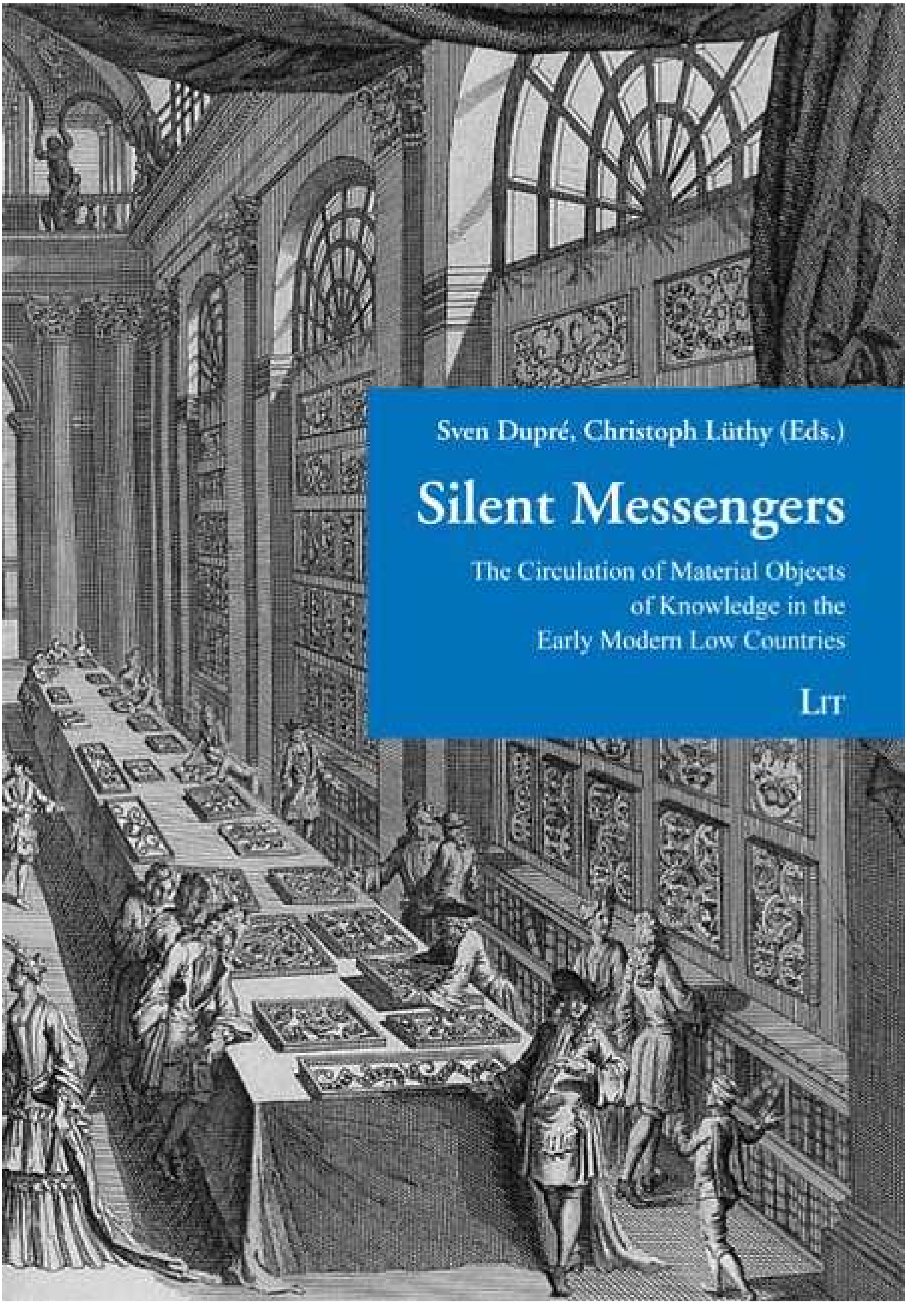

Sven Dupré, Christoph Lüthy (Eds.)

Silent Messengers

The Circulation of Material Objects of Knowledge in the Early Modern Low Countries

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Low Countries Studies on the Circulation of Natural Knowledge

edited by

Sven Dupré and Geert Vanpaemel

volume 1

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Cover Image:
A *Wunderkammer* depicted on the frontispiece of Levinus Vincent, *Wondertoneel der natuur*, part 2 (Amsterdam: Valk, 1715).

Printed with support of the
Research Foundation – Flanders

FWO VLAANDEREN
Fonds Wetenschappelijk Onderzoek
Research Foundation – Flanders

Bibliographic information published by the Deutsche Nationalbibliothek
The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available in the Internet at http://dnb.d-nb.de.

ISBN 978-3-8258-1635-3

A catalogue record for this book is available from the British Library

Fresnostr. 2 D-48159 Münster
Tel. +49 (0) 2 51-620 320 Fax +49 (0) 2 51-922 60 99
e-Mail: lit@lit-verlag.de http://www.lit-verlag.de

Distribution:
In Germany: LIT Verlag Fresnostr. 2, D-48159 Münster
Tel. +49 (0) 2 51-620 32 22, Fax +49 (0) 2 51-922 60 99, e-mail: vertrieb@lit-verlag.de
In Austria: Medienlogistik Pichler-ÖBZ, e-mail: mlo@medien-logistik.at

In the UK: Global Book Marketing, e-mail: mo@centralbooks.com

In North America by:

Transaction Publishers
New Brunswick (U.S.A.) and London (U.K.)

Transaction Publishers
Rutgers University
35 Berrue Circle
Piscataway, NJ 08854

Phone: +1 (732) 445 - 2280
Fax: + 1 (732) 445 - 3138
for orders (U. S. only):
toll free (888) 999 - 6778
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Contents

Introduction: Silent Messengers. The World of Goods and the Circulation of Knowledge in the Early Modern Netherlands

Sven Dupré & Christoph Lüthy

This book has a short title and a long subtitle. The title, "Silent Messengers," refers to a world of mute objects such as ancient or recently produced artifacts, ethnographic items, *materia medica*, plant bulbs, drawn, painted or printed images, archeological findings, tusks, bones or fossils and other *naturalia*. All of these items are messengers to the degree that they appear – or at least appeared to the early modern scholar, *virtuoso* or collector – to carry meaningful messages. However, they are *silent* messengers because they didn't speak, but needed to be spoken about; and because they usually didn't carry a text, but rather led to the production of texts, with human agents bringing about their integration into the scholarly discourse.

The long subtitle, by contrast, indicates the precise framework within which these silent messengers are investigated in this book. Its contributors are interested uniquely in objects that in some way entered into the domain of knowledge claims. They are thus not concerned with Ming vases as precious collectors' items only, or rare spices uniquely in their guise as culinary prestige objects, but with objects that were of interest to the world of scholarly discourse. In addition, the geographical and temporal limits in which the interaction between objects and knowledge claims is being studied is indicated by the phrase "Early Modern Netherlands." This period and this specific geographical area present a particularly gratifying framework to study the interaction between non-textual items and theories. This has to do with the last of the subtitle's expressions to be explained: the "circulation of knowledge" was probably nowhere as intense as in the early modern Low Countries, and this had to do as much with the circulation of scholars which was, in the *Carrefour de la République des Lettres*, particularly lively, as with the extraordinary nodal points that cities like Antwerp and Amsterdam represented in the international exchange of goods, news, and skills.[1]

A World of Goods

One of the starting points of this book is the world of goods in general, of which epistemically relevant objects form a sub-section. Probate inventories from the period between the fifteenth and the eighteenth centuries confirm the observations by historians of material culture that early modern households owned increasingly more and better goods. This accumulation of worldly goods has been placed in economic, social and political contexts: "It was unique aspects of the development of capitalism," John Brewer and Roy Porter introduce a book on the history of consumption,

> first around the Mediterranean and then on the 'Atlantic rim', and in particular the role played by urbanization and the social and political structures associated with it, which ensured in the Euro-American world an unprecedented proliferation of manufactured articles from the seventeenth century onwards.[2]

The accumulated goods were objects manufactured by local craftsmen – the period saw a dramatic growth of domestic industries – as well as tea, tobacco, and other 'exotic' commodities from Asia and the New World. The proliferation of worldly goods is therefore connected to the rise of global trade. The Iberian Peninsula played a singular role in this emergence of global trade as it connected Europe, the Netherlands in particular, with the New World and Asia. Long before Dutch vessels ventured into the Atlantic and the Indian Oceans, Portuguese merchants brought Asian spices and sugar, Brazilian wood, gold and ivory from Africa and the New World to Antwerp via Lisbon. "Global trade before globalization," as this phenomenon has appropriately been called, created a constant flow of goods and merchants, and turned cities in the Iberian Peninsula and in the Netherlands into cosmopolitan centers.[3]

Economic and cultural historians from Richard Goldthwaite to Lisa Jardine have re-written the history of the Renaissance from the perspective of the proliferation of worldly goods.[4] There is wide agreement that we are confronted with

[1] On the link between trade of goods and trade of news and knowledge, see Lesger, *Handel in Amsterdam*; and Davids, *The Rise and Decline*.

[2] Brewer and Porter, *Consumption and the World of Goods*, 4.

[3] See Crespo Solana, "Iberian Peninsula," as well as the title of the book in which this article appeared.

[4] Goldthwaite, *The Building of Renaissance Florence*; Jardine, *Wordly Goods*.

a phenomenon that is not particularly tied to one particular geographical region. Nevertheless, partly because Antwerp had early on become an important node in the Iberian trade networks, a role in which it was later replaced by cities in the Northern Netherlands, the Low Countries have frequently been associated with the rise of the 'consumer society'. Most famously, Simon Schama characterized the Dutch Golden Age with the phrase 'embarrassment of riches', which catches the ambivalent attitude of the Dutch towards wealth, goods, and conspicuous consumption.[5] On the one hand, in contrast to the image of the Dutch Republic as a Calvinist pleasure-denying culture, the Dutch were driven by a lust for consumption, Schama argues, which the VOC and WIC ships and the local craft industries did their best to gratify. This conspicuousness had less to do with Italian court culture than with the influence of Burgundian culture of the fourteenth and fifteenth centuries, according to Schama. The Dutch Republic inherited their taste for conspicuous consumption from sixteenth-century Antwerp, "where this Netherlandish idiom of ceremonious show reached full flower in the *ommegangen* processions on saint's days and the *landjuweel* competitions of the chambers of rhetoric."[6] On the other hand, the Dutch seemed uncomfortable with luxury and riches, an attitude which, Schama argues, did not originate with the Reformation. He selects the literature of Dirck Volkertszoon Coornhert as "one of the crucial connections between the moralizing humanism of Flanders, the social ministry of the Netherlands magistracy and its transplantation north to Haarlem and Amsterdam."[7] Polemics against wealth went together with magnificence. This is perhaps best illustrated by the tulipmania of the 1630s, when the Dutch lost their wits in speculating with tulip bulbs. As we now know, the height of the speculative bubble and its bursting was less dramatic than once thought (although the 1630s did see a speculative bubble in tulip prices). Tulipmania was above all the expression of Dutch anxieties about capitalism and avarice.[8]

Recently, Harold Cook has connected this proliferation of worldly goods and the rise of global commerce to the Scientific Revolution.[9] Moreover, for Cook, the Netherlands, as the cradle of early modern commercial practices, was the geographical region that made this connection possible. Early modern commercial practices were based on the bringing together of merchants and goods from across the world in one vicinity. It is for this purpose that Antwerp pioneered with the

5 Schama, *The Embarassement of Riches*, 289-371.
6 *Ibid.*, 310.
7 *Ibid.*, 327.
8 Goldgar, *Tulipmania*.
9 Cook, *Matters of Exchange*.

establishment of a *Beurs* in the 1530s, which made permanent trade possible. Its example was later followed by Amsterdam, turning these Netherlandish cities into staple markets or major *entrepôts* of worldly goods, such as silver, jewels, Japanese copper, Siamese tin, sappanwood, ginger, nutmeg, cloves, cardamom, ginseng, drugs, Chinese silk, cinnamon, indigo, civet, tea and so on. However, as Clé Lesger has argued, Amsterdam's astonishingly rapid rise in the first third of the seventeenth century was maybe due less to its nature as an *entrepôt* of goods than to its growing eminence as a trading place in knowledge, skills and techniques, and thus as a "great Staple of News," as James Howell called this Dutch city in 1645.[10] Antwerp, Amsterdam, and to a lesser degree other Netherlandish towns, became what might be called 'knowledge junctions', places where information brought in by trading companies, private entrepreneurs, scientific organizations and public institutions could be compared, collected, published, put to the test, or turned into manufactured goods. Antwerp and the rest of the Catholic south could furthermore benefit from the presence of the religious orders, and notably the Jesuits, which disposed of their own international networks.

For the purpose of this book, it is important to realize the degree to which merchants trading with goods arrived at values that overlapped with those of the adherents of the new experimental philosophy. That naval exploration, trade and scientific research could belong to the same program of social utility and progress has maybe nowhere been more clearly expressed than on the two related frontispieces by Andrés García de Céspedes and Francis Bacon (see Figures 1 and 2). Indeed, as Cook argues, what the seafaring merchant shared with this new type of scientist was the idea of "travel, seeing things afresh, exchange, commensurability, credibility, the hope for a better material future through worldly activity, and a preference for plain and precise language," the latter cumulating in the intellectual ideal of *objectivity*, a value that was associated with careful descriptive information about objects.[11] 'Objective knowledge' is in the first instance knowledge appertaining to detailed acquaintance with 'objects', knowledge which emerges from bodily experience. "Placing a high value on what can be known about the world objectively," Cook concludes, "arose from the same movements that gave rise to the revolution in consumption in the Renaissance."[12]

This cluster of themes – travel, exploration, the collection of objects and the 'objective' style of reporting – leads us to the subject of our book, namely the circulation of scholars and notably of objects. In her contribution to this book, Vitto-

[10] Lesger, *Handel in Amsterdam*, 209.
[11] *Ibid.*, 57.
[12] *Ibid.*, 39.

Figure 1 *Figure 2*

Naval circulation led to a circulation of knowledge and in due time became an emblem of the rapid increase in scientific knowledge. This transformation is forcefully illustrated by these two closely related frontispieces. Both show a ship sailing beyond the columns of Hercules, those ancient symbols of the world's limits ("nec plus ultra"). "Plus Ultra" ("Further!"), the proud device chosen by the Kings of Spain for their coat of arms, symbolizes the success of the Spanish expansion beyond traditional geographical boundaries. The combination of this Spanish symbol with a ship (Figure 1) is thus unsurprising for Andrés García de Céspedes, Royal Cosmographer to Philipp III of Spain and teacher at the school for navigators in Seville, who chose it as the frontispiece for his navigation manual (Regimiento de navegacion q[ue] mando haser el rei . . . , Madrid, 1606). More surprising is this choice in the hands of Francis Bacon, Great Chancellor of Spain's rival, England. On the frontispiece of Bacon's Instauratio magna (London, 1620; see Figure 2), the same combination is used as an emblem for the growth of scientific knowledge. The motto at the bottom of the famous frontispiece reads: "Many will pass [through the columns], and science will grow." That this emblematic connection of navigation with growth in knowledge appealed to the readers in the Low Lands is shown by the fact that the 1650 Leiden edition of Bacon's Novum organum used the same frontispiece as the 1620 Instauratio.

ria Feola proposes to view the "Republic of Letters" also as a "Republic of Material Objects." Now, given that the objects shared, discussed and circulated by this "Republic" were usually not recovered by the scholars themselves, but brought or sold to them by seafarers, merchants, military men or diplomats, one has to throw new light on the constitution of that "Republic." Notably the new type of empirically minded early modern scholar would indeed not limit himself to his own literary world, but attempted to belong to larger networks. The role of *intersecting networks* is in fact brought out in several chapters in this volume.[13] María Luz López Terrada analyzes the various overlapping networks that distributed botanical knowledge from the New World to the Low Countries. She identifies Carolus Clusius as the important node connecting communities in Spain and the Netherlands. Clusius recognized the role of his local contacts and friends in Valencia, such as Joan Plaza and Pedro Alemán, in the construction of his knowledge about American plants, which he transmitted to the Southern Netherlands, by sending samples to collectors such as van Coudenberg and de Saint Omer as well as by translations and through his vast correspondence. This world of friendly exchange was firmly rooted in the political reality of the Spanish empire. It was primarily the Spanish that had access to the New World and thus to its vegetation. Given that the Southern Netherlands formed part of the Hapsburg lands, the political and intellectual networks that linked the Spanish Netherlands to the Iberian Peninsula were fairly tight. This political and cultural sense of 'belonging' is beautifully illustrated in Koenraad van Cleempoel's chapter, which discusses the circulation of both the instrument maker Petrus ab Aggere and of his instruments. Ab Aggere was originally attached to the court in Brussels, but when Philip II moved his court first to Toledo, and then to Madrid, ab Aggere and his instruments followed the court's itinerary.

A similar intertwining of political and intellectual networks is described in Fokko Jan Dijksterhuis's chapter. Dijksterhuis investigates the role of Jacobus Golius, who held the chairs of mathematics and of Arabic at the University of Leiden, in the study of conic sections in general, and of the ellipse in particular. Golius played a key role in the Dutch diplomatic and commercial affairs in the Maghreb and the Levant. Dijksterhuis shows that Golius' travels resulted in his acquisition of a manuscript of Apollonius' *Conics*, which he brought back to Leiden and turned into an object of philological study. Golius' linguistic knowledge rendered him attractive to Dutch authorities, which sent him on diplomatic missions to the Levant; but these missions, in turn, served his scholarship and his membership in the Republic of Letters. The intersection of politics and scholarship is perhaps most spectacularly documented in Vittoria Feola's discussion of Jean-Jacques Chifflet's *Lilium Francicum* (1658). She shows how the circulation of dried and fresh flowers as well as a breathtaking combination of botan-

[13] For the notion of intersecting networks, see also Dupré and Kusukawa, *Intersecting Networks*.

ical, heraldic and historical knowledge obtained through an extensive epistolary exchange buttressed Chifflet's refutation of the identification of the fleur-de-lys as a lily – and therefore as an ancient royal symbol with divine, indeed Marianic overtones – by political supporters of French superiority over Spain. Vera Keller's chapter, which deals with the Dutch inventor and natural philosopher Cornelis Drebbel, discusses yet another type of networks: in this case the network in question managed to turn Drebbel's image from that of an artisan into that of a philosopher. The Hamburg literary agent Joachim Morsius in fact documented his personal network in his edition of Drebbel's work, making the latter part of a world to which in reality he did not belong and from which he was in fact excluded in England, where he was then sojourning, and in this way socially re-engineered Drebbel with success.

Going beyond the scope of the 'objects' treated in Cook's *Matters of Exchange*, the 'objects' covered in the present book include manufactured objects, products of early modern craft industries, and materials brought to Europe from Asia and the New World. The proliferation of manufactured objects and 'exotic' goods was part of the same movement known as the 'consumption revolution'. However, this book also deals with rare, ancient and sometimes exotic manuscripts and books, which after all constituted a significant part of the material objects flowing to Renaissance libraries and adding to the magnificence of collectors. Cook has pointed out that "collectors of manuscripts consequently also collected scholars in their households who could make out something of the meanings of these writings," fostering the study of paleography and philology.[14] A similar intersection of scholarly and entrepreneurial networks can of course be observed in the early modern printing industry. Printing shops were not only places where authors came to correct their page proofs and humanists met, but, as Lisa Jardine has pointed out, "the greatest printers in Europe all had to set up business relationships with bankers and merchants in order to launch the new trade."[15] The Antwerp printing house of Christoph Plantin, for example, relied on the financial backing of third parties or the authors themselves. In the early modern world of books and manuscripts, scholarly expertise, wealth and commerce joined hands.

Material Objects of Knowledge

The claims for the connection between the rise of global networks of trade and exchange and the Scientific Revolution have added a new dimension to the study

14 Cook, *Matters of Exchange*, 21.
15 Jardine, *Worldy Goods*, 151.

of the material culture of science. In past decades, instruments, often in relation to questions of experiment and observation, have moved to the forefront of research of historians of science. There is, to begin with, the question of taxonomy and classification: when is an instrument a scientific instrument?[16] When does an 'object' begin to function as an 'instrument'? In what contexts must billiard or glass balls, springs and pendulums, newspaper clippings and soap bubbles be categorized as 'scientific instruments'?[17]

The question of what may legitimately count as a scientific tool or instrument is as intricate as that other question concerning the nature of epistemic objects. The early modern expanse in trade led to the influx of new materials, which could of course all be 'consumed', but they could also be valued as epistemic objects, and examined, studied, classified. Sugar, coffee, tea, chocolate, tobacco, Asian textiles, spices, *materia medica*, and exotic plants and animals were desired as much as examined and described. For this reason, there have recently been calls upon historians of early modern science to pay more attention, not just to instruments and objects, but also to materials.[18] But this inclusion of objects and materials has obvious consequences: it undoes the old dichotomy between the scholar and the craftsman, and that between the hand and the mind, and replaces it with notions that express, in the words of Ursula Klein and Emma Spary, "a differentiated continuum of forms of knowledge": indeed, Domenico Bertoloni Meli speaks of "thinking with objects," Lissa Roberts, Simon Schaffer and Peter Dear have coined the phrase "the mindful hand," and Pamela Smith has attempted to trace the development of an "artisanal epistemology."[19]

When one combines this world of scholarly interest – early modern and contemporary – in instruments, objects and materials with the global networks of trade and exchange that constituted themselves in the early modern period, one inevitably ends up with a very complex and fascinating backdrop to the evolution of modern science. According to Kapil Raj, for example, overseas trading companies played a central role in the early modern knowledge-making process, because "right from their inception, the trading companies supported and even employed mathematicians, practical astronomers, and hydrographers for navigation, and medics for treating crews and identifying commercially viable plants or

16 Field, "What Is Scientific about a Scientific Instrument?" See also Lüthy, "Museum Spaces and Spaces of Science," 417-18.

