tempore sudo calido, fors rationem videris: sed unde tactus ille artifex virtualis, aut corporeus? Neque enim concesserimus ut Luna mare dicitur potius quam demonstratur movere, ut prima vertigo secundam, secunda spiritum & quisque Planeta sibi contiguam naturam: ita fieri quoque in organo Musico, quasi dum gyratur coelum una clavis à Luna, alia à Sole & sic deinceps harmonicè moveatur.

27. In pneumatico organo facilior est ratio soni sufflante vel subeunte spiritu. At in neurospasto, ubi nervi tanguntur plectris assurgentium columellarum, & ligularum, artificiosa apparet nulla. Tintinnabula & cymbala à ventis agitari possunt, ut sonent harmonicè, non tamen plus uno cantur & tono, nisi ab artifice aliter disponantur, quomodo claves, quibus attollenda sunt plectra nervos tangentia, & eae quidem detrahendae vel deprimendae in vulgaribus? Fors dices fistulas esse, quibus ligulae seu plectra sunt affixa: & spiritum ex sua minera subeuntem, eas elevare: elevates plectris tangere setas, & sic fortasse Galiardam unam, donec aliter dirigantur à modulatore, canere. Et quae tunc causa est, cur non omnes in summo maneant, sed sursum, deorsum saltitent alternis per tantam modorum varietatem? (nam in maxima, longa, brevi immorandum est, celeriter fugiendum per fusas, semifusas: & tam á/sw [pro/sw] quàm o)j/sw in omnem dimensionem procedendum.)

28. Vnum adhuc restat atque alterum quod fingere (necesse enim est nos tanquam cum Andabatis in tenebris pugnare, cum ratio instrumenti non sit luculentè exposita) possumus, Si artificiosum est instrumentum, (quod credere par est, cum artifex nominetur, & organicum opus, effectumque ponatur :) quod naturales simul causas materiae, motus sonique habeat, idem fundamentum videri, quod est in globo interno spiritu mobili.

29. Videmus deinde lyras circumforaneorum rotis agitari, tactisque nervis varium sonum reddentibus harmoniam excitari, quae ad certum cantionis genus dirigatur tacto umbilico. Sunt qui officinam in nundinis spectandam proponunt, in qua sunt variae opificum tabernae, cum simulacris opus facientium, quae versa rota omnia incipient laborare pro cuiusque opificii modo. Fiunt & hydraulica instrumenta, ubi aqua rotas circumagit, & consequenter vel folles diducit, conducitque ut in pneumaticis, vel nervos variè aptatos, ut in neurospastis instrumentis, rotarum apicibus, seu pinnis percutit, ut sonus fiat artifices aemulus. Ita & merulae Vitruvii opere hydraulico constant, & gallus ille argentinensis aereus canere potest inspiratu follium ponderibus ductorum. Imagunculas impostores sic movere in temples solent, itaque concinnare, ut videantur loqui, annuere, canere &c. (De Hydraulico organo lege Vitruvium l.10.c. 13. Card. de varietate l.13 & de statuis se moventibus l.7. de subtil. Alia ex Baptista Porta & Cardano recitat Wecker in secret. l. 15. c.33, ubi aliqua vento inspirata.

30. Cum ergò Drebbelius in suo furnulo notasset mirabilem motum spirituum inclusorum, atue etiam nosset circulationum morem, sicubi spiritus sunt subtiles, qui parvo calore excitari possunt, vel etiam internam ebullitionis causam habent, ut in aestu marino: sic disposuit rotas ex materia levissima, subtiles (ponimus ex vitro tenuissimo, quod fortasse est flexile, ex crystallo & lapide Philosophorum: haec enim materia esse affirmatur à Philosophis mysticis) intus cavas, in motum adeò proclives, tamque artificiosè suspensas, ut exili aura subeunte

circumeant & agitentur, posteaque semel motae aliquandiu perseverent, ut rotae perpetuae vertiginis.