17 Daston, *Things that Talk*.

18 See e.g., Beretta, ed., *From Private to Public*, notably Beretta's preface.

19 Klein and Spary, *Materials and Expertise*, 2; Bertoloni Meli, *Thinking with Objects*; Roberts, Schaffer, and Dear, *The Mindful Hand*; Pamela Smith, *The Body of the Artisan*.

derived products overseas."[20] At the other end of the European tale of exploring, collecting, interpreting and 'objectifying' stand the indigenous groups which are often forgotten, but in their interaction with Europeans contributed to the constitution of knowledge. For exactly this reason, Raj has argued that instead of looking exclusively at the final result of interactions, one should focus on the process of circulation itself as the 'site' of knowledge-making. Such a focus, he maintains, demonstrates "the *mutable* nature of the materials – of the men themselves and of the knowledges and skills which they embodied – as also their transformations in the course of their geographical and/or social displacements."[21]

One must of course agree with James Secord that whatever circulates – including books, letters, pamphlets and other textual artifacts – are inevitability material objects.[22] Moreover, as historians of material culture now know, different meanings are attributed to objects when exchanged between cultures.[23] Given the well-known phenomenon that texts change their meaning across time and space, and even more so when translated, edited, illustrated or otherwise modified, one might be tempted to dismiss the distinction between textual and non-textual objects as artificial. There might be even more reasons for defying this distinction, given that even the most silent objects and materials rarely came without words: as the chapters of this book document, bulbs and plants seeds usually arrived together with a letter; old coins or new scientific instruments carried inscriptions; fossils seemed to confirm biblical passages; anatomical preparations either illustrated received doctrines, or lay at the basis of new ones; and images accompanied or sometimes also contradicted theories.

Despite the apparent impossibility of capturing a fully silent object, prior to its envelopment in a web of words, the starting point of this book are objects, not texts. What it wishes to document is the way in which meaning attributed to objects changed as they migrated between different sites – from the New World to the Netherlands, from Louvain to the Spanish court, from the excavation site to the naturalist collection. Van Cleempoel, for example, describes the effects that the move of Petrus ab Aggere from Louvain, home to a school of instrument makers in the tradition of Gemma Frisius and Gerard Mercator and intimately connected to the court in Brussels, to the Spanish court had on his instruments. In Spain, ab Aggere revived the use of universal projection, following the Arabic astro-

20 Raj, *Relocating Modern Science*, 16. See on the centrality of the theme of circulation also Hilaire-Pérez, "Les circulations techniques."

21 *Ibid.*, 20-21.

22 Secord, "Knowledge in Transit," 665.

23 See also Myers, *The Empire of Things*.

nomical tradition that had been thriving in eleventh-century Andalusia (although van Cleempoel does not discard the possibility that ab Aggere had first become familiar with universal projection, not so much through medieval instruments but through books, notably by Gemma Frisius, when still in Louvain). What is certain, by contrast, is that in Spain, ab Aggere transformed the style of lettering on his instruments, no longer following Mercator, but adapting to local Spanish tastes. Van Cleempoel argues that ab Aggere and his instruments established a Spanish school of instrument-makers.

In Feola's chapter on Chifflet, we encounter dried and fresh lilies changing meaning when moving from botanical to political contexts. Chifflet's epistemic move, which allowed botanical knowledge to decide on a politically sensitive heraldic issue, was daringly innovative, but, as Feola argues, not accepted by contemporaries as it was seen to mix genres and domains in an improper way. In Eric Jorink's chapter, we find yet another class of objects changing meaning in the long seventeenth century. The new trading regions in the East and the West caused collections in the Dutch Republic to be flooded with unfamiliar objects. Now, objects were frequently collected to illustrate the text of the Ancients, and biblical history in particular. Yet, Jorink argues, the collectors allowed Trojan horses into their collections. Later in the seventeenth century, partly as a consequence of the emergence of radical biblical criticism, the very same objects that had first been taken to corroborate biblical stories, now began to erode their meaning and reliability. As their ontological status fluctuated, these objects became open to more than one interpretation.

Material objects changing their epistemic status are also encountered in Dániel Margócsy's article. The Dutch anatomists who are the protagonists of this chapter, Govard Bidloo and Frederik Ruysch, held opposite views on the status of illustrations on paper and anatomical preparations. While for Ruysch, anatomical preparations held epistemological primacy, Bidloo believed in the superiority of paper, as anatomical preparations could not capture the variability of nature. According to Margócsy, the respective epistemic status of paper and object also determined their financial value and whether they were bought as luxurious collectables. Ruysch became rich when he sold his anatomical collection to the Russian czar, while Bidloo's anatomical preparations were deemed valuable only in the context of research. It was rather atlases that Bidloo wished to sell as luxurious objects of consumption. It is not with financial reward, but still with the epistemic status of rivaling sets of illustrations, that Claus Zittel's chapter on the images of Descartes' *Traité de l'homme* is concerned. The text of this treatise, which was found upon Descartes' death, referred everywhere to illustrations, which were however missing. The challenge was thus to craft the right image to make sense of the text. Florentius Schuyl and a couple of artists working for Claude Clerselier rose to this challenge separately, proposing rather different images for the same text. The two editions competed for commercial and intellectual dominance in the Dutch and international markets, with Clerselier's edition not only winning this contest, but becoming canonical. A comparison of the two sets of images with each other and with Descartes' text demonstrates, as Zittel shows, that even images that are allegedly dependent on a text can carry a meaning that can not only deviate from it, but even contradict it. In fact, Zittel documents how the common understanding of Descartes' man-machine was constructed on the basis of a reception of Clerselier's images, rather than by Descartes' own words.

What Margócsy shows in his chapter on anatomy in the Dutch Republic, Sven Dupré similarly demonstrates for mathematical bodies of knowledge in the Spanish Netherlands: epistemology could come packaged as consumers' luxury goods. According to Dupré, in early seventeenth-century Antwerp merchant-collectors not only valued objects as commodities to display wealth, but also as objects of knowledge. There, again, it can be shown how the circulation of collectibles led to networks of friendship and to a community sharing knowledge. Only like-minded members of the network – friends thus – could recognize certain goods to be also objects of knowledge. An interesting phenomenon is that Antwerp, a city that was home to such communities and specialized in the re-packaging of imported goods in locally invented luxury goods such as art cabinets and pictures of collections, often embedded claims about the high value of mathematical knowledge rather than providing this knowledge itself.

A different type of circulation of knowledge claims stands at the center of Koen Vermeir's contribution to this volume. Vermeir focuses on the controversy on divination, which raged in the Dutch Republic in the last years of the seventeenth century, having been sparked off by a French polemic. The Dutch polemic, which culminated in numerous experimental trials and ensuing pamphlet wars, mixed objects, materials and theories in a most complex way. Sure enough, the materiality of the divining rod was believed to be important, as were the materials that could be detected by it. But if such early Enlightenment luminaries as Bekker, Bayle, and Rabus lent credence to the French reports, this was due to their mixing of physical assumptions (e.g., regarding the match between effluvia and the pores of the rod, or the dowser's body), experimental observation, religious beliefs and notions of objectivity. In this particular case, what Harold Cook calls "matters of fact" were particularly hard to establish, since the material rods, the dowser's personality and the experiment's particular circumstances were taken to be so unique that no 'objective description' (in the sense mentioned above) could be arrived at, and thus no facticity established.

Taken together, the chapters in this book show how material objects functioned as carriers of knowledge and how networks of people (scholars, craftsmen, mathematicians, anatomy professors, merchants, etc.) attributed new meanings to objects and (to use Cook's expression) constituted a consensus around the intellectual value of objectivity. Nevertheless, the book is equally concerned with the limits of objects to function as carriers of knowledge. Although material objects of knowledge are silent messengers according to the title of this book, it was often impossible for contemporaries, as much as for historians today, to catch objects without their envelopment in a web of words and meanings. While objects offer the possibility of consensus, language and values are sources of difference and division between people, as Cook points out in his closing comments to this book. It suggests to him, and probably to most readers of this book, a natural follow-up project, one that focuses, not on the role of objects, but on interpreters and translators in the circulation of knowledge.

Botanical, Heraldic and Historical Exchanges Concerning Lilies: The Background of Jean-Jacques Chifflet's *Lilium Francicum* (1658)

Vittoria Feola

Introduction

Today, there is a common awareness of the fact that the fleur-de-lys is not a lily (as the name suggests) but instead an iris. In the early modern period, suspicions to the effect that name and plant were an historical mismatch arose in the context of polemical and apologetic writings concerning the status of the Kings of France. In the context of these polemics, a set of diverse types of evidence was invoked: heraldry, history, numismatics, iconography and, evidently, botany too. This article addresses the way in which the "wars of the lilies" combined these, doing so primarily by looking at Jean-Jacques Chifflet's *Lilium Francicum* (Antwerp, 1658).[1]

I will begin by providing a biography of Chifflet. Secondly, I shall locate him in his milieu of like-minded scholars who exchanged botanical, heraldic and historical material about lilies across the Low Countries, France, and Italy. Thus, I will reconstruct the context of production of *Lilium Francicum* and, following this, consider its arguments and compare it to contemporary works.

Jean-Jacques Chifflet

There is no intellectual biography of Jean-Jacques Chifflet.[2] The following account will consider him as an example of a scientifically inclined late humanist and antiquary. Humanists were classical scholars, whose work depended on

1 Hereafter referred to as *Lilium*.
2 What follows is based on de Meester de Ravenstein, *Lettres*.

knowledge of Latin (and often of Greek) for the purpose of rediscovering, editing, and discussing ancient texts as well as transmitting knowledge recovered from the classical world. While philology was their main epistemological tool, they often carried out observations of natural phenomena too. Indeed, the humanists' main fields of interest were the history of man (political history above all) and the history of nature. This explains their concern with natural philosophy.[3] The word "natural philosopher" stems from the sixteenth century; early modern men understood it to mean an expert in the field of (Aristotelian) explanations of natural phenomena.[4] Antiquaries were also a product of humanism in that they were students of early history. Specifically, antiquaries were collectors, custodians and recorders of antiquities, concerned first and foremost with remains from the classical world, such as vestiges of buildings. However, any material object of knowledge was potentially considered an antiquity. Thus, coins, fossils, relics, plants, manuscripts even printed books could be antiquities. It is said that Petrarch (1304-74) was the earliest humanist-antiquary, for he went about Roman ruins and collected coins and manuscripts, which he then observed and philologically used in some of his written works.[5] At the risk of an oversimplification, one can say that Petrarch's scholarship was humanistic and his empirical approach to knowledge through the gathering, analysis and use of material objects (antiquities) was antiquarian. This is fundamental, because the subject of our book are material objects of knowledge. Early modern men did not call them so, rather they called them "antiquities." Other words that they used, often interchangeably, were "curiosity" and "rarity," particularly when the antiquity in point was rare or, in the case of plants for instance, when the object in point was not very old. The seventeenth-century men whom I shall discuss in this essay were humanist-trained and were interested in the study of history and of nature, which they carried out by collecting material objects of knowledge such as plants, manuscripts, coins and drawings, which were analysed through observation (in the case of natural objects) and philological collation (in the case of texts). People like Chifflet and his peers shared an empirical approach to knowledge.

Both Chifflet's life and the intellectual circles in which he operated reflect his contemporary interests in nature, especially medicine and botany, as well as his-

3 Humanism is obviously a very well studied subject. My approach reflects the influence of Anthony Grafton's several works. Particularly relevant for the definitions which I use here is Grafton, *Rome Reborn*.

4 The earliest occurrence of the word in the English language is in Higden, *Polychronicon* (1541), see *Oxford English Dictionary*.

5 Grafton, *Rome Reborn*, passim; Momigliano, *The Classical Foundations*, passim; Crouzet-Pavan, *Renaissances italiennes*, 25-76.

tory. Jean-Jacques Chifflet was born in Besançon, capital of the Franche Comté, on 21 January 1588, to a family of Burgundian origin that had given several men of letters to the area. Following in his father's footsteps, he took his medical doctorate at the University of Dole, before embarking on a medical as well as antiquarian grand tour. He spent further terms at the renowned medical faculties of Paris, Montpellier and Padua, and coincidentally began studying and collecting Roman antiquities in Germany and Italy. On his return to Besançon, Chifflet started his medical practice, as well as antiquarian researches about the Roman heritage of his hometown. In 1618 they resulted in his first publication, *Vesontio civitas imperialis libera, Sequanorum metropolis*.[6]

In 1621 Chifflet was chosen to represent Besançon at the court of the Archduke Albert in Brussels, and so he departed for his first diplomatic mission. During his stay in Brussels, Chifflet ingratiated himself with the Archduke more for his scientific knowledge than for his political wisdom. As part of his medical studies and practice, Chifflet had acquired a good working knowledge of botany. As a result, Archduke Albert made Chifflet the first official botanist of the Franche Comté. This title arrived almost at the same time as another, which, instead, highlighted Chifflet's humanist education as well as his ability as an antiquary. The Roman Senate had particularly warmed to Chifflet's elegant Latin in *Vesontio*, as well as his praise of the benefits of Roman civilisation on ancient Besançon. As a token of their appreciation, the Roman Senate bestowed on Chifflet and on his descendants the title of Roman citizens. Chifflet was so proud of it that, fearing this honour might get lost to posterity, he successfully insisted that the city council of Besançon register his Roman letters patent.

By September 1623, Chifflet was again in Brussels, where he joined his brother Philippe Chifflet, a brilliant former student of the scientifically-minded humanist Erycius Puteanus, Professor of Latin at the University of Louvain, who was now at court, seeking an ecclesiastical posting. Both Jean-Jacques and Philippe did well in Brussels. Apart from receiving the title of governor of Besançon, Jean-Jacques obtained the post of physician of the chamber of the Infanta. Philippe, on the other hand, was made chaplain of the Brussels oratory.

On 28 April 1628 Chifflet arrived in Madrid where he succeeded in obtaining from the Spanish King the transfer of the Burgundian parliament from Dole to Besançon. As a result, he was appointed Physician to the Archduke and his wife in Brussels.

In Madrid Chifflet published the first of a long string of pro-Spanish political-

6 Chifflet, *Vesontio.*

antiquarian works, *Portus Iccius*.[7] Chifflet wished to demonstrate that the Flemish port of Mardyck, near Dunkerque, was ancient Portus Iccius, from which Julius Caesar set sail for the conquest of Britain. It was now under the sovereignty of the Spanish King. At the time, possession of classical vestiges conferred prestige both on individuals and on countries, and by attributing to Spain such a prestigious ancient Roman site, Chifflet implicitly stole an antiquity from France, thus demeaning her value as a repository of classical antiquities. With *Portus Iccius*, therefore, Chifflet joined the flourishing group of writers supporting the Spanish monarchy.

Back in Brussels, Chifflet spent the remainder of his life researching antiquities in order to publish works on political history in homage to the Hapsburgs, while continuing to practice medicine and studying plants. Hence, Chifflet developed two careers simultaneously. On the one hand, he became a sort of royal historiographer for the Spanish Hapsburgs. His *Recueil des traittez de paix, treues et neutralité entre les couronnes d'Espagne et de France* (1645), *Ad Vindicias Hispanicas lumina nova* (1649), *Opera historica* (1650), *Stemma Austriacum* (1650), *De pace cum Francis ineunda consilium* (1651) and, as I have shown, *Lilium Francicum* (1658) are significant examples of early modern, pro-Spanish, historical propaganda.[8] In all of them, Chifflet states forcefully the rights of the Spanish monarchy to rule over its domains and to be pre-eminent in Europe. By publishing works of historical propaganda, Chifflet put his humanist learning to the service of a princely patron. In 1650 he was made First Physician of the King of Spain in explicit recognition of his anti-French works.[9]

Chifflet also pursued his scientific interests and published a medical work, *Pulvis febrifugus orbis Americani* (1653), which was re-issued in Rome by the learned French Jesuit natural philosopher and antiquary Honoré Fabri under the title *Pulvis Peruvianus vindicatus* (1655).[10] With *Pulvis febrifugus* Chifflet was one of the first European physicians to describe the benefits of a new drug, the Peruvian bark. Chifflet, who experimented with it, as he states in his work, became an early advocate for its massive introduction into European pharmacopoeias. The high cost of Peruvian bark, however, caused much opposition against the import of this new American drug. The Jesuits, who had first used it, were reported to have bought bark for the price of its weight in silver. It was not until the mid-

7 Ibid., *Portus Iccius.*

8 Chifflet, *Recueil des Traittez de Paix*; *Opera politico-historica*; *Stemma Austriacum*; *Lilium Francicum.*

9 Besançon, Bibliothèque Municipale, MS. Chifflet 25, fols. 157-68.

10 Ibid., *Pulvis febrifugus*; Fabri (ed.), *Pulvis Peruvianus.*

eighteenth century that the bark successfully found its place in European drugs of herbal origin thanks to Linnaeus. *Pulvis febrifugus* reflects Chifflet's life-long interest in botany.[11]

Chifflet's interests in both history and nature are best appreciated if one considers the broader milieu of scholars, of which he was a part.

Chifflet's Milieu: Exchanges of Material Objects Concerning Lilies

When Chifflet returned to Brussels, in 1623, he befriended Gian-Francesco Guidi di Bagno, nuncio to the Archduchess Isabel's court. Chifflet asked Bagno to introduce him to his learned friends, in order to establish new interesting and potentially career-advancing relations. Hundreds of letters survive between Chifflet and Bagno, and through many of them it is possible to map out some of Chifflet's early contacts from Brussels.[12]

Among them, Chifflet's acquaintance with Nicolas Claude Fabri de Peiresc, who was dubbed the "Prince of the Republic of Letters" and in our context deserves special attention.[13] As I describe below, Chifflet exchanged many more material objects than just letters with Peiresc, who was then based in Aix-en Provence, in Southern France. Chifflet wrote to Bagno on 25 June 1627 and told him he had sent Peiresc his last two works, *De Linteis* and *Portus Iccius*, and was awaiting Peiresc's thoughts on them. On 22 October, Chifflet informed Bagno that Peiresc was not pleased with his *Portus Iccius*, because he had stolen a remarkable antiquity from France, speaking metaphorically. Chifflet replied, emphasising his pro-Spanish sentiments.[14]

Although it has not been possible to trace the beginning of their friendship, it is known that Chifflet and Peiresc shared at least two friends: André Duchesne and Jérôme de Winghe. André Duchesne (1584-1640) was Richelieu's royal historiographer and author of a number of historical and heraldic works about the medieval history of France, England and the Low Countries.[15] Despite the fact that Duchesne aimed to demonstrate the superiority of the French Kings against similar Spanish claims of the kind that Chifflet supported, making them there-

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11 Sandved, *Bark*, passim.

12 de Meester de Ravenstein, *Lettres*.

13 On Peiresc, see Miller, *Peiresc's Europe*; Tamizey de Larroque, *Les correspondants de Peiresc*; Lebègue, *Les correspondants*. Peiresc's letters can now be read online on a little-known, yet useful site: www.internum.org.

14 de Meester de Ravenstein, *Lettres*, 42 and 57 respectively.

15 Among his works, Duchesne, *Les antiquitez, Bibliotheque, Historiae Normannorum, Histoire d'Angleterre.*

fore political opponents, the two men corresponded for years, exchanging books and manuscripts relating to the history of France and the Spanish Netherlands. The earliest letter that Duchesne sent from Paris to Chifflet, then in Besançon, dates from 29 May 1619.[16] It was followed by Duchesne's reply on 22 October 1620.[17] These inaugurated a long series of exchanges of historical materials.[18] For instance, Chifflet sent Duchesne tomb inscriptions, which he had collected around the Spanish Netherlands.[19] In turn, Duchesne collected material about the fleur-de-lys, which he then passed on to Chifflet.[20] This included medieval and contemporary manuscripts about the fleur-de-lys, and drawings of coins depicting it. When Duchesne arrived in Brussels, Chifflet told Bagno that they had met and discussed history with other people at court.[21] Duchesne shared Chifflet's interests in the study of political history and nature. Although Chifflet was much better versed in scientific subjects by virtue of his university training and his medical profession, Duchesne did not disdain from taking notes about observations of the reproduction of freshwater octopuses as well as making calculations about the length of the year. Political allegiances did not divide the two men as much as historical and scientific interests united them.[22]

But it was Jérôme de Winghe (1557-1637) who perhaps can best be paired with Chifflet for his contemporary interests in both political history as well as science, especially botany.[23] De Winghe was canon at Tournai, a collector of books and manuscripts, the owner of a cabinet of curiosities, which included a rich collection of coins, and the planter of one of the earliest acclimatation gardens of Northern Europe.[24] It was he who taught Peiresc how to build this type of garden in Provence. In a letter from Peiresc to de Winghe, dated from Aix on 14 March 1609, Peiresc wrote: "you have made me conceive the idea of a garden."[25] Equally, de Winghe's own book classification system inspired Peiresc's own. Witness Peiresc's letter dated Aix, 27 February 1607, in which he wrote: "I am awaiting your library catalogue with wonderful impatience, postponing to have my li-

16 MS. Chifflet 23, fol. 345.

17 Paris, Bibliothèque Nationale de France, MS. Baluze 51, fol. 151.

18 Duchene's letters to Chifflet are contained in MS. Chifflet, 23, fols. 121-128 and 342-347. Chifflet's letters to Duchesne are in MSS. Baluze 46, fols. 121-122; 144-145; 51, 151-152.

19 MS. Baluze 67, fols. 8-13.

20 MS. Baluze 49, fol. 381.

21 de Meester de Ravenstein, *Lettres*, Chifflet to Bagno from Brussels, 21 May 1627, 36-7.

22 MSS. Baluze 164, passim, and 62-63, fol. 338.

23 *Biographie Nationale*, t. 27, 350-1.

24 Lebègue, *Les correspondants*, 22.

25 Ibid., 22: "vous m'avez fait concevoir l'idée d'un jardin." The translations are mine, unless stated otherwise.

brary rearranged in order to model mine on yours."[26] De Winghe and Peiresc were often in contact and exchanged books and manuscripts, as well as plants and gardening advice. For example, on 17 September 1612, de Winghe told Peiresc that he had found "various names of peaches in the Theatre of Agriculture and Rustic Home, the same as those which you shall send me."[27] On 31 December 1614, Peiresc sent de Winghe some "Ilex Coccigera,"

which does not grow at all in these quarters, rather, near Aix and the Rhone ... I have given it to Father du Callas to send it to Paris where my brother Valavez will procure to give it to you. If you wish to have some Ilex major growing here, this is a species that is a bit different from the green oak of France, possibly I will add some Gland among those of the Suber. As to gardening, I will send you some Nuts of the said Suber.[28]

In the rest of the letter, Peiresc mentioned several more plants that he had evidently been discussing by letter with de Winghe, such as Mollis Balbefurum, which Peiresc called a "curiosity."[29] This Mollis Balbefurum was a bulbous plant, and, like all such kinds of flowers, was in great fashion at the time. The 1630s continued in the 'tulipomania' that had been gathering momentum for years. Their being bulbous plants made them curiosities, things to own, even in the case of widespread flowers such as lilies and irises. De Winghe was so intrigued by all kinds of bulbs that he managed to get in contact with Domenico Caccini, an eminent Florentine botanist (who also owned a large library and a cabinet of curiosities), with whom he exchanged tulips from Brussels for irises and lilies from Florence, among other plants.[30] A letter from de Winghe to Caccini, dated from Tournai, 21 June 1611, enlightens us about their mode of scientific communication.

Now to come to the way in which we have to manage our correspondence about plants and flowers, I tell your lordship that you can send your letters and whatever else to my nephew Father Massimiliano Habeke, Father of the Society of Jesus in Antwerp, who has excellent

[26] Tamizey de Larroque, *Lettres*, vol. VI, 86, "j'attends le catalogue de votre bibliothèque avec merveilleuse impatience, en retardant de faire le mien pour le modeler sur le vôtre."

[27] Aix-en-Provence, Bibliothèque Méjanes, MS Peiresc 213 (1031), 354: "Les divers noms de Peches ay trouué au Theatre d'Agriculture et Maison Rustique, tels que vous m'enveryez me seront bienvenu." De Winghe referred to Charles Estienne's *Théâtre d'agriculture*.

[28] MS. Peiresc 213, 365, "vous receurez avec la presente, n'y ayant peu mettre de celuy d'Ilex Coccigera qui ne croit point en ces quartiers icy, ainsi du costé d'Aix et du Rhone ... J'en ai donné à Monsieur du Callas mon père d'envoyer à Paris à mon frère de Valavez qui vous les fera tenir. Si vous voulez de l'Ilex major de ce pays cy, c'est une espece un peu differente du Cheyne vert de France, et possible en ajouteray je quelque Gland parmi celles du Suber."

[29] Ibid, 366; "curiosité" in the original French.

[30] *Dizionario Biografico degli Italiani*, vol. 16, 33-4.

means to let me have everything promptly, the post is a very good medium when things are not heavy, otherwise we should use the Conduct. This said, Father Massimiliano is known to the Reverend Father Rector in Florence. If your lordship has any correspondents in Lille, I have friends who will get you what I will send you, among others Mr van der Haer, Chancellor and Treasurer of St. Peter's or (in his absence) his brother, who is staying with the said treasurer in the same house. If your lordship has a shortest and surest way, please let me know and I will not be failing to use it to send you the double-flowered daffodil. As for the double anemone, mixed with red and white, I do not remember having received it or heard of it.[31]

The letter carries on about flowers the two men intended to exchange, including four tulips de Winghe was including for Caccini, "the rarity of which one cannot describe with a pen."[32] Interestingly, Caccini used this very letter from de Winghe to annotate some observations about plants, including the quamoclit (a sort of American jasmin for which Caccini's botanical garden was renowned), which de Winghe had requested in exchange for tulips. Caccini used this letter as the basis for another one which he must have sent de Winghe, but which does not figure in their little-known correspondence, which is kept in the Royal Library of Brussels.[33] In the next, long letter from de Winghe, dated Tournai, 16 December 1611, he thanked Caccini for all the bulbs he had sent from Florence and sent back another box of bulbous plants, including daffodils. De Winghe added that he would gladly receive seeds of "chamelia Italica, which I believe is common in

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31 KBR MS. III 893, fol. 205r, "Hora per venire alla via c'hauemo da tenere nella corrispondeza nostra nel fatto di piante et fiori, dirò a V. S. ch'ella puo mandare le sue lettere, et ogni altra cosa, al mio nipote Padre Massimiliano Habeke Padre della Societa di geu in Anversa, ilquale ha buonissimo medio di farmi tener il tutto promptissimamente, la Posta e la via buonissima, quando le cose non son di peso, Altramente conuien servirsi della Condotta/ Detto P Massimiliano è cognosciuto dal R.do P. Rettore di Fiorenza/ Se V. S. ha qualche corrispondente in Lilla, io ui ho amici che mi faran tener quel che V. S. mi mandarà/ fra li altri vi e il S. Vander Haer Can. et tresoriero di san Pietro ouero (in absentia sua) il suo fratello, stando con detto tresoriero nella medesima casa/ se V. S. sa altra via più breve et sicurase me lo potra scrivere et significarmela accio io me ne posse servire anch'io, et per la medesima non mancaro' di mandare a V. S. la gionchiglia a fior doppio/ quanto all'anemone dopio, mescolato di rosso et bianco, non ho memoria l'aver ricevuto, ne d'haverne sentito parlare."

32 Ibid. fol. 205v., "la rarita delli quali non si potra ben descrivere con la penna."

33 Ibid, fol. 205r-v. The letters de Winghe-Caccini are all contained in KBR MS. 893, fols. 205-9. The *Dizionario Biografico degli Italiani* does not list them as primary sources available on Caccini. Tongiorgi Tomasi and Tosi, in their *Flora e pomona*, 12, have referred to them without indicating, however, the shelfmark. Egmont has used MS 893 to publish excerpts of the correspondence Clusius-Caccini, but has not focussed on de Winghe at all; Egmont, *Correspondence*. So far as I have been able to ascertain, this is the first time that the letters between de Winghe and Caccini are examined.

your lands" and as well as Persian and Syrian irises from Florence. In exchange, de Winghe intended to send to Caccini some that he had recently procured in "Brussels (that ocean of tulips)."[34] In the last letter from de Winghe to Caccini, there is a long list of plants, flowers and vegetables, which departed from Tournai, via Antwerp, to reach Florence. It includes various kinds of irises, lilies and tulips, as well as exotic plants and English roses.[35]

Although I have not been able to find a direct link between Caccini and Chifflet, there is an intriguing letter from de Winghe to Chifflet about heraldic matters concerning the fleur-de-lys and lilies and irises in the Caccini correspondence in Florence.[36] Moreover, it has been shown that de Winghe was a friend of Peiresc's, who corresponded with both him and Chifflet. Peiresc was also in touch with Filippo Magalotti, another gentleman from Florence with a keen interest in botany and an acquaintance of Caccini's.[37] Although nothing conclusive can be said about a relation between Caccini and Chifflet, what matters here is that they participated in the same group of scientific scholars who exchanged all kinds of objects of knowledge.

For instance, de Winghe sent Peiresc tulips and drawings of antiquities while asking in exchange plants from the garden of Vespasien Robin, the French King's botanist. Peiresc obliged, and in return requested for more irises and lilies and other bulbs. De Winghe, then, received Jacques-Auguste de Thou's *History* and other historical works from Paris.[38] De Winghe sent Peiresc some notes which his brother Philippe de Winghe had taken while he was living in Rome as an engraver. These notes concerned archeological remains as well as a medieval manuscript of Genesis. Peiresc was as interested in them as he was about a certain Jacob Metius, then considered to be the inventor of the telescope.[39] He also enquired about the antiquities of Tournai and Courtrai. Among de Winghe's informants one finds an unidentified "M. de Bouffer," a neighbouring owner of a botanic garden who supplied him with some heraldic material too. De Winghe did not fail to answer Peiresc's queries, and as soon as Peiresc received this information from Tournai, he passed it on to Duchesne, in Paris, who was working on the heraldry of Normandy and the Low Countries during the Hundred Years War. He then shared

34 KBR MS. 893, fols. 206.1r, quotations from fol. 206.1v and fol. 207.1r respectively: "la Chamelia italica credo che sia cosa comune nelle vostre lande," "Brussella (oceano delli Tulipani)."

35 KBR MS. 893, fol. 209r-v.

36 Florence, Biblioteca Medicea Laurenziana, MS. Med. Palat. 131, no foliation available.

37 Tamizey de Larroque, *Lettres*, 74-7.

38 Lebègue, *Les correspondants*, 22-3.

39 Van Helden, *The Invention of the Telescope*, passim.

it with Chifflet, who was collecting antiquarian material for his *Lilium*.[40] When Peiresc was either in Paris or Aix, Chifflet corresponded with him directly.[41] Another common correspondent of Chifflet and Peiresc was de Winghe's neighbour, the astronomically inclined humanist and astronomer Govaart Wendelen. Aside from publishing on comets, which he observed from Tournai (with de Winghe?) Wendelen sent Chifflet, on 2 November 1653, from Tournai, eight pages of his researches on the origins of the Franks.[42] Wendelen and Chifflet had in fact already co-authored the *Opera politico-historica* (1650), an anti-French work about the origins of Salic Law in France.[43]

Thanks to his milieu of like-minded men, Chifflet gathered a volume of notes about a subject close to his heart; namely, the coat of arms of the French king, the fleur-de-lys. This served as the basis for his *Lilium Francicum*, to which I am about to turn after a short excursus into heraldic matters.[44]

Chifflet's Lilium

1. Heraldry and the fleur-de-lys

Since the fourteenth century, France and the independent Spanish kingdoms had been engaged in a double war of swords and pens. Many tracts were composed about the superiority of the "two suns," as political writers dubbed France and Spain, hinting at the necessity that one of them should be dominant in Europe.[45]

The fourteenth century was also the time when heraldry developed. This was a system for the visual representation of social status. People and institutions, such as knights and gilds, started to bear arms (anyone from gentry status up did). Their pictorial representations were (and still are) called coats of arms. They usually included particular objects which were associated to knighthood, such as swords or towers, as well as geometrical forms; they could also portray in stylised forms certain animals or flowers which were deemed to be appropriate heraldic symbols. Among animals, for instance, rampant lions and leopards were considered suitable

40 Besançon, Bibliothèque Municipale, MS. Chifflet 23, fols. 121, 123-7, 342-7.
41 MS. Chifflet 23, fols. 244, 341, 379, 420.
42 MS. Chifflet 23, fols. 325-32. Wendelen, *Liberti Fromondi;* ibid., *Tetralogia cometica*, which Wendelen dedicated to Chifflet.
43 Chifflet, Wendelen, *Opera politico-historica*, passim.
44 MS. Chifflet 175. Chifflet's botanical/medical notes, which he also used for *Lilium*, are in MS. 142 (which contains extracts from Pliny's *Natural History*) and MS. 124, fols. 4-61, which contains his numismatic notes.
45 See, for instance, Black, *Political Thought*, passim; Burgess, Hodson, Lloyd, *European Political Thought*, passim, and their bibliographies for further references.

animals to represent noble houses. Among flowers, the iris was chosen as the symbol for royalty. No wonder, therefore, that the king of France took up an iris, which was misleadingly called fleur-de-lys (in French, fleur-de-lys means lily flower, not iris) as the main symbol of his coat of arms. Heraldry is a codified set of legal rules that people and institutions bearing arms ought to respect, with heralds being competent in that branch of the law known as the law of arms. Heraldic symbols cannot be assumed arbitrarily, rather, they must be granted and confirmed by the relevant College of Heralds.[46] Other rulers in Europe adopted stylised forms of irises too; for example, the king of England, the duke of Burgundy and the city of Florence. Given France's political pre-eminence, the fleur-de-lys soon became more associated with France than with any other place.[47] All these were legally registered coats of arms, and in order for kings to change their country's coat of arms, they had to ask their College of Heralds about the legal aspects involved. For example, when Edward III of England quartered the English arms with those of France, thus establishing his claim to the French throne, he had heralds legally register this change. The legal consequence, which was immediately apparent to everyone in Europe, was that the new coat of arms of the English monarchy was now that of an Anglo-French monarchy, in which the English king claimed sovereignty over the kingdom of France. Assuming arms, therefore, had potentially serious legal implications involving the notion of sovereignty. Napoleon knew this all too well when he asked England to give up the arms of the French monarchy, at a time when the English realistically considered the matter as settled.

In the seventeenth century France was rising in power. New tracts about the superiority of the lys were being printed at the same time as France was experiencing the *dévot* movement. Unlike their predecessors who had sung the praise of the lys, now the Jesuits, above all, produced tracts about it, in which they however introduced a novelty. Playing on the misleading word lys, meaning lily, French authors spoke of the fleur-de-lys as of a lily, the flower symbolising the Virgin Mary. Many new churches were built, in both France and Italy, dedicated to the Virgin of the Lily. The *dévot* built a new political-religious symbolism for the kingdom of France, which they wanted to be placed under the protection of Mary. The lys ought to be a lily, not an iris, because irises had always only been associated with

46 Allmand and Armstrong (eds.), *English Suits*; Black, *Law Dictionary*; Dugdale, *Origines Iudiciales;* Feola, "Elias Ashmole and the Court of Chivalry"; Squibb, *The Law of Arms.*

47 Fox-Davies, *Art of Heraldry*; Pastoureau, *Armoiries*; idem, *Couleurs*; idem, *Emblèmes*; Hinkle, *The fleur de lys*; Lombard-Jourdan, *Fleur de lis*; de Bray, *Manual.*

royalty whereas lilies had always been the flowers of Mary.[48] The fleur-de-lys, of which they spoke in the usually patriotic and anti-Spanish terms, was now an implicit way of saying that God, through the Virgin, protected France. Previously, God had intervened once, when He had given the fleur-de-lys to a medieval French king to show him his protection. Now the Virgin seemed omnipresent. It was a way of underlining the power of the Counterreformation church without which Richelieu's state would not stand.[49] The same kind of iconography was widespread in Counterreformation Austria too, an example of which can be seen in the elaborate frontispiece of Abraham a Sancta Clara's *Neuerwählte Paradeis-Blum* (Vienna, 1675).[50] Chifflet's *Lilium* appeared in this context.

2. Arguments of *Lilium Francicum*

In *Lilium Francicum* Chifflet addressed some crucial questions. What was the origin of the fleur-de-lys? For which flower did it stand? Why did French supporters insist that the lys was a lily when it was an iris instead? Chifflet's central arguments were as follows. First, French claims were wrong that God had given their kings the fleur-de-lys some time around the foundation of the kingdom of the Franks in the ninth century. Instead, Chifflet maintained that the lys was adopted not earlier than in the twelfth century. Equally inaccurate were French claims about the lys being a lily. Chifflet demonstrated that irises were the only flowers associated with royalty in heraldry, and that lilies were religious symbols, not political ones. Finally, Chifflet argued that the identification of the fleur-de-lys with a lily was a seventeenth-century fabrication. He used the typically humanist tool of philology to prove his points by historically reconstructing the use of the symbol that his contemporaries called fleur-de-lys. In addition, he wedded classical philology to the empirical botanical observations of lilies and irises. Chifflet wished to show that botany could give the final answer to why so many supporters of the superiority of France were wrong in their historical analysis of the fleur-de-lys. Indeed, Chifflet opened and ended *Lilium* by speaking about botany and of 141 pages in-folio, Chifflet explicitly talked about botany on 24 pages (that is, in a seventh of the book) and implicitly on many more.[51]

Chifflet opened his book by explaining:

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48 For instance, see Claude Villette, *An extraict des propheties… Ensemble la noble fleur-de-lys de Louys treizieme Roy de France* (Paris, 1617).

49 Haran, *Le lys*, 169-72, 250-4.

50 Abraham a Sancta Clara, *Paradeis-Blum*.

51 *Lilium*, 1-3, 116-35.

> Fifty years ago I was studying medicine as a young man in Paris and was friends with the most honored Jean Robin, who was the royal botanist; there I saw all kinds of flowers, local as well as exotic ones, the contemplation of which I enjoyed very much. On other days I went to visit the Palaces of the Louvre and of the Tribunal, and everywhere, on coats of arms, royal thrones, timbers, tapestries, and window panels I could see flowers, which people call lilies, as the heavenly sent signs of King and Kingdom. The same sight was to be found in private houses, in country inns and shacks, as of these flowers had showered from the clouds, to cover the entire nation.[52]

He carried on explaining: "The desire entered my mind to investigate of what sort those lies were, where they came from, and by which events they had obtained such a celebrity status."[53]

Chifflet was writing in response to Jean Tristan, Sieur de Saint-Aimant, author of the *Traicté du lys, symbole divin de l'espérance, contenant la juste défense de sa gloire, dignité et prerogative*, which had been published two years before. According to Chifflet, Tristan had misrepresented what Chifflet had written in a previous work of his, *Anastasis Childerici Regis*. Chifflet had uncovered, with the help of his friend de Winghe, the tomb of Childeric, King of the Franks, who had been buried in Tournai, then the capital of the Frankish kingdom. Together with the tomb, they had found a treasure of ancient coins. Basing his work on this discovery, Tristan had written in his *Traicté* that Childeric's insignia included the fleur-de-lys.[54] Hence, he had concluded that the lily of the fleur-de-lys had made its first appearance on coins at the time of Childeric, showing that the symbol of the French monarchy was even older than the time of Charlemagne, as had been previously been stated by various pro-French authors.[55]

But in his *Anastasis Childerici Regis*, Chifflet had not shown at all that the fleur-de-lys was a prominent element of the coins in the tomb. In fact, as he pointed out himself, "I have stated earlier in my *Anastasis Childerici Regis* that the

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52 *Lilium*, 1: "Cum antes annos quinquagenos adolescens studio medico Parisijs operam darem, frequentabam hortum viri honoratissimi Ioannis Robini, qui Regius tunc Botanicus erat: illic videbam flores omnis generis, inquilinos, exoticos, quorum amoena contemplatione lubens perfruebar. Diebus aliis excurrebam in Regum Luparam, & in Forense Palatium: observabam undequaque in scutis tesserariis, in Regalibus soliis, tabulatis, aulaeis, vitreisque, depictos passim aureos flores, quos lilia vocant, Regum regnique decora coelitus demissa. Occurrebant eadem spectacula in privatorum dominibus, in gurgustiis, tuguriisque; ut è nubibus pluisse viderentur illi flores, totamque gentem obumbrasse."

53 Ibid., 1-2: "Subiit mentem cupido inquirendi, cuius generis essent lilia illa, quae illorum cunabula, quibusve processibus evecta essent in tantam celebritatem."

54 *Lilium*, 2.

55 Ibid., 2-12.

symbol of hope on Roman coins is not the flower of a lily." And so he addresses the following attack to Tristan:

The state of the brain determines one's imagination: if the brain is damaged and the spirits are damaged, phantasy malfunctions: while it offers to the mind darkened images, those who suffer from this disease of wisdom will think, say and write absurd and deviant things. As I have said earlier, the golden – or royal – bees that have been found in the tomb of King Childeric in Tournai were very ancient symbols of royal majesty. These were, after a long period, substituted by the lilies, because these were also golden and don't differ too much from the shape of bees, as I have shown by means of old coins from Ephesus and Delphi.[56]

Coins were an antiquarian passion with Chifflet, as evidenced by both his published works and his manuscript notes.[57] Chifflet had insisted, as he repeated forcefully in *Lilium*, that the pictogram, which might be taken for a lily on Childeric's coins, was a bee, this pictogram being a medieval transformation of an earlier pictogram that stood for a generic plant. Chifflet made show of all his competence in Roman antiquities by presenting pictures of Roman coins which already portrayed a flower akin to a lily (see Figures 1 and 2). He explained, with the help of both classical and modern writers, that that pictogram represented indeed a plant or a flower (not particularly a lily, as even archaeologists agree today) which stood for *spes*, hope, the hope of the renewal of the life cycle after the winter – as Chifflet put it, *spes* was in *germinatio*, hope was in germination. To visually prove his point, Chifflet published pictures of four Roman coins in which Gaule is dealing with Rome and which do not bear any such flowery symbol at all. That is, that the symbol of hope only appeared on Roman coins when it was in the hands of Rome, and never was it drawn in the hands of Gaule. Not until much later, well after the time of Charlemagne, in the twelfth century, was it first adopted as the new symbol of the French monarchy.[58] Chifflet's Tournai-based friend, the astronomer and antiquary Govaart Wendelen had supplied him with manuscript notes about the Franks, on which Chifflet worked for *Lilium*.[59]

56 *Lilium*, 2: "Dixeram obiter in Anastasi Childerici Regis, Tesseram Spei in Romanorum numismatis non esse Florem Lilij … Prout cerebrum se habet, sic & imaginatio: illo laeso, & vitiatis spiritibus, depravatur phantasia; quae dum tenebricosa menti simulacra offert, absurda & aliena cogitant, loquuntur, & scribunt, qui sapientiae morbo laborant. Dixeram praetereà, Aureas Apes, verè regias, in sepulchro Childerici Regis Tornaci repertas, symbola fuisse regiae maiestatis antiquissima: illis videri, longo post intervallo, lilia substituta, quae et aurea essent, et ab Apum formâ non abluderent; ut ostendi antiquis numismatis Ephesiorum atque Delphorum."

57 MS. Chifflet 124, fols. 4-61.

58 Ibid., 12-22.

59 MS. Chifflet 23, fols. 325-32. Chifflet and Wendelen shared scientific interests, such as the use

12 LILIVM FRANCICVM

quemadmodum patet ex auerſis numiſmatum faciebus duodenis, quas in tabellâ ſculptas hîc exhibeo, vel ex nitidiſſimis archetypis deſumptas, vel ex manu picto codice Huberti Goltzij (quem Gorlæus vocat *fulgidiſſimum rei antiquariæ ſidus*;) vel denique ex Iacobo Biæo, inſigni calcographo Antuerpienſi; vt Antonij Auguſtini ſententiâ de typo Spei penitus aſſeratur.

Præfat. ad Dacty-loth.

Figure 1: Jean-Jacques Chifflet, Lilium Francicum, 12. Roman coins of the 'spes' type showing a plant that looks like a lily (but was never meant to be one, it was just a generic representation for any plant) and stood as a symbol for nature's regeneration. (British Library, MS 9915.bb.22; Courtesy of the British Library, London)

VERITATE ILLVSTRATVM. 17

Augusti: *Erat enim tempus quando messis est in* SPICA *&* FLORES *producit, videlicet circa festum S. Ioannis Baptistæ.* Anno 1184.
Florem spicæ fructus sequitur, de quo Plinius: *Omnium satorum* FRVCTVS *aut* SPICIS *continetur, vt* TRITICI, *hordei; muniturq; vallo aristarum quadruplici: aut includitur siliquâ, vt leguminum; aut vasculis, vt sesaniæ, ac papaueris.* Lib. 18. cap. 7.
Itaque tritici, postquam defloruit, fructus sunt maturæ fruges. Gemmas duas annulares antiquissimas hîc exhibeo, cum Spei typo.

1. 3. 2.