31. Non tamen necesse est cavas esse, & in ipsas auram intrare. Potest enim alio modo quoque impulsus fieri, ut in molis pneumaticis per alas, & aquagiis: & tunc etiam ex bracteis tenuissimis ligneis, vel metallicis rotarum apsides constare possunt. Quid si circumactus subeunte spiritu magnes alas traheret, quibus motis rotae verterentur? Est quoddam specimen apud Cardanum in IX variorum, quod reposuit Wecker in secretis lib. 15. cap. 32.

32. Dato motu orbium, applicatis & tactis nervis, facile est sonum fieri, eumque varium primùm nervis variis artificiosè extentis: deinde ordinatum & successivum per rotas plures, & ordinariam pinnarum seu ligularum in rotis dispositionem, ut possint numerosè & alternis tangere, prout opus direxerit artifex.

33. De principio vero halante & spiritum non nisi serenis, & calidis diebus suppedit ante, prius dictum est. Spiritus autem semel impulsus perambulat inquietè totam sphaeram, vel cavitates, cumque elabi clausis exactè spiraculis non possit, impellit alas pneumaticas, vel similia instrumenta, quibus motis postea agitantur rotae.

34. Si libet, finge machinam, in qua spiritus moveat rotam vecti adaptatam. Vectis autem detrahat vel premat pinnas, seu claves (Cardano clavos) iterumque dimittat, sicque fungatur manus musicae vice. Redactae autem regulae, chordae, ligulae & caeterae in numerum ordinemque certi cantus esse debent. Etiam hoc modo organum a)utki/nhton fieri potest. Alius globo mobili perenni adaptaret organum musicum, ut simul & sirenes Platonis canerent & in humeris Atlantis coelum verteretur, luderetque operam simulacris.

35. Haec probabiliter sic differuntur, suntque longè verisimiliora, quàm opinio de anima & spiritu mundi per vim magneticam attracto, uti stultè, sicut & in unguento armario, fingitur.

36. Turpe est Philosopho evagari ad Metaphysica & figmenta demonstrationum expertia, ubi in propinquo causae naturales esse possunt.

37. Autorem etiam alias praeclarum insimulatione magiae daemoniacae per melusinas Paracelsicas & sirenes Platonicas, vel circaeas potius (quae sunt diabolicarum imposturarum & praestigiarum quaedam pigmenta, infamem reddere, ipsa honesti ratio & amor proximi non sinit. Tàm diu praesumitur quis bonus esse, inquiunt Iurisperiti, quam diu contrarium non demonstratur. Plenius autem de hac re dici, & demonstratius poterit ab his, qui machinarum istarum ĆË/Ľā [au)to/ptai] fuerunt: plenissimè artifex ipse docebit, qui omnem operis à se inventi & perfecti rationem intelligit.

38. Nos quorsum hac thema disceptandum proposuimus? An non erant utiliora, & demonstrationibus suis certa? Erant sane: sed quibus suum tempus, locus, iudicium. Primum placuit varietas quaestionum, ut torporem facile obrepentem consuetarum auditu excuteremus, excitaremusque animos ad alacritatem. Deinde, spectavimus acumen mentis, quod non ex plebeis resultat, sed cotem exigit exquisitiorem. Praeterea elicere artificii manifestationem quam satagimus? Quod si illud non possumus, an non ex similibus fundamentis simile? Tandem cum utiles de rebus naturae quaestiones coincident, non poenitebit nos vel in his saltem aliquid pro commodo studiosas iuventutis in nostro Casimiriano varia Philosophia exercitandae, proposuisse, ingeniaque ad usum logicae, cognatarumque artium in paradoxa materia commisisse.

Summa artificii & declaratio per Quaestiones.