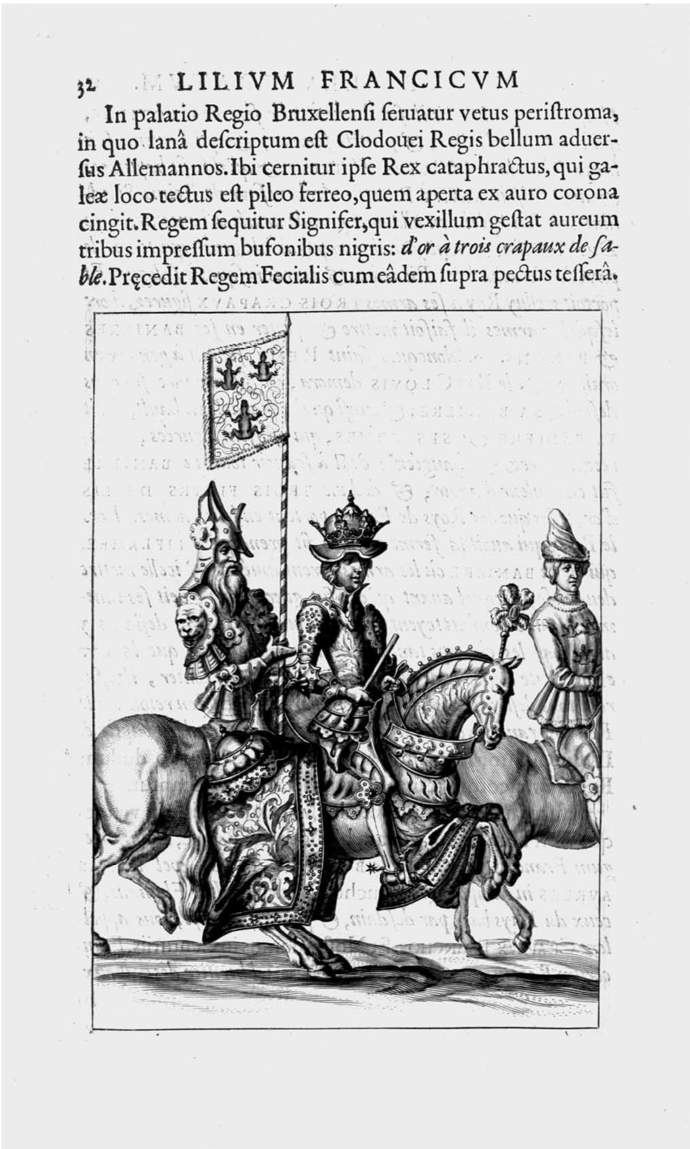
In priore onychinâ simulachrum Deæ trifidum herbæ germen dextrâ porrigit, quod est Spei nascentis symbolum. In alterâ smaragdinâ expressa est vtriusque Spei tessera, nascentis & adultæ. Adultam ostendit spica ad pedes Deæ à solo prodiens. Post verticem Deæ sculptus est Sirius, *quod ardentissimo æstatis tempore exoritur sidus, sole primam partem Leonis ingrediente.* Plinius lib. 2. c. 47. l. 18. c. 28.
Illi stellæ se interponit beneuolum numen, ne ardore suo spicam florentem exurat. *Accendit* enim *Solem, & magnam æstus obtinet causam.* Festus Auienus:

———*Siriaco torretur* SPICA *calore.* In Arati phenom.

Achatem profert Gorlæus, quæ geminam quoque ostendit Spei tesseram: sed sculpturæ antiquitas mihi planè suspecta est. Primò, quia Spei numen stolæ laciniam non attollit, vt passim in nummis, vbi sinistra cornucopiæ non Num. 15.

C est

Figure 2: Jean-Jacques Chifflet, Lilium Francicum, 17. Roman rings showing the same generic plant as Figure 1, which the Romans put together with a 'spica', a wheat ear, which also symbolizes nature's regeneration. (British Library, MS 9915.bb.22; Courtesy of the British Library, London)



32 LILIVM FRANCICVM

In palatio Regio Bruxellenſi ſeruatur vetus periſtroma, in quo lanâ deſcriptum eſt Clodouei Regis bellum aduerſus Allemannos. Ibi cernitur ipſe Rex cataphractus, qui galeæ loco tectus eſt pileo ferreo, quem aperta ex auro corona cingit. Regem ſequitur Signifer, qui vexillum geſtat aureum tribus impreſſum bufonibus nigris: *d'or à trois crapaux de ſable.* Pręcedit Regem Fecialis cum eâdem ſupra pectus teſſerâ.

Figure 3: Jean-Jacques Chifflet, Lilium Francicum, 32. The French King Clovis (c. 466-511), the first King of the Franks, who united all tribes under one ruler, here depicted on a late medieval tapestry which Chifflet copied from the Royal Palace in Brussels. Clovis is carrying a flag with what the fourteenth-century author of the tapestry believed to have been the King of the Franks' heraldic paraphernalia: three frogs. Since the tapestry dates from the period of the Hundred Years War, Chifflet assumed that the French monarchy used the three frogs as its main heraldic symbol well into the fourteenth century, and that it converted them into the fleur-de-lys only later. (British Library 9915.bb.22; Courtesy of the British Library, London)

Why do Belgians and other Europeans call the French "frogs," asks Chifflet mockingly, yet with a serious objective in mind. The answer, he says, is simple. Until at least the twelfth century, the coat of arms of the French king contained three toads.[60] Chifflet added the image of a medieval tapestry, then hung in the Royal Palace in Brussels, showing the French king bearing France's coat of arms: it contains three toads (Figure 3). Here Chifflet relied, among other sources, on a vast amount of heraldic material, such as coats and grants of arms, treatises about blazons and drawings of heraldic paraphernalia, which his friend Duchesne had been collecting, also thanks to Peiresc's help.[61] Only afterwards was the fleur-de-lys adopted in substitution of the toads. Hence, Chifflet concluded that the fleur-de-lys' divine origin was a fairy tale.[62]

As further evidence for his historical point, Chifflet used an argument *ex contrario*. If there had been any genuine evidence of the use of the fleur-de-lys before the twelfth century, Peiresc would have certainly used it to prove the antiquity of the French heraldic symbol.[63] In fact, Peiresc himself confirmed that the fleur-de-lys did not come into use before the twelfth century.[64] Here Chifflet referred to Peiresc's life-long research about French history and, possibly, to a set of manuscripts about medieval tournaments that Peiresc had been collecting in order to write the history of the Provence. Actually, Chifflet had asked to work on those manuscripts himself but Peiresc, maybe out of a patriotic feeling, told Duchesne in a letter from Boygency, dated 25 July 1632, that he would rather let someone other than Chifflet use them.[65] Peiresc knew Chifflet's anti-French stance from *Portus Iccius*. Actually Chifflet seems to have over-emphasised his friendship with Peiresc. They undoubtedly collaborated, sharing manuscripts and books about medicine and antiquity. For example, in a letter to Duchesne, Peiresc asked for a copy of Chifflet's edition of his father's medical work, *Singulares ex curationibus*. Peiresc could not, however, be too fond of someone who was combating

of astronomy for navigation, the calculation of the year and the determination of longitude. MS. Chifflet 63, fols. 229v and 325-30 contain Chifflet's notes about these topics. MS. Chifflet 213, 326-32 contains a letter from Wendelen, sent from Brussels on 15 December 1623, in which Wendelen writes to Father Jean-Baptiste Morin (physician, mathematician, correspondent of Galileo Galilei) about an ancient Jewish way to calculate the year.

60 Ibid., 30-32. At 32, there is a picture of a Burgundian tapestry representing the king of France with his toad flag.

61 See Ibid., 5. Also, Duchesne, *Angleterre*, passim. For a complete list of items that Duchesne collected, see the *Catalogue des manuscrits de la collection Baluze.*

62 *Lilium*, 30.

63 Ibid., 54.

64 Ibid., 116.

65 Lebègue, *Les correspondants*, II, 316-17.

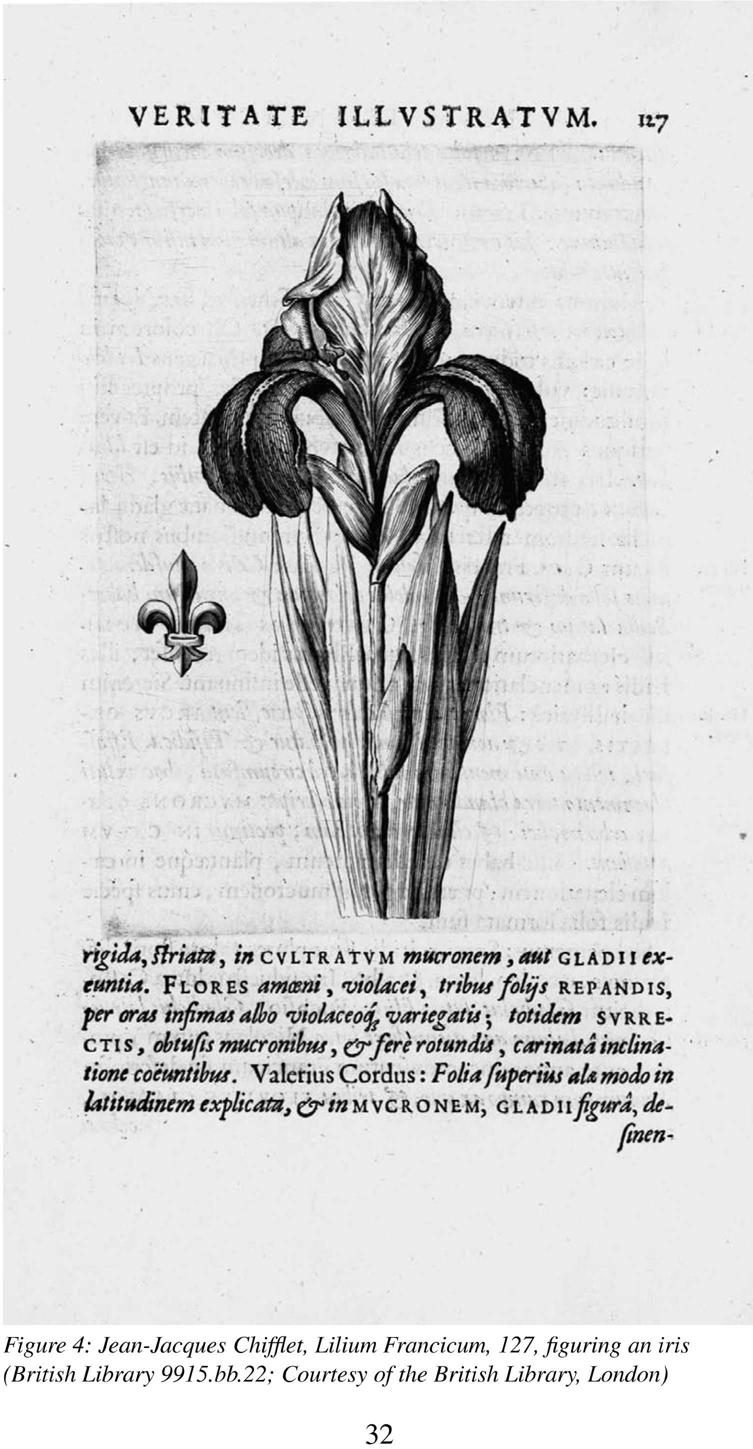
pro-French writers. One could perhaps note that this was a case in which different political views could be an obstacle to scientific communication, although, generally speaking, it seems that the contrary was often the rule, as shown by most exchanges described here.

In his chapter on botanics, Chifflet quotes extensively from both ancient authors, such as Pliny, Galen, and Dioscorides, as well as contemporary botanical writers, such as Leonhardt Fuchs and Conrad Gessner. His aim is to highlight the differences between lilies and irises (Figures 4 and 5): they were different though cognate flowers, with different medicinal properties. He recalls the history of the use of lilies in classical myths (the white lily, symbol of purity, disdained by Venus, as shown on a Roman coin) as well as modern ones (the lily as a symbol of the vagina of a woman in labour, for its stamen springs out of it like new life).[66] As Nancy Siraisi has explained, "the growth of humanist philological interests unquestionably sharpened awareness of confusion in botanical terminology. From the fifteenth century, reforming physicians and medical philologists became ever more vociferous in their criticisms of confusion in the nomenclature and identification of medicinal substances."[67] Chifflet's efforts to pinpoint which exact flower the fleur-de-lys was, needs to be seen in this context too.

For the *ars heraldica*, however, lilies have never been heraldic flowers. "Ars Heraldica à Tristano non intellecta," mocks Chifflet with all his authority as the Chancellor of the Golden Fleece, the most senior heraldic position within the most prestigious chivalric order in Europe.[68] Irises were true chivalric symbols ever since the codification of the laws regulating the art of devising blazons. Moreover, Chifflet cites plenty of evidence from French heraldic books which talk of the fleur-de-lys as an iris.[69] Chifflet insists that Tristan was ignorant of both heraldry and botany, because, he argues, if Tristan had known the botanical differences between the two flowers, he would not have made such a gross mistake of calling the fleur-de-lys a lily and not an iris.

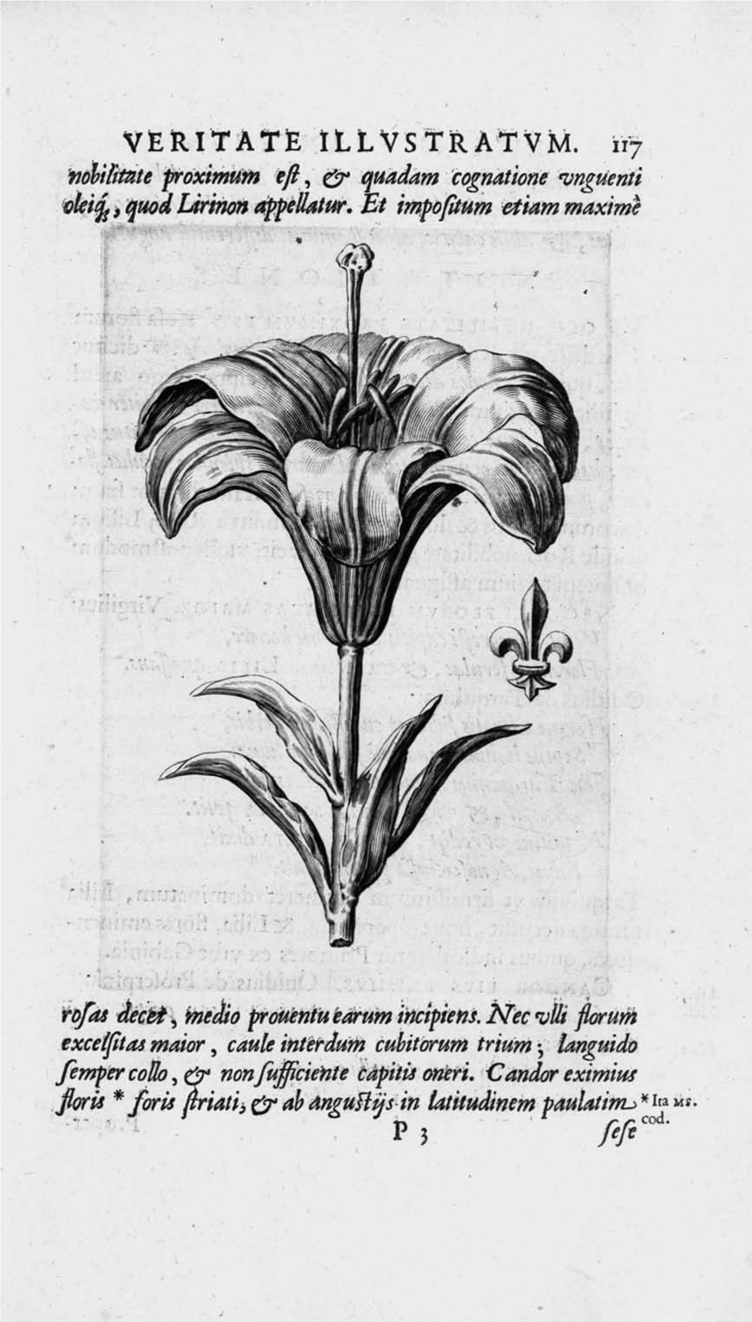
Incidentally, Western artists have always been careful to paint irises only in scenes which emphasised royalty, reserving white lilies for the Virgin Mary. For example, Hugo van der Goes' Portinari altarpiece portrays the Virgin Mary with the Child significantly with a vase containing both white lilies and irises at Mary's feet (Figure 6).[70]

66 *Lilium*, 120-28.
67 Siraisi, "Life Sciences and Medicine," 190.
68 *Lilium*, 123.
69 Ibid., 129.
70 Impelluso, *La natura*, passim.


VERITATE ILLVSTRATVM. 127

rigida, striata, in CVLTRATVM *mucronem, aut* GLADII *exeuntia.* FLORES *amœni, violacei, tribus folijs* REPANDIS, *per oras infimas albo violaceoq; variegatis; totidem* SVRRECTIS, *obtusis mucronibus, & ferè rotundis, carinatâ inclinatione coëuntibus.* Valerius Cordus: *Folia superiùs alæ modo in latitudinem explicata, & in* MVCRONEM, GLADII *figurâ, desinen-*

Figure 4: Jean-Jacques Chifflet, Lilium Francicum, 127, figuring an iris (British Library 9915.bb.22; Courtesy of the British Library, London)



VERITATE ILLVSTRATVM. 117

*nobilitate proximum est, & quadam cognatione vnguenti oleiq;, quod Lirinon appellatur. Et impositum etiam maximè rosas decet, medio prouentu earum incipiens. Nec vlli florum excelsitas maior, caule interdum cubitorum trium; languido semper collo, & non sufficiente capitis oneri. Candor eximius floris * foris striati, & ab angustijs in latitudinem paulatim* * Ita ms. cod.

P 3 *sese*

Figure 5: Jean-Jacques Chifflet, Lilium Francicum, 117, figuring a lily (British Library 9915.bb.22; Courtesy of the British Library, London)

Figure 6: Hugo Vander Goes, Portinari Altarpiece, detail showing a lily, the flower symbol of the Virgin Mary. (Courtesy of the Galleria degli Uffizi, Florence)

To stress his point further, Chifflet explains that lilies have always had medical associations ever since Greek antiquity, unlike irises. For instance, Nicandros, relying heavily on Pliny the Elder and many subsequent medical writers both ancient and modern, had spoken of the uses of lilies' roots as antidotes against the viper's bite.[71] This seemingly bizarre classical association can be explained thus. In ancient Greece lilies were thought to originate from the Colchides, the land to which Jason went to look for the golden fleece. Colchides was considered a land of magic and of venom. According to classical folk medicine, which mixed both Galenic and Neoplatonic elements, a flower (an herbal remedy, as advised by Galen) from the same land of venom (in sympathy with the place of origin of all venoms) could cure both by means of herbs and by sympathy, so to speak, a viper's venomous bite. Indeed, later botanical writers repeated the same argument as Chifflet, for example, Matthias Tiling in his *Lilium curiosum seu accurata lilii albi descriptio* (Frankfurt am Main, 1683) and in his *Rhábarbarologia seu curiosa rhabarbari disquisitio* (Frankfurt am Main, 1679). Tiling was a physician who published widely on anatomy and pharmacology. Irises, on the contrary, had only ever had heraldic associations. Witness their widespread use on various European heraldic crests, like the English and the Burgundian monarchies' coats of arms; certainly not only on the French one.[72]

Chifflet was sure that only a physician like him, with a sound background in botany (which he needed for the preparation of drugs) as well as in heraldry and philology, was in the right position to give the final answer to the Franco-Spanish pen-war.[73]

3. Contemporary reception of *Lilium*

The contemporary reception of Chifflet's *Lilium* shows that it simply sparked up additional polemics. Jean Ferrand's *Epinicion pro Liliis* (1663) replied to *Lilium* as well as to one of Chifflet's futher anti-fleur-de-lys arguments in the *Dissertatio*

[71] Chifflet refers to Nicander of Colophon's *Alexipharmaca*, which he knew in the translation by Jean de Gorris (Gorrhaeus Parisiensis).

[72] Ibid., 125-27 and 82.

[73] MS. Chifflet 3, fols. 101 and 158 contain some medical notes in Chifflet's hand; in the same volume there are his notes about the rights of the Spanish crown over the archbishopric of Besançon, fols. 278-80. MS. Chifflet 132 contains Chifflet's medical notes and alchemical recipes, as well as herbal remedies, for instance involving tobacco (fol. 75). MS. Chifflet 142, fols. 206-3, contains notes about Pliny's *Natural History*. MS. Chifflet 156 is full of Chifflet's medical notes. MS. Chifflet 174 contains Chifflet's medical correspondence with his relative Pierre Poutier, a professor of law at the university of Dole and amateur medical practitioner.

militaris de vexillo regali (1642), which, in turn, had provoked David Blondel's *Genealogiae Francicae plenior assertio* (1654).[74] The fact that the lys was being illegitimately – from a heraldic and a botanical point of view – turned into a lily was not debated. They had no time to waste, and most probably no scientific inclination either, in answering Chifflet's botanical assertions. Besides, it is possible that these authors thought that Chifflet's botanical knowledge did not belong to the genre.

Yet, from a botanical point of view, a survey of a variety of seventeenth-century dry and printed herbals from the Southern Low Countries shows that *Lilium* was unique in the length of the description that a botanical author dedicated to two single flowers, the lily and the iris. The anonymous dry herbal *Dictionarium Botanicum flandrico-gallico-graeco-latinum*, which is kept today in the Royal Library of Brussels, only contains a lily, which is called "lys," followed by two lines of commentary from Pliny's book 17, text 24.[75] Likewise, the anonymous dry herbal in MS. 5863 contains four pages dedicated to various kinds of "lys," but in fact only one is a lily, the others being an "iris susiana," an "iris flore ceruleo," the "caprifolium italicum = lilium inter spinas." As this herbal also contains two notes about magic and alchemy, in a seventeenth-century Spanish hand, one can infer that it was used for the preparation of drugs.[76] In the dry herbal of the Jesuit College of Brussels there was no lily or iris whatsoever.[77] In a dry herbal from Ghent, now kept in Brussels, there is a "gladiolus," that is a flower akin to an iris, whereas what is called "lilium" is a kind of violet (*muguet*).[78] The same occurs in the dry herbal of an anonymous gentleman of the Southern Low Countries, who clearly took delight in the self-image of an amateur botanist, without, however, caring much for lilies and irises, which do not appear in it. MS. 5868 B opens with a stunningly beautiful watercolour (in-folio) depicting a gentleman in the Northern countryside, resting among flowers (which cannot be identified as they are there just decorative elements of the picture and not supposed to be realistic representations of particular plants). This was a herbal for personal erudition (see Figure 7). Plants were arranged in no logical order, their names were given in Latin and only three botanical writers are cited: Pliny, Leonhardt Fuchs, and Matthias de

74 Ferrand, *Epinicion*; Chifflet, *Dissertatio militaris*; Blondel, *Genealogiae Francicae*.

75 Brussels, Royal Library, KBR MS. 3362, fol. 174v.

76 KBR MS. 5863, fols. 190v-191r, 200v-201r, 232v-233r. On fols. 254v-255r there is a note about magic in Spanish, whereas on fols. 294v-295r there is a note about alchemy in a different hand, also in Spanish.

77 KBR MS. 5862.

78 KBR MS. 5869, fols. 3r and 74r, respectively.

Figure 7: Anonymous herbal, frontispiece. Here we have the representation of a gentleman amateur botanist in his beautiful garden. The image is meant to be a mere embellishment to the book, as flowers and plants which surround the gentleman-gardener cannot be identified botanically. (KBR MS. 5868 B, Courtesy of the Bibliothèque Royale de Belgique, Brussels)

l'Obel.[79] The *Hortus Nicolai Haverlat* – the garden of Nicholas Haverlat – was another herbal for home use and contained mostly flowers and medicinal plants such as "chamomilla," "valeriana" and "melissa." It includes an iris but no annotation about it.[80] Yet another herbal for medical use was Justus Frisius', a Jesuit from Louvain. His dry herbal is bound together with a printed botanical work, *Chrysogonia animalis et mineralis* (Darmstadt, 1643) by the German physician Johannes Tack. The herbal is superscribed "Societatis jesu Louani 1667." This enables one to determine whether Chifflet's work on lilies and irises had any effect; but, as I hope to have shown, it did not. Frisium annotated both the dry herbal and Tackius' printed text, and each contains references to medical and botanical writers, such as Hippocrates, Dioscorides, Rembert Dodoens, Andreas Libavius, Antonio Musae (a seventeenth-century Roman botanist), Philippus Theophrastus Aureolus Bombastus von Hohenheim called Paracelsus. However, neither Frisium nor Tackius were interested in lilies or irises.[81] Another physician's dry herbal from the 1680s, Claude Lion's *Hortus Hijemalis,* contains a muguet called "lilium" as well as several types of irises, among them, the "iris florentina," a somewhat commercial symbol of Florence through the eponymous scent which Florentine perfume-makers sold with profit all over Europe. But no mention is made of a lily or an iris typical of France. Lion also mentioned l'Obel and Libavius, whom he might have cited in connection with drug making techniques implying both herbs and chemicals.[82] Both lilies and irises are found, instead, in an another anonymous Belgian herbal, which, curiously enough, has no page numbers but for "f.114v": the very page on which lilies and irises are pinned.[83] Was it because those bulbs were at the time so intriguing to deserve a page number?

Among seventeenth-century European printed herbals, the situation was not that different as far as lilies and irises were concerned. The Englishman Thomas Johnson's *Descriptio itineris plantarum*, for instance, had many flowers but lacked those two.[84] By contrast, subsequent editions of Pietro Andrea Mattioli's *Compendium de plantis* did mention lilies, though only their white variety, and spoke of the medicinal properties of infusions of lily roots, following Dioscorides and

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79 KBR MS. 5868 B, fols. 56r and 63r, respectively.

80 KBR MS. 5867 B, fols. 62r-63r and 32r, respectively.

81 KBR MSS. 6364-66 D, passim.

82 KBR MSS. 5864-5. "lilium cormallium," a kind of muguet, is pinned and called thus on fol. 149v. Various types of irises, including the "iris florentina" are on fol. 136v. L'Obel is cited on fol. 67v, Libavius on fol. 70v.

83 KBR MS. 5866, fol. 114v.

84 Johnson, *Descriptio itineris plantarum*, passim.

Galen.[85] On the other hand, Conrad Gessner's *De raris et admirandis herbis* ignored it. Intriguingly, the Belgian Adrian Spigel's *Isagoge in rem herbariam* did talk of lilies, a variety of which he referred to as "Corona Imperialis," but he immediately added that "flos vulgaris est."[86] Rembert Dodoens, to whom Chifflet owed much in his botanical section, is the only early modern author, together with Leonhardt Fuchs, who neatly distinguished the botany of lilies and irises. Dodoens, in his English translation by Henry Lite, spoke of the "floure de luce, or Iris." He also pointed out that a famous scent was made out of "the white Iris of Florence." As to lilies, relying entirely on Pliny, Dodoens treats them as different though cognate flowers.[87] Fuchs too, in his *De historia stirpium*, treats lilies and irises as distinct flowers, and relies above all on Dioscorides and Galen.[88] Finally, the Englishman John Ray, writing in 1694, distinguished irises from lilies, and made the point that the fleur-de-lys was an iris. He cited several authors, such as John Parkinson, Carolus Clusius and l'Obel, but he did not mention Chifflet.[89]

From contemporary dry and printed herbals, therefore, one can conclude that Chifflet's long botanical section dedicated to only two flowers was outstanding, because of its length and accuracy in presenting all possible authors who had dealt with them in the past. In the same way as he was writing what he saw as the definitive history of the fleur-de-lys as a heraldic and, therefore, a political symbol, Chifflet adopted a philological attitude towards the reconstruction of the history of man's botanical knowledge about lilies and irises. The marriage of humanist techniques to Chifflet's medical and botanical knowledge was thus consummated in his *Lilium*. His debt was to both ancient authors, like Pliny, Galen and Dioscorides, and to two modern authors, namely Dodoens and Fuchs. If compared to Dodoens' and Fuchs', Chifflet's botanical section surpasses theirs in length. Nevertheless, contemporary reception of his work was almost non-existent among botanical writers: if he had any influence on John Ray, for instance, he did not cite him. In fact there survive far more copies of Chifflet's works in English libraries than in France and Belgium together, but this does not prove any direct link.

Furthermore, when one considers the history of seventeenth-century botanical illustration, *Lilium* also stands out. For a book about an eminently political topic, Chifflet's engravings of a lily and of an iris are strikingly beautiful and accurate,

85 Mattioli, *Compendium*, 509.
86 Spigel, *Isagoge in rem herbariam*, 51-52.
87 Dodoens, *A New Herbal*, 138, 140, 144-45, respectively.
88 Fuchs, *De historia stirpium*, 363-67.
89 Ray, *Stirpium Europaearum*, 154.

and as such can be put on a par with the best scientific illustrations of the time.[90] They were in line with Plantin's tradition of high quality botanical pictures. Indeed, Plantin had not only put out *Lilium* but a whole string of Low Country herbals, which were seminal works in the history of botany, such as the heavily illustrated ones by Dodoens, Clusius and Christophorus a Costa[91] As far as I have been able to ascertain, Chifflet's pictures of lilies and irises were originally made for his book. The engraver was Jacob van Werden (fl. 1647-99), a Flemish draughtsman who worked in Antwerp and Paris. Ironically, he was also *Archier de Garde de Corps* of Louis XIV.[92] Chifflet used the sixteen pictures in *Lilium* to several effects, and firstly, to show his philological skills, for instance in reading and using numismatic evidence. This is the case with the coins shown above, in which one can see for oneself that Chifflet was right in his rebuke of Tristan's argument about Roman coins and symbolic flowers. Secondly, he used pictures to portray the French king wearing toads instead of fleur-de-lys as his royal insignia. His choice of visual evidence, therefore, was instrumental in bringing before the readers' eyes pictures that complemented Chifflet's quotations from written sources. Thirdly, he used two engravings to depict an iris and a lily as accurately as possible from a botanical point of view. He had the two flowers precisely drawn, against a white background to exalt their details, with only a small fleur-de-lys next to each of them. This served the purpose of underlining that Chifflet was speaking of real flowers in his botanical section, and that one ought not forget that a real flower had originated a heraldic and political symbol. It was crucial, therefore, that Chifflet explained all he knew about irises and lilies as flowers – that is, from a botanical standpoint – in order for the reader to understand where the fleur-de-lys came from. Chifflet's uses of pictures, therefore, reflects the typical humanist approach of presenting their arguments as the truth which they have empirically reconstructed through texts and objects (such as coins). Likewise it shows Chifflet's strategy of persuasion through letting the readers view by themselves that he is in the right, because the written evidence he has been discussing finds confirmation in pictures. Also, Chifflet used pictures of flowers worthy of being inserted in a natural history book in a most clever way, by placing the fleur-de-lys next to them so as to have the botanical image (and, therefore, his argument) overwhelming the French political symbol (and arguments).

From the point of view of botanical illustration, therefore, Chifflet's *Lilium* should be considered as part of the prestigious Low Countries tradition of high-

90 *Lilium*, 117, 127.
91 Kusukawa, "Uses of Pictures," 223-25.
92 Hollstein, *Dutch and Flemish Etchings*.

quality illustrated botanical works, as well as a clever example of the ways in which typical humanist uses of antiquarian images could be combined with scientific imagery.

Conclusion

This essay has shown that the circulation of material objects was the *conditio sine qua non* for scholars, such as those around Chifflet, to gather material for philological analysis, in the case of texts, and by direct observation, of plants, or natural phenomena broadly conceived. Hence, the circulation of material objects played a crucial role in the development of an increasingly empirical approach to knowledge. Indeed, the so-called Republic of Letters should perhaps be more accurately renamed as the Republic of Material Objects given that epistolary exchanges more often than not were accompanied by exchanges of all kinds of objects. From seeds to blooming flowers, from copies of ancient manuscripts to contemporary printed works, from fossils to living animals, from heraldic treatises to Roman coins, humanists formed vast collections of material objects that they put together in different repositories within the same space. The universal nature of humanist learning was reflected in the eclectic nature of private collections. The circulation of material objects was a chief means by which scholars increased their collections.

The books that they published were yet another product of these eclectic collections and, in a sense, they were a chief means whereby to use (some) items from their collections as evidence for their scholarly arguments. The humanists' main fields of concern were the history of man and nature. Chifflet's *Lilium* was about both, and its context of production is an example of the uses of scientific communication and exchanges of material objects in early modern Western Europe. This essay has shown that lilies circulated both in fresh and dried form; that knowledge of lilies and irises circulated in manuscript and printed forms; but above all, that knowledge about such flowers circulated between botanical and political contexts. It was used not only to increase botanical expertise, but also to prove political points. Historians have largely ignored *Lilium*. Chifflet's focus on the fleur-de-lys as a political symbol has only attracted the limited attention of Alexandre Haran.[93] This is because *Lilium* has been considered as just another drop in the ocean of

[93] Haran, *Le lys*, passim. I am grateful to Dr Monique Weis for pointing this book out to me. There, Haran traces the history of the fleur-de-lys as an emblem for many things French, from the Middle Ages until the seventeenth century. Haran's main interests, however, lie in biblical exegesis and the use of biblical and generally Jewish sources in Western European political polemic in the time under consideration. When he deals with *Lilium*, therefore, Haran does mention it in connection with the new association of the lys to the Virgin Mary and Chifflet's historical reply

the century-long polemics about the superiority of France or Spain. I have argued, instead, that *Lilium* deserves attention as a typical printed product of exchanges of material objects among scientifically inclined late humanists and antiquaries.*

to it. But Haran's treatment of Chifflet's work can only be limited, given the wealth of material he has chosen to work on for his analysis of a thousand years of Western European intellectual history. *Lilium*, therefore, comes out of Haran's book as a drop in the ocean of the seventeenth-century Franco-Spanish lys polemic. Besides, Haran did not take notice of the importance of botany for Chifflet's argument. Haran's work, however, is worth noting, in that it is the most recent and best documented study of the Franco-Spanish polemic around the fleur-de-lys. This makes Haran's belittlement of Chifflet's *Lilium* exemplary of the existing lacuna. The University of Besançon research group working on the Chifflet brothers has done much to unearth material about them and has the merit of having begun an important research project about all their works. But even they have paid no attention to the particular way in which Chifflet built his historical argument partly on the basis of botanical knowledge.

* I wish to thank the Foundation Francqui, the IUAP-project "City and Society in the Low Countries, 1200-1800: Space, Knowledge, Social Capital" and the Centre National de la Recherche Scientifique (France) for their financial support.

Flora and the Hapsburg Crown: Clusius, Spain, and American Natural History

María Luz López Terrada

Introduction

During the sixteenth century and the early decades of the seventeenth, the exchange of plants and seeds, as well as of images thereof, was common between the Iberian Peninsula and the Low Countries. This exchange was undoubtedly due to two factors. First, there existed at that time a passionate interest in natural historical knowledge of both European and so-called 'exotic' species. As has been pointed out in previous studies, this passion was a defining characteristic of a discipline in rapid growth and directly linked to trade developments and the perceived need for empirical knowledge.[1] However, there exists a second factor that is as important as the first one, but which is often ignored: the political union of the two territories. They both formed part of the same dynastic monarchy, a fact that doubtlessly facilitated this type of exchange when considering how normal it was to have court-bound scholars move between the courtly and intellectual centers of the empire.[2]

Studies of European natural history have not paid the slightest attention to Spanish activity in the domain of plants.[3] Yet, the work of Spaniards, which was spread through the exchange of books and translations or through the dispatching of seeds and letters, was fundamental for the acquisition of knowledge not only on the Peninsula but throughout Europe as well. This group, which we may call

1 Cf. Ogilvie, *Science*; Smith & Findlen, *Merchants*; Jardine, *Cultures*; Freedberg, *The Eye*.

2 On the Spanish monarchy, see Maravall, *Estado*; Elliott, *España en Europa* and Bennassar, *España*. On the scientific circulation between the Low Countries and Spain, see López Piñero & Navarro Brotons, *Relaciones*.

3 For example, in recent studies such as Ogilvie, *Science*, the role of Spain in sixteenth-century botany is intentionally not discussed. Neither does Cook, *Matters*, mention such activity in his monumental work on the Low Countries.

the "community of botanists of the Low Countries," consisted most notably of Matthias de l'Obel, Rembert Dodoens, Bernardus Paludanus and Carolus Clusius, all of whom played a central role therein. Clusius is probably the most perfect example of this phenomenon: one of the most famous botanical scholars of the second half of the sixteenth century, he was also the undisputed protagonist in the circulation of botanical knowledge between the Low Countries and the Peninsula.

In the sixteenth and seventeenth centuries, there were numerous means to catalogue, publicly present and understand nature, the main methods being observation, description, the accumulation of data, exhibitions in gardens, monographs, illustrations and collections. Europeans at the time considered the conquest and knowledge of nature a political imperative. This gave rise to important innovations in the discipline of natural history, which as a consequence was undergoing a fundamental transformation. Plants came to be regarded in a different way because they gradually became objects of study in themselves and also because scholars came to distance themselves from symbolic and emblematic approaches. New concepts of natural objects arose, which corresponded to contemporaneous material and political changes. In particular, the attitude towards the natural world itself changed, as did the perceived relationships between natural and artificial objects in themselves and in their artistic representation. These changes were embedded in, and were an expression of, a new commercial world and an emerging idea of empire. They were also linked to what the classical historical studies have regarded as the great Renaissance renovation of natural history. This Renaissance was the product of the confluence of humanism, which included the textual criticism of the classics (and in the case of this paper the Greek and Roman biomedical texts), with the inclusion of botany in academic curricula, notably within the domain of university-based medical studies. In this respect, one must recall that the vast majority of botanical cultivators were trained as medical doctors. As a consequence, in Ogilvie's words, "Natural History had changed radically: from a closed world it had become an almost infinite universe."[4] This transformation of botanical knowledge was in certain circles furthermore accompanied by a fascination for the exotic. This interest manifested itself in different ways, such as in private or public collections, the creation of botanical gardens where exotic species could be grown and the publication of botanical texts that included illustrated descriptions of exotic plants.[5]

As mentioned, the study of botany in the modern era was intimately linked to

4 Ogilvie, "Many Books," 33.

5 Cf. Arber, *Herbals*; Ogilvie, *Science*; Cook, *Matters*, 82-132; Reeds, *Botany*; Smith & Findlen, *Merchants*, 1-19

the expansion of the emerging European states engaged in different types of colonial arrangements and in different relationships with traders and naturalists. Given that, at the time, the Spanish monarchy was an expanding political and economic power with an enormous geographical area to colonize, there was a strong drive to get to know the natural characteristics of the new territories in order to master, control and govern them. Evidently, for certain types of scientific knowledge, the Spanish crown held a central position, especially for those directly related to the conquest and exploitation of the American territories. With regard to the domain of botanical knowledge, Spain's key position expressed itself in large amounts of texts and manuscripts as well as in certain forms of institutionalized research. This institutionalization manifested itself at three different levels: at the Court, especially during the reign of Philip II; at botanical gardens, which began the cultivation of exotic species, notably of the Americas; and at the universities, where (like elsewhere in Europe) botany was an integral part of the medical curriculum and where the keeping of gardens of simples was mandatory.[6] It should therefore not come as a surprise to hear that it was on the Iberian Peninsula, and particularly in Spain, that intellectuals first developed the idea that the moderns had superseded the ancients.[7]

This colonial setting, then, is the general framework within which one must understand the exchange of botanical knowledge between the Low Countries and the Peninsula.[8] Given the state of rapid development of botany, it will come as no surprise that a certain number of natural historians came to play a decisive role in this development, all the more because, by law, only inhabitants of Castille were granted access to the Spanish territories in the Americas. In some of my previous work, I have analyzed in detail the forms and ways in which botanical knowledge was gathered and spread, notably with respect to the types of species on which information was traded. In this chapter, I wish to lay emphasis on the pioneering role of Spanish naturalists in the description of American nature.[9]

6 On natural history in the Spanish monarchy during this period, cf. López Piñero, *Ciencia y técnica*, 279-308; Ordóñez, Navarro & Sánchez, *Historia de la Ciencia*, 269-76.

7 As Jorge Cañizares recently, and José Antonio Maravall some forty years ago, pointed out; see Cañizares, "Iberian"; Maravall, *Antiguos y modernos*.

8 Navarro & Eamon, *Black Legend*, esp. "Iberian Science in an Imperial Setting," 89-147.

9 Pardo & López, *Primeras noticias;* López & López, *Influencia*. These books are entirely dedicated to this subject.

María Luz López Terrada

The Spread of Knowledge of American Plants in Europe

The earliest news of curative and food products from the New World to reach Europe was contained in Columbus' own texts and those of others directly involved in the discoveries, the most influential being the *Decades* of Pedro Mártir de Anglería. These texts had no essentially scientific intention, nor were they written by physicians. The only exception to this rule is the *Carta al Cabildo de Sevilla* (1493-1494) by Diego Álvarez Chanca, which, although it circulated in manuscript form, was not printed at that time. This initial phase was followed by one that may still be subsumed under the heading of "first news and descriptions," and which was initiated by the *Sumario* (1526) and the first part of the *Historia general y natural de las Indias* (1535) by Gonzalo Fernández de Oviedo, the only author of that period who set out to describe American nature and its products. Later influential works were the *Historia de las Indias* (1552) by Francisco López de Gómara and the *Chronica del Peru* (1553) of Pedro Cieza de Léon. Of secondary importance was the *Cartas de relación* (1522-1524) by Hernán Cortés, *La relación de lo acaesido en las Indias* (1542), the *Relacion y comentarios* (1555) by Alvar Núñez Cabeza de Vaca, and the *Historia del descubrimiento y conquista del Peru* (1555) by Agustín de Zárate.

It is worthwhile mentioning the territories from which the plants and the aforementioned texts came. The sources from Columbus' circle and Anglería's *Decades* were concerned with the West Indies, especially the Española Island and Puerto Rico, which were also the territories, together with Dairén, of Gonzalo Fernández of Oviedo's enormous opus. Cieza's *Chronica del Peru* focused on the northwest of South America, between the Gulf of Urabá and Potosí, an area that more or less coincided with Zárate's work. Hernán Cortés' *Cartas de relación* obviously referred to Mexico, while Cabeza de Vaca, during his time as the governor there, described his observations during his famous journey of 18,000 kilometers through the north of Mexico and the south of today's United States and, to a lesser extent, to the Rio de la Plata. The lack of information from Cortés and Cabeza de Vaca concerning plants in New Spain was amply compensated by the information indirectly collected in the *Historia de las Indias* by Francisco López de Gómara, who also included much information from Anglería and descriptions from Fernández de Oviedo.

About two hundred species of similar groups were identified in this first bout of Spanish activity. The spread of this new knowledge took place in a large quantity of editions and translations of almost all of these works as well as through other channels of communication. Anglería's *Decades*, for example, apart from its

Spanish editions, was printed in Latin in Antwerp, Basel, Cologne, Paris, Venice and other European cities and was furthermore translated into Italian, French, Dutch and English. A second phase, with more than a hundred plants being described and depicted by Gonzalo Fernández de Oviedo, brought a qualitative change, which was also absorbed abroad quickly. This was due to the twenty or so editions and translations into Italian, Latin, English and also to the scientific and commercial contacts that Oviedo had in Italy with outstanding personalities such as Giovanni Battista Ramusio, Girolamo Fracastoro and Pietro Bembo. López de Gómara's work also enjoyed considerable success, being published six times in Italian, seven times in French and twice in English. Cieza de León's work, in turn, apart from its Antwerp reprints, was also published seven times in Italian, and once in English. One must also take into account the paraphrases, fragments and the plagiarized forms of these works that were published all over Europe and found in numerous collections of travel stories or descriptions of exotic lands.[10]

Until the middle of the sixteenth century, European treatises on botany or *materia medica* contained scarcely any information concerning American plants, but what little they did contain came from these early Spanish texts. None of these treatises mentioned more than six or seven species, and ironically enough, these were mainly plants that had not only been introduced by way of the Peninsula, but had meanwhile also come to grow spontaneously in Europe. As such the true origin of the species was often unknown. Perhaps the most important example in this respect was corn, which was studied by Jean de la Ruelle and by the so-called "German fathers of botany," Otto Brunfels, Hieronymus Bock and Leonhardt Fuchs. At the time, it was called *Turcicum frumento* or *Turkisch Korn*, as it was thought to come from Turkey. Much the same occurred with pepper and pumpkin. We have here two very different processes of the circulation of natural objects. In the first of the cases, the origins of the plants are not known, despite the fact that the plants are cultivated in Europe and familiar to Europeans. That supposes a process of assimilation in the botanical speech where information with respect to its origin is lost. For example, the origin of guaiacum, an American plant discovered by the Spanish in their initial contacts with the Americas, was well known at the time and generated copious specialized literature. The wood coming from this tree was taken to Europe as a luxury object and as a medicine

10 Pardo & López, *Primeras noticias*. It includes a complete list of the cited texts and complete information about the first American plants described.

to fight the "French disease" or *morbum gallicum*, a disease that some people believed to have the same American origin.[11]

Clusius' Translation of Monardes' Work

While political priorities predominated in Spanish historians' "first notices and descriptions," a new set of natural historical concerns came to the fore in the second half of the sixteenth century, due largely to the work of Carolus Clusius (1526-1609). Clusius benefited from a broad range of contacts with botanical cultivators both in Spain and across Europe, a fact reflected in his knowledge of Hispanic plants and in his efforts as a translator. In recent years Clusius has received significant attention from historians of science.[12] However, there has been relatively little consideration given to his relationship with the natural historians of the Iberian Peninsula, despite the publication of Clusius' correspondence with his Hispanic colleagues.[13] He was, in fact, the Latin translator of enormously influential texts by Cristobal de Acosta and Nicolás Monardes. For example, Clusius' *Per Hispanias*, to which I will return, has not been adequately studied and is usually relegated to nothing more than an entry in lists of his published works. This is unfortunate because Clusius played a crucial role in disseminating the rapidly expanding knowledge about American flora that came to light in the 1560's and 1570's. During this period, a new era began thanks to the contributions of Monardes who, along with Francisco Hernández, can be considered the first to go beyond simple observation to systematically study the plant life of the Americas.[14] Although Monardes and Acosta's texts varied in character, they each had an extraordinary influence on Europeans' understanding of New World flora and became essential points of departure for subsequent works.