1. Cornelius Drebelius Belga seu Batavus coelum opere mechanico repraesentavit cum marinorum aestuum simulacro; Num id primus? Rx. De aestu marino non constat: de sphaera legimus Archimedis opus apud Cicer. lib. 1. Tuscul. ubi dicitur Lunae, Solis & quinque errantium motus in sphaeram alligasse, effecisseque idem quod apud Timaeum mundi aedificator Deus, ut tarditate & celeritate dissimilimos motus una regeret conversio, imitatus id divino ingenio. De eadem est in I. de natura Deorum: arbitrari quosdam Archimedes plus valuisse in imitandis sphaerae conversionibus, quam naturam in

efficiendis, praesertim cum multis partibus sint illa perfecta quam haec simulata solertius. Ibidem meminit familiaris sui Posidonii qui nuper effecerit sphaeram cujus singulae conversiones idem efficiant in Sole, Luna & quinque errantibus quod efficitur in coelo singulis diebus & noctibus. Fuit autem Archimedes tempore II. belli Punici, captis Syracusis an. urbis 542. interfectus, & sepultus posita sphaera cum Cylindro super sepulchro eius. Praeter opera sphaerica verò inveniuntur multa alia partim per orbis in plano, partim globos.

2. Fierine potest eiusmodi simulacrum perfectum? Rx. Non potest: imo adhuc astrologi inter se certant de numero sphaerarum, & ratione motus: Physici disputant, Planetae circulis, an sphaeris moveantur, non contenti Aristotelica definitione, quòd astra moveantur super orbibus suis: quidam etiam stetne coelum & terra moventur, ut Coperniciani &c. Lites de Calendario notae sunt. Probabili aliqua ratione $f\bar{A}no\frac{3}{4}/wj$ [$f\bar{A}nome/nwj$] potest repraesentari coelum, non $e\bar{l}j\bar{o}hmonikw=j$ [$e\bar{l}pisthmonikw=j$], hypothesibus quibusdam propositis.

3. Melius ne per sphaeras seu globos, an per circulos seu armillas fieri possit? Rx. Est istud in artifice situm, qui sphaeris uti potest ut Archimedes & Possidonius: potest armillis: potest utrisque. Alia ratione in plano etiam orbis valent.

4. Ex qua materia? Rx. Vitrea: vel metallica. Ligna enim & similes videtur ineptior esse. Perspicua vitrea Archimedis fuisse dicitur. Si Drebelius Crystallo illiquato lapide Philosophico usus est, fecitque metallum perspicuum, quod malleabile & flexile vitrum vocant, ne excellentius quid & mirabilius praestitit. In instrumento Musico locum habet materia mineralis, animalis, vegetabilis.