Monardes' most important work, published in Spanish with the title *Historia Medicinal de las cosas que se traen de nuestras Indias Occidentales*, appeared in

[11] López & López, *Influencia*, 30-54. On *morbo gallico* and guaiacum cf. Arrizabalaga; Henderson & French, *Great Pox*, 88-113.

[12] On the growing interest for Clusius, see "The Clusius Project" (Scaliger Institute of Leiden University): www.Clusiusproject.leidenuniv.nl/index.php3?m=24&c023. Cf. Egmond, "The Clusius Project" and Egmond *et al., Carolus Clusius*, as well as the digitalisation work. Also Ogilvie, *Science*, 44-48, 184-91 and Cook, *Matters*, 84-104. Finally, in Spain, the recent Spanish translation of *Rariorum aliquot stirpium per Hispanias observatarum Historia* (Clusius, *Descripcion*).

[13] About Clusius cf. note 12, above and Hunger, *Charles de l'Escluse* and *Carolus Clusius und seine Zeit*.

[14] On Monardes, see López Piñero, *Historia medicinal* and *Nuevas medicinas*. On Hernández, see López Piñero & Pardo, *La influencia* and Varey et al., *Searching*.

three parts between 1565 and 1574. Monardes resided in Seville, which he called the "port of call to the Western Indies." This proved a tremendous advantage, allowing him access to the plant specimens newly arriving from the colonies. As a physician, Monardes naturally focused on pharmacological characteristics and therapeutic uses of American plants, as well as on methods of preparation and application. His works were among the most published scientific texts in Europe at the time and the author became known as "the foremost authority on New World *materia medica*."[15] Taking a great interest in the nearly one hundred "new medicines" catalogued by Monardes, Clusius played a central role in disseminating Monardes' findings. Clusius even visited Seville in January of 1564, but a surprising paucity of information about this visit prevents us from knowing whether the two men met. What we do know is that Clusius' translation of Monardes' *Historia Medicinal* began a process by which a large number of American species, previously unknown by European naturalists, was assimilated into European medicine.

In a recent study on Clusius' Latin translations of and commentaries on Monardes' vernacular work, Pardo notes that Clusius' translation practice ran counter to "the Renaissance practice of translation which passes from prestigious Greek or Latin to the vernacular." While its translation into Latin made Monardes' original available to larger audiences, its readership was also more erudite: the European cultural elite.[16] Clusius' rendering of the first two parts of the *Historia Medicinal* was printed in Antwerp by Plantin in 1574 and republished with no significant changes in 1579. Three years later, in 1582, Plantin published the third part, prepared by Clusius in Frankfurt the previous year. By the time a complete translation of all three parts was published in 1593, Plantin had died, and the edition was overseen by his widow and by his son-in-law, Jan Moerentorff, at the *Officina Plantiniana*. In 1605, Clusius himself was nearing the end of his life and – as he had done with his texts on Iberian, Austro-Hungarian and other European plants – he prepared a single volume containing all his translations concerning exotic natural history. Entitled *Caroli Clusi Atrebati Exoticorum libri decem*, the work contains Latin translations of books by García da Horta, Pierre Belon and Monardes, preceded by 93 original pages by Clusius himself.[17]

As I have already hinted, Clusius' translation of Monardes' work contained a great deal of commentary. While this is not the moment for an exhaustive examination of his notes and observations, two examples will indicate the nature of

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15 Bleichmar, "Books, Bodies and Fields."
16 Pardo, "Two Glimpses," 175-76.
17 López & López, *Influencia*, 89-100.

Clusius' additions: the chapter on balms and the chapter devoted to tobacco. The first of these, commentaries on two balms of American origin, was quite brief and had as much to do with Clusius' interest in the past as it did with his fascination with the novel. As a faithful follower of scientific humanism, Clusius had a particular interest in "recuperating" the curative products mentioned by the authors of Antiquity, attempting to identify them with the new American medicines. This explains, for instance, why he refused to accept the disappearance of the classical "opobalm" claiming that it could still be obtained in "Happy Arabia" and in "certain places in Egypt near Cairo." Actually, the "balsamum orientale verum" had disappeared during the Middle Ages and continued to be extraordinarily rare until the beginning of the modern era. It is in this context that we can understand Clusius' short commentaries on two balms of American origin – the balm of Peru and the balm of Tolú – from which the first samples had been obtained in 1581 and 1582, respectively.[18] Clusius' humanist interest in the balms mentioned by classical authorities prompted him to make known an important therapeutic novelty.

The brevity of the notes on balms contrasts with Clusius' extensive commentaries on Monardes' chapter on tobacco. Clusius notes that in the Low Countries, at least during years surrounding 1600, tobacco was grown more as a decorative plant than "for its extraordinary medicinal qualities." He even refers to it as "a panacea for all types of illnesses." The abundance of its cultivation allowed him to make careful, if brief, descriptions and excellent drawings of *Nicotiana tabacum* L., as well as *Nicotiana rustica* L. Clusius had first seen tobacco in 1564 when passing through Lisbon, which explains why he used the name "petum" of Brazilian origin. The Lisbon connection also explains why he states that tobacco had been introduced in France by Jean Nicot, an ambassador at the Portuguese court. He goes on to mention the praise that Charles Estienne had bestowed upon it in *L'agriculture et maison rustique* (1564) and the "strange and almost divine curative properties of the Nicotiane." Some holes in Clusius' knowledge lead to an error: not recognizing that Fernández de Oviedo's "perebecenuc" referred to a type of *Solanum*, he attributes the term to tobacco, a mistake that numerous others would repeat. This can be attributed to the fact that he had seen neither Fernández de Oviedo's study on tobacco nor the references to this plant in the Columbian texts written by Anglería, Cabeza de Vaca and López de Gómara.[19]

Clusius' reliance on texts, when combined with the fact that his studies of American plants were undertaken in Europe, leads to a peculiar feature of his translations. As Pardo points out, these erudite texts communicate a feeling of

[18] The complete list of plants and Clusius' notes is found *ibidem*.

[19] López & López, *Influencia*, 96-97; Clusius, *Exoticarum*, 309-10.

tremendous removal from the American colonies, one even greater than the number of leagues or days of travel separating the two continents. This sense of removal – a conceptual distance between the point of origin and the point of consumption, cultivation and study – was already present to some extent in Monardes. But in Clusius' Latin version, an almost unfathomable chasm lies between Europe and the natural world of the Americas. Plants come to Clusius as if from beyond a vague horizon; the Americas themselves become merely the source of fragments of plants, names of uncertain orthography, pieces of stone, animal viscera, and seeds that can only be coaxed to fruition with great difficulty in European soils.[20] Despite this distance and the impossibility of knowing directly many of the plants described, these translations contributed decisively to the spread of studies of American nature carried out on the Peninsula. In particular, the spread of descriptive work – whether carried out by colonisers *in situ*, as was the case of Oviedo, or by physicians and others on the Spanish mainland, as was the case of Monardes – converted exotic plants into objects not only prized for their medicinal value and financial worth but also coveted by collectors.[21]

Because of the diffusion of Clusius' translations, European botanical texts regularly began to include American plants and, unlike the case of corn discussed earlier, properly denote their origins. Studies have shown that authors from the Low Countries, Germany, Italy, France and England drew upon Clusius' illustrations, as well as on his text. For example, both Rembert Dodoens and Matthias de l'Obel's botanical works included all the descriptions of American plants from Clusius' translations.[22] This is not surprising, given that Dodoens, l'Obel and Clusius were friends who worked closely together, exchanging materials, information and drawings. Plantin, who published works by all three, maintained his own correspondence with Spanish botanists such as Arias Montano.[23] Thus Clusius' work, drawing on that of Spanish botanists and historians, formed a site for the nucleation of new networks of knowledge concerned with American flora. Circles of erudite Europeans began to possess comprehensive information both about American plants that were grown in Europe (such as the "milium Indicum Plinianum seu Mais Occidentalium Frumentum turcium, vulgo," of which Mathias de L'Obel commented "did not come from Turkey but the West Indies" (see Figure 1) and about exotic plants that were not cultivated there, such as different types of

[20] Pardo, "Two Glimpses," 187.
[21] On curiosity in New World exploration and scientific collections, see Evans & Marr, *Curiosity*, esp. 43-62 and 63-86
[22] López & López, *Influencia*, 104-25. On illustrations, see Kusukawa, "Uses of Pictures," 211-46.
[23] Arias Montano, *Correspondencia*, 264-64, 570-71, 837.

cacti.[24] However, these changes were not only qualitative – the information was more accurate and abundant – but also quantitative: more species were studied. Illustrative of these changes is Kaspar Bauhin's *Pinax*, the definitive version of which was published in 1623. In the book, Bauhin states "that both beginners and experts needed a guide not only to the different forms of plants but to the literature describing them."[25] The *Pinax* was an authentic culmination of the complete botanical works of the time and included more than one hundred and fifty plants originating from the American continent.[26]

The Exchange of Plants, Seeds and Letters Between Clusius and the Peninsula

Clusius' work as a translator only begins to describe his engagement with the Iberian Peninsula. He maintained a wide correspondence, which included many Spaniards, in order to provide himself both with plants and seeds and, when natural originals were not available, with descriptions and representations.[27] Naturally, he preferred to receive plant samples or seeds from his correspondents, but when first-hand experience was impossible, Clusius relied on humanist methods of collation and textual comparison.[28] In this sense, his European network of correspondents, and in particular his Spanish colleagues, played a pivotal role in Clusius' acquisition and diffusion of knowledge about American plants. While the importance of his trips to Seville, Lisbon, Valencia, and so on, should not be understated, it is also true that a significant part of his botanical descriptions were based upon letters and specimens sent to him by correspondents.[29] In general, these networks had a great impact on Clusius' work on non-European plants, and in particular on the *Exoticarum*.

One of his correspondents, the Spanish humanist Benito Arias Montano, was particularly important.[30] The two became close friends during Arias' stay in Antwerp from 1568 until 1575. Philip II had given Arias the monumental task

[24] L'Obel, *Plantarum*, 24, adv. 13-14.

[25] Ogilvie, "Many Books," 38. On Bauhin, see Reeds, *Botany*, 111-133; Fuchs-Eckert, *Die Familie*.

[26] López & López, *Influencia*, 135-151.

[27] On Clusius' correspondence with Spaniards, see Asso, *Clarorum*, 37-69; Barona & Gómez, *Correspondencia*; López & Negri, *Cartas*, 203-12.

[28] Mason, "Americana," 202; Ogilvie, *Science*, 256-58.

[29] The complete Clusius correspondence (*ca.* 1300 letters) is available at: http://www.Clusiusproject.leidenuniv.nl/

[30] Concerning Arias Montano, there exist many studies, from the classic by Rekers, *Arias Montano* (1961) (Spanish ed. 1973), to the most recent Maestre *et al., Arias Montano*; Hänsel, *Spanischer*

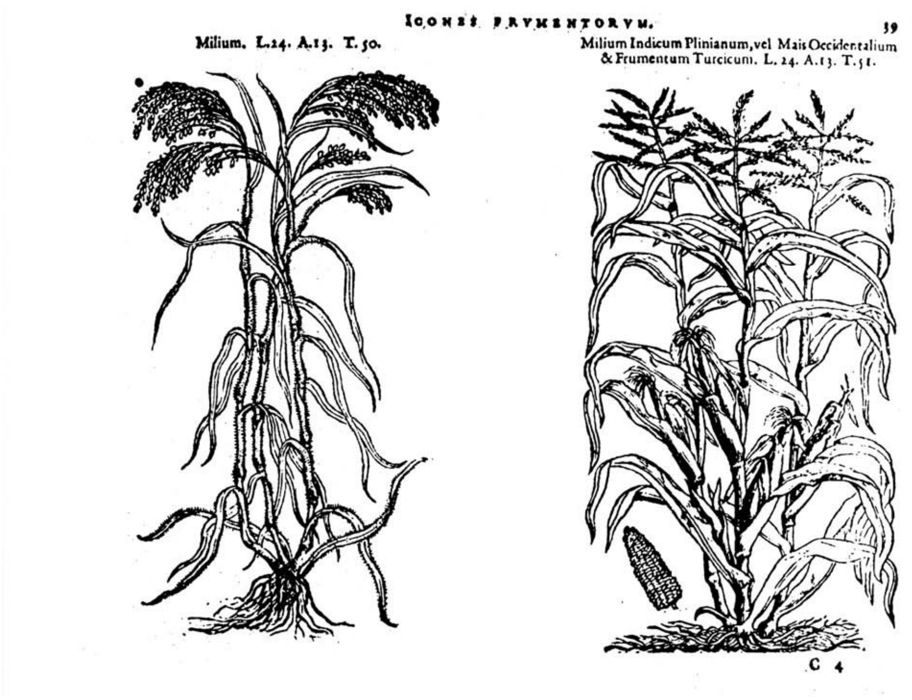

Figure 1: Frumentum turcicum, woodcut from Matthias de l'Obel, Plantarum seu stirpium historia . . . Cui annexum est Adversariorum volumen (Antwerp, 1576), 39.

of editing the Polyglot Bible (*Biblia sacra, hebraice, chaldaice, graece et latine*, 1569-1573), a hallmark of humanist scholarship printed by Plantin.[31] Arias was in contact with the group of intellectuals and scientists who regularly met at the printer's house, a group which included the cosmographers Abraham Ortelius and Gerard Mercator, the doctor and mathematician Cornelius Gemma, the humanists Joseph Justus Scaliger and botanical cultivators such as Clusius, Dodoens and l'Obel.[32] Arias and Clusius' involvement in this group, all supporters or members of the "Family of Love," was reflected in their books and in letters.[33] For example, on 29 October 1575, Plantin wrote a long letter to Arias, giving him news of their mutual friends, including Dodoens, Johannes Sambucus, Johannes Crato and Clusius.[34]

In April 1569, Arias wrote to Clusius in response to a letter in which Clusius had sent him seeds. In this letter, Arias informed his friend that he had sent Philip II a summary of Clusius' Latin translation of the work by García da Horta. Arias encouraged Clusius to continue publishing, using a friendly botanical comparison: "I wouldn't like you to let the years pass by, like an olive, but for you to be like the fig tree, useful and bearing fruit twice every summer." In August of the same year, he wrote again, informing Clusius of the death of the naturalist Bernardino de Burgos, whose *De plantis Hispanis* was left unpublished. Arias went on to discuss other matters, including the fact that he hoped to receive Monardes' treatise shortly.

After 1575, when Arias left Antwerp, there was little contact between Arias and Clusius. In 1591, Arias moved to a retreat in La Peña de la Sierra de Aracena (located in the southwest of the Peninsula between Spain and Portugal), where he lived until his death in 1598. He was not idle, however, and frequently travelled to Seville, where he was friends with a group of humanists and scientists, among whom were Simón de Tovar and Francisco Sánchez de Oropesa. In February 1596, Arias sent one last letter to his old friend Clusius. Written in "a field of flowers

Humanist and Gil, *Arias Montano en su entorno.* Also those published by the University of Huelva in their collection *Bibliotheca Montaniana*. On Arias and Clusius, see Gómez i Font, "Benito Arias Montano y el naturalista C. Clusius," 85-90.

31 Concerning the relationship between Arias and Plantin, cf. Bécares Botas, *Arias Montano y Plantino*; Arias Montano, *Correspondencia* and Macías, *Biblia*. The digital edition is found at: https://socrates.leidenuniv.nl.

32 Rekers, *Arias Montano*, 106-11.

33 Concerning Arias Montano and the Low Countries, cf. López Piñero & Navarro Brotons, *Relaciones*. For Arias and Clusius' involvement in the "Family of Love," see Cook, *Matters*, 94-96.

34 "Dodonaco, Sambuco, Cratoni et Clusio, ut aliis amicus quos tui amantes novi salutem ex te ascribam." Montano, *Correspondencia*, 264-65.

near Hispali," Arias nostalgically recalled the time he lived in the Low Countries, which he called "dulcissimus totius vitae," and the friends he made there. Among them he signalled out Ortelius with whom he had corresponded and through whom he had received material for Clusius. He also talked of the second part of his as yet unfinished *Naturae historia* and of plants that Simón de Tovar had recently sent him. The cessation of the correspondence between Arias and Clusius did not indicate a lack of interest in American flora on Clusius' part. For example, in a 1597 letter to Joachim Camerarius, a doctor and naturalist in Nüremberg, Clusius requests information about the work of Francisco Hernández. In the same letter, Clusius mentions the news of his friend, Arias, saying: "In twenty years, I have only received one letter from Benito Arias Montano, which he wrote last year. He lives near Seville, free from problems, and spends his time studying. It appears that he remembers his old friend."[35]

The nostalgic turn in Arias' 1596 letter to Clusius is echoed in Arias' *Naturae historia*, published posthumously in the Officina Plantiniana in 1601. In the chapter "De cognitone ac definitone herbarum," Arias refers to "the great figures of our times: Rembert Dodoens, our host, now deceased, Carolus Clusius, a pleasant friend we met in Flanders, Matthias de l'Obel, younger than us, Simón de Tovar and Francisco Sánchez de Oropesa."[36] But while Arias continued to think about his friends, the final letter he sent to Clusius is significant because it represents his last contribution to the establishment of relations between Spain and the Low Countries in the field of natural history, relations that had overcome religious and political barriers. In this context, we need to recall Arias' actions in favour of Ortelius, Mercator, Gemma Frisius and Plantin. For example, he succeeded in having Plantin appointed Philip II's *prototipógrafo* (first typographer). This meant that Plantin could publish Spanish scientific books, among them the great surgical treatise by Francisco Arceo (1574) and *De compositione medicamentorum examine. Nova methodus* (1586) by Simón de Tovar. While Arias' contributions are significant, they can be overstated; for example, there is no evidence to support the hypothesis that the botanical materials that Arias sent to Clusius came from Hernández's expedition to New Spain.

For his part, Clusius spent the last fifteen years of his life in Leiden, where he continued his correspondence with Spanish natural historians. He exchanged letters and botanical materials with Simón de Tovar, Juan de Castañeda and Rodrigo Zamorano, all of Seville. Because Clusius' correspondence with Spanish

[35] Letter from C. Clusius to J. Camerarius, dated Leiden, February 20, 1597. Ed. Hunger, *Charles de l'Escluse*, II, 447-48.

[36] Arias, *Naturae Historia*, 241.

naturalists has been well studied, I will mention only that we know of just two letters from Tovar to Clusius, dated February and June 1596.[37] These letters are magnificent examples of Clusius' Spanish correspondence, providing a detailed account of the exchange of descriptions of plants and seeds between the naturalists. While Clusius sends tulips to Seville, Tovar ships north two boxes of seeds and two more of bulbs. Tovar's shipment contained sixty-four plants from the Iberian Peninsula; fifty Clusius had specifically requested in an alphabetically ordered list, plus fourteen more. In addition, there were three New World plants: an "acacia," of the genus *Acacia*; a "mechuacan" (*Convolvulus mechoacan* Vandelli); and "one called *Good Night*" (*Mirabilis jalapa* L.). Tovar also informs Clusius about his specimens of "Coralii arbor Indicus" (*Erythrina coralloides* D. C.), which had "flowers very similar to coral, from whence the name is drawn," as well as a "drago canario" or Canary Islands Dragon Tree, and "one known in *nahuatl* as 'azcalxóchitl'," which Tovar called "Narcissus Jacobaeus" because its flowers resembled the Cross of St. James. This last plant was *Sprekelia formossisima* Herb. Tovar includes a brief description that would be later published by Clusius. Tovar also discussed problems of acclimatisation of the plants he sent in the Low Countries, given the region's "coeli inclementia." In other words, Tovar's relationship with Clusius included much more than a simple exchange of letters and descriptions; these were accompanied by a material exchange of specimens, observations about the possibilities for cultivation, and so on.

As I mentioned earlier, only two letters survive from Tovar's correspondence with Clusius, both from 1596. We know much more about Castañeda's collaboration with Clusius. Over a period of five years, Castañeda sent Clusius a great deal of material and information.[38] In the first year of their correspondence, he sent four species that Clusius had requested, two of which were American: the "Narciso indico jacobeo de la flor roxa" (*Sprekelia formosissima* Herb.) and the "Tuna negra, sobre que se coge la Cochinilla" (*Nopalea cochenillifera* (L.) Salm-Dyck). Castañeda also sent seeds, roots, bulbs and plants; he sent lists, information and drawings. He even tried to correct the information in Clusius' publications. On receiving, for example, the copy of *Rariorum plantarum historia* (1601) that Clusius sent him, Castañeda felt compelled to correct its representation of "Coral arboris ramulus" (*Erythrina coralloides* D.C.). The illustration of the plant, based on information supplied by Tovar, included only its leaves; Castañeda commented

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[37] Letter from S. de Tovar to C. Clusius, dated Seville, March 13, 1596. Ed. Asso, *Clarorum*, 41-47. Letter from S. de Tovar to C. Clusius, dated Seville, June 1, 1596. Ed. Asso, *Clarorum*, 47-51. See the digital edition at: https://socrates.leidenuniv.nl/.