5. Cum materia sit inanimata, atque adeo interno carens motus principio, (neque enim naturale est opus, sed artificiale) qua ratione motum accipere potest? Rx. Nihil quod est in potentia, qua est tale, potest seipsum ex potentia in actum perducere. Cum itaque insitus actus desit, externum adesse necesse est. De Archimedis opere testantur fuisse mechanicum, & una conversione simul caeteras peregrisse. Opera mechanica impulsione externa, vel tractione, vel volutione vel vectione (tot enim sunt motus ab alio, qui violenti quoque dicuntur oppositi naturalibus Arist. 17. Phys. tex. 10.) moventur, quia externum, idque violentum habent principium. Assistere hìc motorem oportet, & vel trahere, vel rotare, vel impellere deprimendo, elevando &c. aut pro eo pondera laborant, vel aquae, vel spiritus, hoc est, aër, ignis, vapor, halitus, ventus, aut argentum vivum, ut in libramentis horologiorum: Spiritum autem variè suppeditare licet. Quae afferuntur de spiritu mundi, magneticaque attractione syderum, incerta sunt. Aliquid esset in contiguitate corporum mundi, si elementaria forent quietas. Est autem & tunc motus regulariter ab ortu in occasum, sed qui turbatur variis. Formae magicae assistentes, extra contemplationem sunt Physicam, potestque fieri, ut genii, seu daemones suam operam Magistro Mago locent. Omnino aut substantiale est quod artis opus impellit, aut accidentale, idque quantum, aut quale. De substantiis motoribus, & pondere quanto jam dictum. Qualitatem quoque posse motus causam praebere perspicuum fit exemplis, quanquam non semper sine spiritibus. Exempla sunt in manifestis & occultis: Ex manifestis sunt calor, frigus, humidum siccum, grave, leve: ad quae secundae referuntur. Ita ligna ex arboribus vento dejectis, dicuntur mutatione aëris crepare, accepto quodam motu ex alteratione. Calorem disgregando flatus praebere & ex consequente motum, docent aeolii folles forma globorum aquam continentium, qui super prunas positi flatus emittunt. Drebelius ipse instrumentum forma retortae seu Cornu proposuit, ex quo igni facto, etiam sine intus existente aqua halitus emittuntur rostro in aquam immerso. In argento vivo concurrunt rotunditas divisibilitas, humiditas spirituosas, gravitas &c. Occultae causae sunt in magnetismis, antipathiis, sympathiis: ut inter magnetem & ferrum. Sed ut motus fiat varius, regi magnes & duci ab aliqua causa debet: Item in herba viva, quam pudibundam dicunt accessu hominis, cujusmodi & arbor quaedam est. Sic amores vehementes & odia viventium dicuntur affectum relinquere etiam in partibus

defunctorum, uti narrant de lupi corio & chordis ovillis: de sanguine interfecti &c. Sunt solsequiae herbae: sunt lunares: Et Luna praeficitur trahendis movendisque humoribus: Arbor tristes antipatheticè afficitur lumini diurno, sympatheticè nocturnis seu astris, seu frigore, seu humore &c. Quaedam effervescunt, ebulliuntque certis diebus & spiritus concipiunt, ut cadavera aquis mersa per putredinem. Sic se expurgant succi & maria fermentatione. Adjuvat aliqua calor, ut in circulationibus & digestionibus chymicis.

6. Audio varia moventia: sed quae nam praesenti rei sunt accomoda? Rx. Globo competit vertigo ab animali, (potest enim & brutum movere ut in machinis tractoriis) vel aqua, vel flatibus, vel argento vivo: vel ponderibus. Haec qui occultius, & subtilius potest accomodare, artifex est solertior. Concurrunt & causae, ut cum artifex latitans trahit magnetem variè, unde saltus &c. Est & cum funiculis, nervisque occultis utitur: Est cum motu aeris variè concitato &c. In instrumento Musico ratio est secretior. Placent tamen rotae, vectes, & libramenta per argentum vivum, aut spiritum subeuntem, moventemque machinas artificiosè dispositas, & chordis musicis applicatas, quo modo posset quis virginem Cythara, Lyra, aut testudine canentem, aut fistulatore exhibere, ductu nervorum, inspiratu follium &c. Drebbeliana fundamenta ostendi possunt in eiusdem Elementario.

7. Quid de aestu marino, & Euripis: potestne is arte imitatoria repraesentari? Rx. Est quidem adhuc sub iudice lis de causa, quibusdam afferentibus syderum, maximèque Lunae tractu & remissione, accessu, recessu, & phasibus fieri aestuationem: aliis ponentibus γαλαντωσιν quandam terrae, unde mare ad diversa littora accedat: aliis fermentationem & expurgationem naturalem qualis observatur etiam in humoribus & lacubus nonnullis: veruntamen priore causa ommissa, quam nemo imitari possit, duabus posterioribus simile quid exprimi, & referri non fuerit impossibile. Si in eodem globo super axe, & polis suis mobili repraesentatur, pendere debere terram quiescentem, & aquam suam cum Insulis continere existimare licet. Orbe lunari circumlato emisso radio pendens terra concussas Euripos referet.

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