[38] Menéndez, *Plantas*, 97-107. See the digital edition at https://socrates.leidenuniv.nl/.

that while the "leaf of the coral tree is very natural," the flower did not sufficiently resemble coral. Consequently, he sent petals and arranged for an artist who was a patient of his in the "Hospital de los Flamencos" of Seville to draw the flower. What best reflects Castañeda's contribution to Clusius' information concerning American flora, however, are the descriptions and samples of almost fifty American plants he sent. Many of these plants were already known, some from the "first notices" of Fernández de Oviedo and others from the works of Monardes, Tovar, and other authors; but Castañeda provided Clusius with the materials to make first-hand descriptions. On top of this, he sent some plants unknown to Clusius, such as sweet varieties of *Capsicum*.[39]

The examples of Tovar and Castañeda are illustrative of the way in which Clusius' *Exoticorum libri decem* (1605) benefited from his correspondence with Spanish cultivators and naturalists. As we have seen, this information consisted of descriptions of plants that Clusius himself had not seen, as well as seeds and plants that his correspondents sent. Clusius made no attempt to hide his debts in the *Exoticorum*; for example, the second book contains a chapter dedicated to the "Fructus exotici Hispali accepti," informing readers of the plants Tovar and Castañeda had sent. Among these were the "coxco cypote" (*Myroxylon balsamum* (L.) Harms.), the butternut or "almendras del Perú" (*Caryocar nuciferum* L.), and the Marvel of Peru or "buenas noches" (*Mirabilis jalapa* L.), each with an accompanying illustration.[40] Additionally, in the third book, among the fruits and vegetables, there appear several American species, such as the "Oviedi Bixa." In the chapter, he explains that, "Nam Septembri mensi [1602], inter quaedam semina quae mittebat doctissimus vis Ioannes Cataneda" were those of the species described by Fernández de Oviedo and now known as the lipstick tree (*Bixa orellana* L.), which was successfully cultivated in the Low Countries.[41]

The Exchange of Information in *Rariorum aliquot stirpium per Hispanias observatarum Historia* (1576)

The most important monograph on Iberian flora published in the sixteenth century, the *Rariorum aliquot stirpium per Hispanias observatarum Historia* (1576), represents the third and final aspect of the exchange of botanical information between the Peninsula and the Low Countries via Clusius (see Figure 2). Although it was not published until two years after the Latin translation of the first two "books" of

39 López & López, *Influencia*, 78.
40 Clusius, *Exoticorum*, 44-45.
41 Ibid., 44-45; 74. López & López, *Influencia*, 101-103.

Monardes' treatise, the *Per Hispanias* contained elaborate descriptions of plants native to the Iberian Peninsula, as well as a considerable number of species from the New World, already grown in Spain. Clusius visited the Iberian Peninsula from 1564-1565 and, as the title indicates, his book represented the information he acquired himself while travelling through a large part of the Peninsula, including: Aragón, Murcia, Valencia, Granada, Western Andalucía, Extremadura, Castile and Portugal.

In his dedication to the Emperor Maximilian II, Clusius clearly states the objective of his work: "To describe plants observed in Spain, especially if one bears in mind that the majority were described by the Ancient authors; modern authors have paid little attention to them and some were unknown even to the Ancients."[42] To carry out this ambitious plan, he followed the method typical of the second half of the sixteenth century. He included precise descriptions of plants and their variants, and their names in various languages, acknowledging the problems of classification and identification of these in the Classics. He divided the work into two parts: the *liber primus*, in which he described trees, bushes and shrubs; and the *liber secundus*, devoted to bulbs and herbaceous plants. In each of the chapters, he gives a description of a plant and considers its varieties, giving a detailed descriptions often based on the Classics. He frequently gives precise information of the place he observed the specimen, both where it grew naturally and where it was cultivated. There are consequently numerous references to the different gardens and orchards he visited throughout his journey. He also, as was usual, provides information about the medicinal properties of the species described, ranging from the most orthodox academic Galenism to the popular uses he learned of while on his journey. To conclude the book, he included, along with the Latin names that headed the chapters, the terms used in other languages, including languages of the Peninsula. He described 300 plants in total accompanied by 233 illustrations.[43]

A detailed study of this text decisively demonstrates that the usual image of Clusius as the "discoverer" of all the plants he described is totally inappropriate. For example, in a recent study it is said: "Clusius (1526-1609) was the most famous phytographer of the sixteenth century. In his journey through Spain and Portugal in the 1560s, he *discovered* some two hundred previously undescribed plants. Although Clusius did not undertake the trip primarily to study botany, (he

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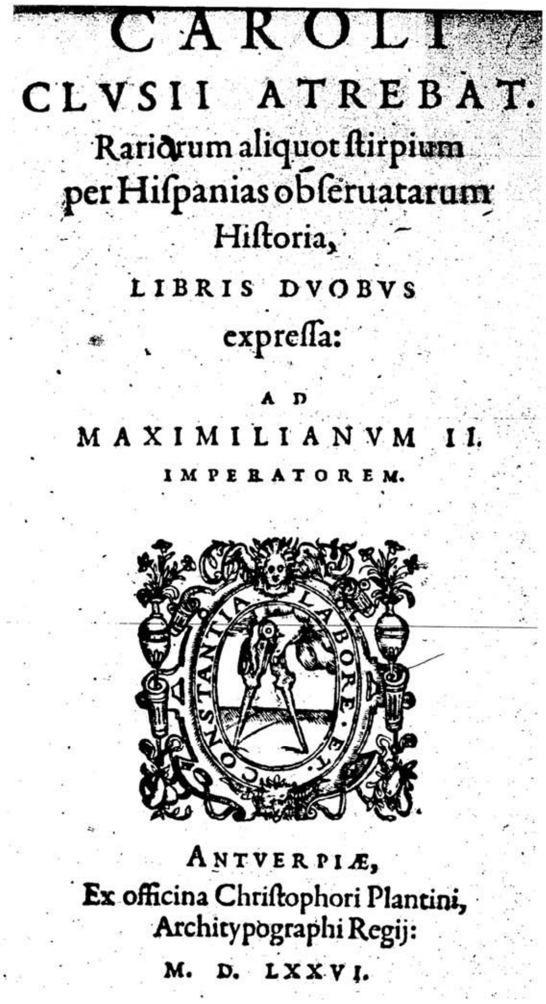
42 "Stirpium in Hispanis observatorum descriptionies darem: praesertim cum pleraeque sint veteribus quidem descripta, sed a recentioribus minime hactenus observatae et nonnullae etiam veteribus forsitam ignotae." Clusius, *Rariorum*, 4-5.

43 A precise description of the text, although from a current botanical perspective, is given in Menéndez, "Charles de L'Ecluse," 9-23.



CAROLI
CLVSII ATREBAT.
Rariorum aliquot ſtirpium
per Hiſpanias obſeruatarum
Hiſtoria,
LIBRIS DVOBVS
expreſſa:
AD
MAXIMILIANVM II.
IMPERATOREM.

LABORE ET CONSTANTIA

ANTVERPIÆ,
Ex officina Chriſtophori Plantini,
Architypographi Regij:
M. D. LXXVI.

Figure 2: Carolus Clusius, Rariorum aliquot stirpium per Hispanias observatarum Historia (Antwerp, 1576).

was to accompany one of the Fugger sons to the family's branch office in Lisbon), he examined and collected plants on the way. Despite the shortness of the trip and the scant attention he could pay to plants along the way, he *found* many that were rare and not easily found elsewhere – unknown to modern authors and perhaps also to the Ancients" (emphasis added).[44] This is in no way an accurate description of how the *Rariorum aliquot per Hispanias observatarum Historia* was compiled. On the one hand, as the author states at the beginning of the book: "On that trip, I noted down, to remind me, the shape of most of them, where they were growing, and their names. I personally drew with charcoal the shape of some of them. Upon returning from Spain, those that survived the slowness of the trip, such as bulbs and tubers, were dried and sent to friends."[45] Clearly, he made his own observations and drawings, but he also initiated the exchange of seeds and species between the Low Countries and the Peninsula. But apart from this, he collected various descriptions some given to him by other botanical cultivators on the Peninsula and others taken from texts, as Clusius points out in his book. So the *Per Hispanias* was not only the result of his own research, but also of his visits to libraries, gardens and collections.[46]

Although the book contains numerous references to the ways in which Clusius gathered information and knowledge, the example of Clusius' relationship with the professor of *materia medica* at the University of Valencia, Joan Plaza, will give a sense of both his debts to Spanish naturalists and his willingness to acknowledge them . . .

It is noteworthy that the only institution of higher learning that Clusius mentions in the *Per Hispanias* is the University of Valencia, which he praises in his correspondence in spite of having been in Seville, Madrid and the other great Spanish universities of Salamanca, Valladolid and Alcalá.[47] The College of Medicine of the University of Valencia was perhaps the most important in the Hispanic Kingdoms during the sixteenth century. Inaugurated in 1502, it was a municipal university, financially maintained and run by the local middle classes. Significantly, it included a chair of "hierbas y otros medicamentos simples" (herbs and other simple medicines). The existence of this professorship allowed the study of

44 Ogilvie, *Science*, 148.

45 "In ista peregrinatione plurimarum formam, natales, et nomina memoriae causa adscripti, nonnullarum etiam efigies ipse carbone aut rubria delineavi, atque omnes fere inde rediens exsiccates detuli; aut earum semina, vel ipsas etiam plantas, quae videlicet vecturae traditatem ferre potuerunt (quales sunt bulbosae et tuberosae) amicis inde misi." Clusius, *Rariorum*, 7.

46 This fact has also been pointed out by Cook, *Matters*, 93.

47 "Valentia sola et habet doctos professores, et latinae linguae exercitia colit." Ed. Ram, "Caroli Clusii," 50.

materia medica to flourish in Valencia. One important figure to hold the chair was Pere Jaume Esteve, a pupil of Jacobus Sylvius and Guillaume Rondelet. Among other works, Esteve was the author of the *Theriaca de Nicandro*, which included Latin translations and ample commentaries, as well as the *Diccionario de las yerbas y plantas medicinales que se hallan en el Reino de Valencia*. The most famous person to hold the chair in the sixteenth century was, nevertheless, Joan Plaza, whose tenure, between 1567 and 1583, coincided with the establishment of the botanical garden in Valencia.[48] Plaza was appointed to the chair in May 1567, exactly two years after Clusius' stay in the city. Clusius names Plaza almost twenty times in the *Per Hispanias,* and he is the only Spanish author in the Renaissance who is mentioned, apart from the noted humanist Antonio de Nebrija. Plaza is most often mentioned in the course of discussions of plants from the kingdom of Valencia. These were plants that Plaza had studied first hand in the normal course of collecting and studying local species. But there are also references to Plaza's opinions when it comes to relating specific plants to those mentioned by classical authorities. In both cases, what is most striking is the great respect Clusius shows for Plaza, going as far as to equate him with Rondelet.[49] The most interesting cases, however, are those in which Clusius cites Plaza in connection with American plants that Clusius had learned of in Valencia.

The first of these plants was the avocado (*Persea Americana* Mill.) to which he dedicates chapter two of the book, "De Persea" (see Figure 3). After devoting a chapter to the Canary Islands Dragon Tree, Clusius begins his discussion of the avocado by saying: "This tree is very rare, we include an illustration of one of its branches, and I have seen it only in the Kingdom of Valencia, at the Monastery of the Holy Virgin of Jesus, one mile outside the city. It had been brought from America." He goes on: "I saw it in flower during the spring and learned that its fruit would be ripe in autumn from the famous Joan Plaza, Valencian doctor and professor who showed it to me in the aforementioned place." Plaza himself informed him that the Valencians called the plant "mamay," although he points out that it is different from the flower of the same name in America. Following a long

48 On Esteve, see López Piñero, *Pere Jaume Esteve*. On Plaza an the *Herbes* chair, see López Piñero, *Medicina*, 74-87.

49 In the chapter dedicated to the lily of the sea or "lliri de marines" (*Pancratium maritimum* L) he says: "Meo tempore C[larissimo] V[iro] D. Gulielmo Rondeletio praeceptori colendissimo Scilla vocabatur ... Quae in Valentino littore nascitur, D. Joanni Plaçae, medico et professore celeberrimo Hemerocallis nuncupabatur" (in Clusius, *Rariorum*, 289). He uses the adjective "valentinus" with other species, some of which still maintain the same botanical name. On one occasion, he uses Plaza's surname in genitive: "Sparganium Placae" which describes like "clarissimus medicus D. Ioannes Plaça" (*ibidem*, 254).

16 RARIORVM STIRPIVM

De Perſea. CAP. II.

VALDE rara etiam hæc eſt arbor, cujus ramum hic expreſſum damus: nam ſolo Valentino regno vnicam arborem vidi, in monaſterio Diuæ Virginis, cui cognomen de IESV, primo ab vrbe Valentia lapide. Ex America eò delata fertur.

PORRO

Figure 3: De Persea, woodcut from Carolus Clusius, Rariorum aliquot stirpium per Hispanias observatarum Historia (Antwerp, 1576), 16.

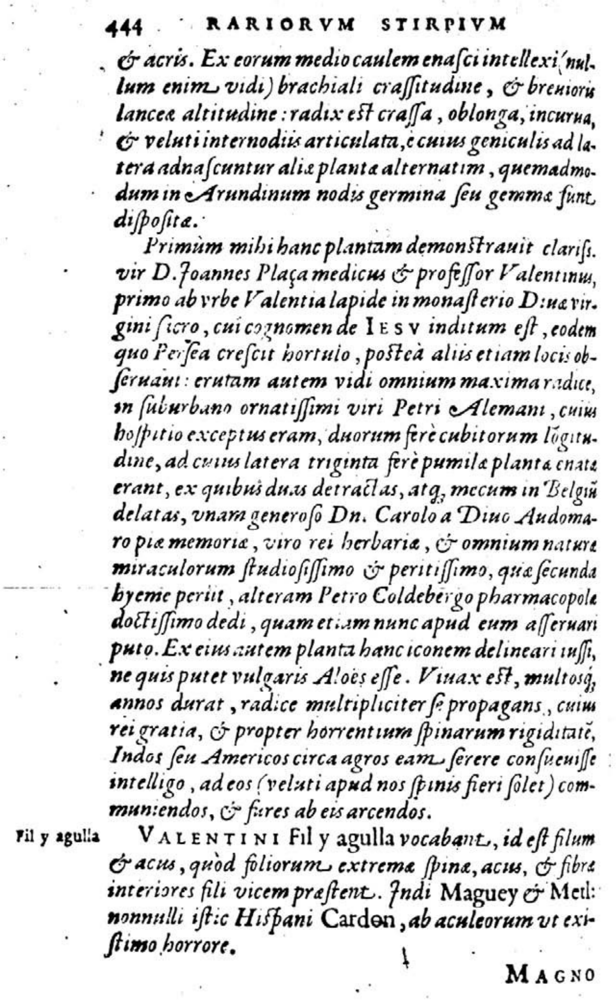
discussion of the avocado's possible identity with the plant "persea" described by Theophrastus, Pliny and other classical authors, Clusius concludes – incorrectly – that the plant must be the mamey (*Mammea Americana* L.) described by López de Gómara.[50] It is clear from this and other similar comments throughout the work that Clusius, like many other sixteenth-century naturalists, continued to rely heavily on classical authorities. Thus, the greatest problem a plant poses is how it might be located in the texts of Pliny and Dioscorides. In general, however, it is important to distinguish between the thorniness of the philological problem a plant presents and Clusius' goals. In keeping with the botanical writers of the second half of the sixteenth century, the plant's description is much more important than its identification.

The second American plant that Clusius learned about from Plaza was what he called "American Aloe" (see Figures 4 and 5). He begins the chapter justifying its inclusion among the "aculeatarum classi" instead of the tubers, given that its rigid appearance was different from the common aloe. Clusius then provides a detailed description of the plant, stating that it was the "famous Joan Plaza, Valencian doctor and professor who first showed it to me in the same garden where the *persea* grows." While in Valencia Clusius saw yet another example of the same plant:

> Seeing it uprooted, it had the largest root of any plant on the farm of the illustrious Pedro Alemán who had kindly offered me his hospitality; the plant was two cubits long and from its sides had sprouted thirty small plants, two of which I removed and brought with me to Belgium. One I gave to the magnanimous and fondly remembered Charles de Saint Omer, a man of great passion and understanding in the matter of herbs and of every one of nature's marvels. The plant died in its second winter. The second I gave to the eminent and wise apothecary Pieter van Coudenberg; I believe it still grows at his house.[51]

This passage clearly illustrates Clusius' important role as a bridge between northern and southern communities. I think we learn at least three things here. First, Clusius sought out contacts in Spain that shared his fascination with plants and sought to further it; clearly, his knowledge of the "American aloe" would not have been possible without the help of Joan Plaza and Pedro Alemán. Second, we learn that Clusius gave away both of the samples he collected to contacts in the Low Countries, one going to a collector of natural objects and the other to an apothecary with his own garden. Clusius goes so far as to tell his readers the respective fates of the two samples: van Coudenberg's was alive while Saint Omer's was al-

[50] Clusius, *Rariorum*, 16, 17 and 19.
[51] Clusius, *Rariorum*, 444.



444 RARIORVM STIRPIVM

& acris. Ex eorum medio caulem enasci intellexi (nullum enim vidi) brachiali crassitudine, & brevioris lanceæ altitudine: radix est crassa, oblonga, incurua, & veluti internodiis articulata, e cuius geniculis ad latera adnascuntur aliæ plantæ alternatim, quemadmodum in Arundinum nodis germina seu gemmæ sunt dispositæ.

Primùm mihi hanc plantam demonstrauit clariss. vir D. Joannes Plaça medicus & professor Valentinus, primo ab vrbe Valentia lapide in monasterio Diuæ virgini sacro, cui cognomen de IESV inditum est, eodem quo Persea crescit hortulo, posteà aliis etiam locis obseruaui: erutam autem vidi omnium maxima radice, in suburbano ornatissimi viri Petri Alemani, cuius hospitio exceptus eram, duorum ferè cubitorum lõgitudine, ad cuius latera triginta ferè pumilæ plantæ enatæ erant, ex quibus duas detractas, atq; mecum in Belgiũ delatas, vnam generoso Dn. Carolo a Diuo Audomaro piæ memoriæ, viro rei herbariæ, & omnium naturæ miraculorum studiosissimo & peritissimo, quæ secunda hyeme periit, alteram Petro Coldebergo pharmacopolæ doctissimo dedi, quam etiam nunc apud eum asseruari puto. Ex eius autem planta hanc iconem delineari iussi, ne quis putet vulgaris Aloës esse. Viuax est, multosq; annos durat, radice multipliciter se propagans, cuius rei gratia, & propter horrentium spinarum rigiditatẽ, Indos seu Americos circa agros eam serere consueuisse intelligo, ad eos (veluti apud nos spinis fieri solet) communiendos, & fures ab eis arcendos.

Fil y agulla VALENTINI Fil y agulla vocabant, id est filum & acus, quòd foliorum extremæ spinæ, acus, & fibræ interiores fili vicem præstent. Indi Maguey & Metl: nonnulli istic Hispani Cardon, ab aculeorum vt existimo horrore.

MAGNO

Figure 4: Description of Aloe Americana. Carolus Clusius, Rariorum aliquot stirpium per Hispanias observatarum Historia (Antwerp, 1576), 444.

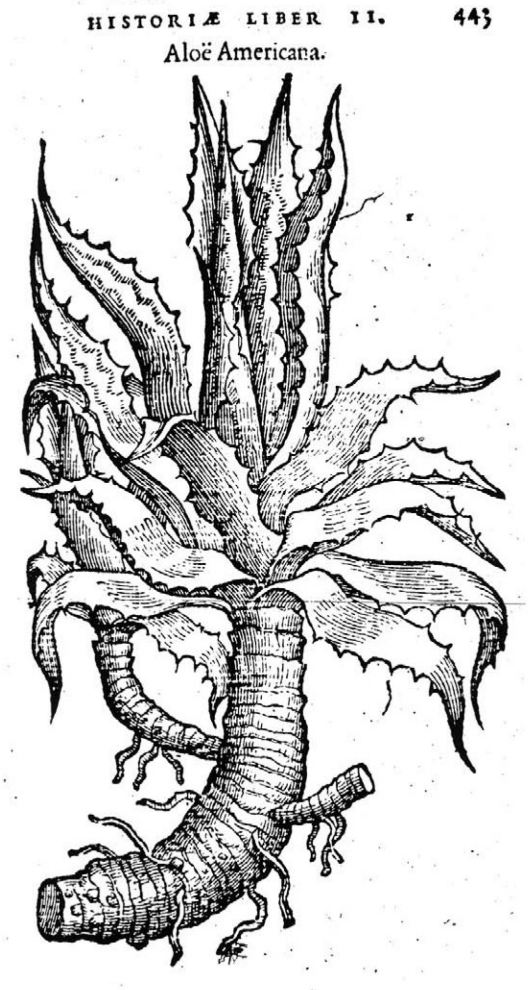


Figure 5: Aloe Americana, woodcut from Carolus Clusius, Rariorum aliquot stirpium per Hispanias observatarum Historia (Antwerp, 1576), 443.

ready dead. What we can draw from the generous distribution of exceedingly rare plant specimens is that Clusius sought to promote the collection and cultivation of American plants in the north. The third thing we learn is that the *Per Hispanias* not only describes an American plant acclimatised to the Mediterranean for the benefit of an erudite community of European botanical cultivators, but also represents the importance of the mechanisms of acquisition and distribution of individual natural originals. Clusius underscores the importance of friendly exchange, telling us the specific locations, names and occupations of landowners and collectors, and even the life histories of individual specimens! All of this leads to what I find to be an inevitable conclusion: Clusius characterises himself *not* as the discoverer of these plants, but as a link between two communities of botanical cultivators, one in Valencia, the other in the Low Countries.[52] This is the case repeatedly in the *Per Hispanias*: Clusius learns from one network of local cultivators, collects and describes, then distributes descriptions and specimens to another network.

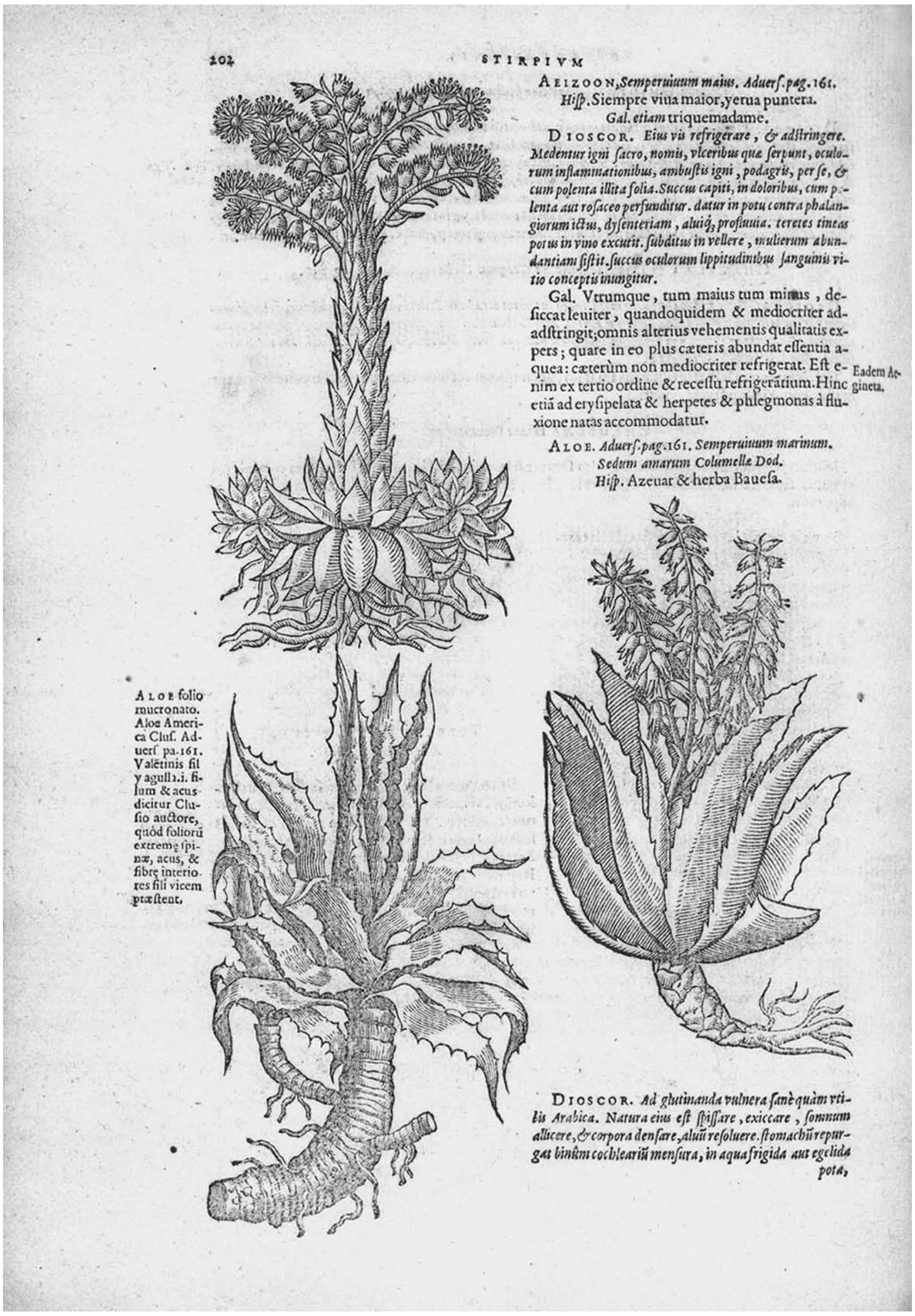
While an attitude of generosity and not a claim to discovery characterizes his accounts of learning about American plants, Clusius' terminological decisions further illustrate, to an almost absurd extent, his eagerness to represent natural history as a collective endeavour. As in the chapter devoted to the avocado, he ends his chapter on the American aloe by transcribing the description of the "metl" or "maguey" by López de Gómara. The engraving that illustrates it appears to correspond to the species *Agave atrovirens* Karw.[53] But Clusius returns to Plaza and adds one note further, *saying* that according to him, "the Valencians called it 'fil y agulla,' that is to say 'needle and thread': needle because of the thorns at the end of the leaves and because the inside fibers could be used as threads."[54] Thanks to this brief anecdote – we might even imagine that Plaza told it in an offhand manner, given its content – the Valencian popular name "fil i agulla" spread throughout Europe and was used by different authors such as l'Obel and Dodoens until the middle of the seventeenth century. For example, in l'Obel's *Plantarum seu stirpium historia*, published by Plantin in 1576, the chapter devoted to the aloe was entitled "Aloe America Valentinis fil i agulla" (see Figure 6).[55] But the spread of this term in Catalan – the language of Valencia – was not restricted to the authors in Clusius' circle but extended to the works of Jacques Dalechamps,

52 On seeds sent from Seville, see Menéndez, "Plantas vasculares."

53 Clusius, *Rariorum*, 445-46. Respect of the first icon of the *Agave* sp. in Europe, see Guillot, "Piet Van Der Meer."

54 "Valentie fil y agulla vocabant, id est filum et acus, quod foliorum extremae espina, acus, et fibra interiores fili vicem praestant." Clusius, *Rariorum*, 444.

55 L'Obel, *Plantarum*, 202-3. The text and the picture are copies of the *Rariorum*.



202 STIRPIVM

AEIZOON, *Semperuiuum maius. Aduerſ.pag.161.*
Hiſp. Siempre viua maior, yerua puntera.
Gal. etiam triquemadame.

DIOSCOR. *Eius vis refrigerare, & adſtringere. Medentur igni ſacro, nomis, vlceribus quæ ſerpunt, oculorum inflammationibus, ambuſtis igni, podagris, per ſe, & cum polenta illita folia. Succus capiti, in doloribus, cum polenta aut roſaceo perfunditur. datur in potu contra phalangiorum ictus, dyſenteriam, aluiq; profluuia. teretes tineas potus in vino excutit. ſubditus in vellere, mulierum abundantiam ſiſtit. ſuccus oculorum lippitudinibus ſanguinis vitio conceptis inungitur.*

Gal. Vtrumque, tum maius tum minus, deſiccat leuiter, quandoquidem & mediocriter adadſtringit; omnis alterius vehementis qualitatis expers; quare in eo plus cæteris abundat eſſentia aquea: cæterùm non mediocriter refrigerat. Eſt enim ex tertio ordine & receſſu refrigerātium. Hinc etiā ad eryſipelata & herpetes & phlegmonas à fluxione natas accommodatur. Eadem Acgineta.

ALOE. *Aduerſ.pag.161. Semperuiuum marinum. Sedum amarum Columellæ Dod.*
Hiſp. Azeuar & herba Baueſa.

ALOE folio mucronato. Aloe Americā Cluſ. Aduerſ pa.161. Valētinis fil y agulla.i. filum & acus dicitur Cluſio auctore, quòd foliorū extremę ſpinæ, acus, & fibrę interiores fili vicem præſtent.

DIOSCOR. *Ad glutinanda vulnera ſanè quàm vtilis Arabica. Natura eius eſt ſpiſſare, exiccare, ſomnum allicere, & corpora denſare, aluū reſoluere. ſtomachū repurgat binûm cochleariū menſura, in aqua frigida aut egelida pota,*

Figure 6. Aloe Americana or fil i agulla, woodcut and description from Matthias de l'Obel, Plantarum seu stirpium historia … Cui annexum est Adversariorum volumen (Antwerp, 1576), 202.

Kaspar Bauhin and the herbal compiled by Pier Antonio Michiel between the beginning of the 1570s and his death in August 1576.[56]

Thus the influence of Plaza's narrative included in Clusius' *Per Hispanias* (1576), could still be noted in Bauhin's *Pinax*, published almost half a century later. But rather than exceptional, I find the case of the American aloe to be emblematic of the exchange of information among Clusius, his Hispanic colleagues, and botanists working in northern Europe. The fact that Clusius established contacts with cultivators across the Iberian Peninsula who spoke Catalan and other languages in addition to Spanish contributed to the dissemination of plant names in a variety of languages. One has to bear in mind that one of the biggest problems that faced the botanical cultivators of the time was that they had hundreds of new plants, each of which required a name. It was logical, therefore, that a new species be named by or after the person who exhibited it, if only for the sake of ease. It is obvious that Clusius' stay in the Peninsula, in addition to his translations, correspondence, and exchange of plants and seeds, proved crucial in establishing a link between north and south. These connections continued to be of importance for decades and contributed to some of the most important studies of American natural history in the early modern period. It was the importance of networks, friendships, and collaboration, not the triumph of individual efforts, that Clusius continually sought to foreground in his books. Clusius, to our way of thinking, is no less important for not being a discoverer.

[56] Dalechamps, *Historia generalis*, 1697; Bauhin, *Pinax*, 286; Pardo "Two Glimpses," 198.

The Migration of Instrumental Knowledge from Flanders to Spain. The Role of the Sixteenth-Century Flemish Instrument Maker Petrus ab Aggere

Koenraad Van Cleempoel

Introduction

The landscape of Flemish instrument making during the Renaissance period has been charted in recent years, opening up new areas of research. One of these new areas of research includes the question of migration, which is the subject of this chapter.[1] It has been argued that Louvain, under the impulse of Gemma Frisius (1505-1555), Gerard Mercator (1512-1594), and the Brussels-based court of Charles V, became the leading centre in Europe for applying mathematical and astronomical/astrological knowledge to scientific instruments. The resulting 'Louvain School', which was active between c.1540 and c.1580, produced Europe's most coveted astrolabes, armillary spheres, astronomical rings, quadrants, sundials, surveying instruments, and globes.[2] A problem in dealing with these artefacts, however, is that the instrument makers did not always engrave their name on their artefacts. As, such, it has been necessary to develop a specific methodology in order to attribute unsigned instruments to workshops of known Louvain makers such as Gerard Mercator, Gualterus Arsenius, Michel Piquer, or Adrianus Zeelst. By looking at particular stylistic features, the personal signature of the maker can be seen and the attribution of the instrument to its author is possible. In particular, the style of engraving turns out to be a valuable tool in this effort, since the Louvain makers engraved their instruments in a consistent manner. This allows for a comparison between unsigned instruments and signed ones. In fact, they based their italic style of engraving on a model book published by Mercator in 1541

1 Van Cleempoel, *Catalogue Raisonné*.
2 Van Cleempoel, *Instrumentos científicos*.

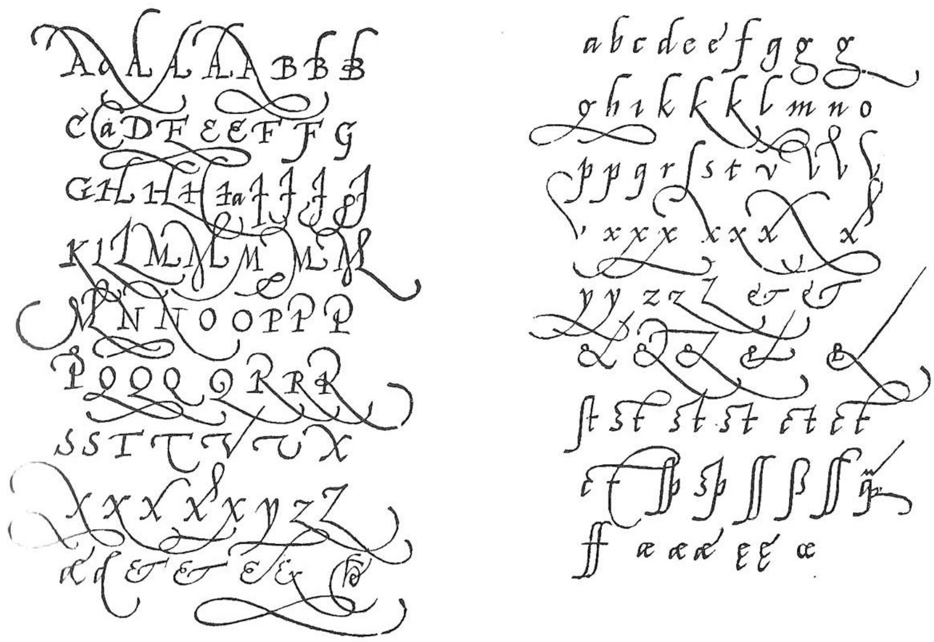


Figure 1: Gerard Mercator, Literarum latinarum, quas italicas, cusoriasque vocant, scribendarum ratio (Louvain, 1540).

(Figure 1).[3] However, each maker, including Petrus ab Aggere, developed his personal variation on the Mercator standard. Later on in this paper, it will be argued that some unsigned instruments can be attributed to Ab Aggere on the basis of, among other factors, his particular style of engraving.

When one looks at the entire panorama of Renaissance instrument making workshops, it is temping to discern two categories or profiles. First, there were those makers whom we would now label as 'innovative mathematicians' and who transformed their research and their own ideas into brass objects. This category includes makers such as Gerard Mercator, Adrianus Zeelst, Michel Piquer, and Michiel Coignet. Their instruments – and in some cases their extant manuscripts – bare witness to their invention of new and original scales and projections. On the other hand, there was a group of makers that concentrated on producing a large number of instruments of technical and aesthetical refinement, but who did not necessarily add new technologies. Gualterus Arsenius, with his over 45 preserved instruments, would seem to fall into this category. The subject of the present paper, Petrus ab Aggere, would certainly have to belong to the first category, since his

[3] Osley, *Mercator*.

extant oeuvre consists of few instruments of great refinement whose engravings display advanced universal projections.

Migration of Instruments and Their Makers

In the disciplines of art history and architectural history, it has long been recognised that migration to and from Flanders during the fifteenth and sixteenth centuries greatly influenced its local artistic scene.[4] The reputation of the Louvain School was considerable as it was a European intellectual centre that specialized in the translation of cosmographical knowledge into innovative instruments. Various cases of individual makers migrating to Louvain are known, Michel Piquer's arrival at Louvain c. 1545 being a case *par excellence*. He came to Louvain from Northern Spain by way of Lyon, and his style of instruments radically changed the instrument work taking place in Louvain.[5]

But around the same time, there was also the reverse phenomenon, with emigration from Louvain to other European cities and courts. Thomas Gemini, for example, arrived in London around 1540, where he started to produce Louvain-like astrolabes that ressembled those of Gerard Mercator in terms of size, style, and the engraved astronomical/astrological information.[6] In fact, Gemini's instruments seem to have initiated the tradition of 'Elisabethan instrument makers'.[7] Other known cases of migrating Louvain makers which await further investigation are those of Cornelis Vinckx and Carolus Platel, who went to Italy. The case of Erasmus Habermel in Prague and his alleged relationship to Louvain makers also deserves further research.

Petrus ab Aggere

We shall now examine the migration of Petrus ab Aggere, a Flemish maker, who, it will be argued, laid the foundation of the Spanish school of intrument makers in the Renaissance period. Biographical information concerning this man is very scarce. Robert Karrow refers to him because Abraham Ortelius mentions in the preface to his *Catalogus* a certain Ab Aggere as the author of a world map in the shape of an eagle published in Mechelen.[8] But the link with Ab Aggere, the

4 Coessens, *Fiamminghi*, 1995.
5 Van Cleempoel, *Catalogue Raisonné*, 27-33.
6 Turner & Van Cleempoel, "Tudor Astrolabe," 400-409.
7 Turner, *Elizabethan Instrument Makers*.
8 Karrow, *Mapmakers*, 32-33.

instrument maker, has hitherto never been made, despite the fact that several engravers of maps, such as Gerard Mercator, Adriaan Zeelst, Michiel Coignet, and Ferdinand Arsenius, were also active instrument makers. Although it has not yet been possible to locate an exemplar of this eagle-shaped map, several signed and unsigned instruments can be associated with Ab Aggere.

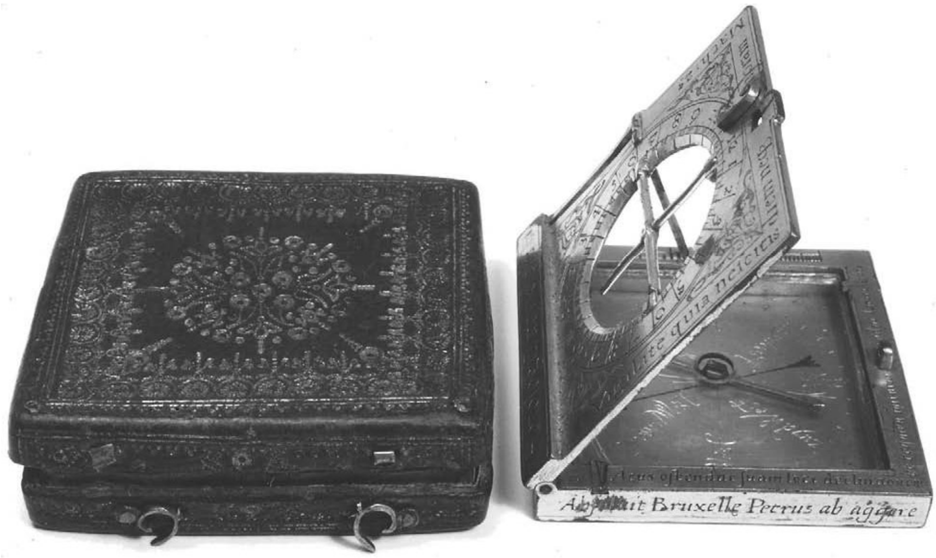


Figure 2: Petrus ab Aggere, equinoctional sundial. (Chicago, Adler Planetarium; inv. DPW-40)

Signed Instruments

1. Chicago sundial

The earliest known instrument by this maker is an equinoctional sundial signed *Absolvit Bruxelle Petrus ab Aggere in Gratiam D. Francisci de hispania anno salutis Humanae 1558* (Figure 2).[9] Ab Aggere thus made this instrument at Brussels in 1558 for Franciscus from Spain. It consists of a square box whose lid can be raised to whatever angle agrees with the latitude the user finds himself at. This lid has a circular opening, which is engraved with an hour scale on the rim and a folding gnomom at the centre. Inside the box is a compass allowing for the instrument's orientation along the N-S axis. The lid contains an hour ring and an engraved passage from Matthew, 25: *Vigilate quia nescitis – diem neque horam.*

[9] Chicago, Adler Planetarium (inv. DPW-40). Illustrated and described in Van Cleempoel, *Instrumentos cientificos*, 204-5.

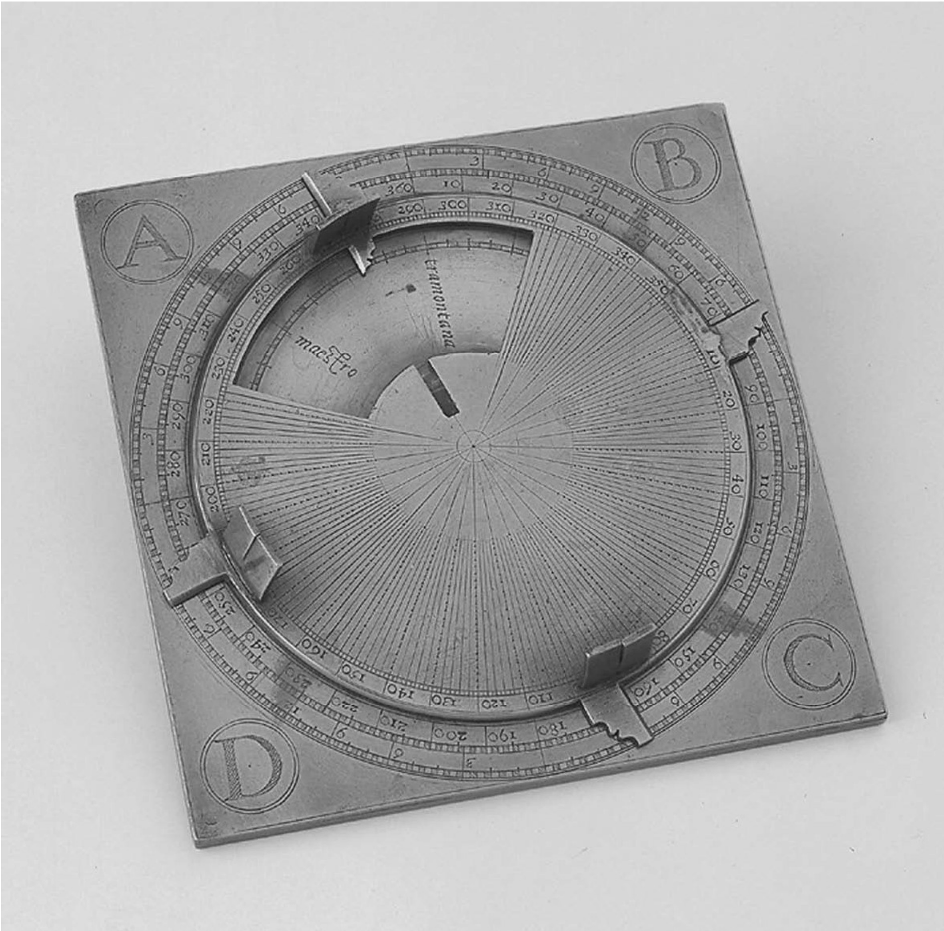


Figure 3: Petrus ab Aggere, simple theodolite. (Florence, Istituto e Museo di Storia della Scienza; inv. 1278)

2. Florence theodolite

The second signed instrument is a simple theodolite signed: *Absolvit Toleti Petrus ab Aggere Mathematicus Reius* [sic] *anno Dni 1560* (Figure 3).[10] Ab Aggere provides us here with further biographical information by defining himself as the royal mathematician of the king and by stating that he was working at Toledo in 1560. So far this has been the only solid proof of his association with the Spanish court. The typology of the instrument also deserves special attention because it is

[10] Florence, Istituto e Museo di Storia della Scienza (inv. 1278). Illustrated and described in Van Cleempoel, *Instrumentos cientificos*, 224-5.

the earliest brass version of a theodolite invented by Gemma Frisius, who praised the advantages of a graduated circle with an alidade capable of rotating over a graduated circle. Ab Aggere mounted the theodolite on the full circle with one quarter fretted so that the wind directions, indicated underneath, could be read. This instrument possibly inspired Gualterus Arsenius of whom two very similar instruments have been preserved at Oxford and Stuttgart.[11]

Figure 4: Petrus ab Aggere, equinoctional sundial. (Oxford, Museum of the History of Science, inv. 35.203)

3. Oxford sundial

The third instrument is another equinoctional sundial, of the same style as the first one, but bearing the engraved inscription IN GRATIAM D. PETRI FAGIARDI F. PETRUS AGGERIUS Madrici anno 1562 (Figure 4).[12] Ab Aggere thus made it in Madrid in 1562.

[11] Both discussed in Van Cleempoel, "Theodolite," 1998.

[12] Oxford, Museum of the History of Science (inv. 35.203). Illustrated and described in Van Cleempoel, *Instrumentos cientificos*, 206-7.

Figure 5: Petrus ab Aggere, compendium. (Private Collection)

4. PC sundial

Finally, we have a unique star-shaped compendium, which is not dated but bears the monogram P A F, which is short for *Petrus Aggerius Fecit* (Figure 5).[13] It was originally designed as a sundial, with ten star points serving as gnomons casting shadows on the graduated slopes. It consists of a box with hinged leaves on both sides, all of which have exactly the same star shape. All six sides are engraved, the front side with a conversion scale for different hour systems and the rear side

[13] This instrument was kept until 1999 at The Time Museum, Illinois (inv. 3294), and is now in a private collection. It is illustrated and described in Van Cleempoel, *Instrumentos cientificos*, 204; see also the sales catalogue of Sotheby's: *Masterpieces from The Time Museum* (New York, 1999), lot 5.

with an orthogonal Rojas projection. Inside the box, we find eight directions with wind names and a circular opening for the compass. The back is fully engraved with a list of city names with their corresponding latitudes. The back side of the hinged leaf also contains city names and latitudes and has scales for the zodiac and the twelve months. Inside these scales is a cartouche to show the planets that govern the different days of the week, both night and day.

Unsigned Instruments

1. Madrid astrolabe

In 1999, the Museo Nacional de Ciencia y Tecnologia in Madrid was able to acquire a very important astrolabe (Figure 6).[14] At that time, a detailed analysis of the astrolabe's unusual projection was published, but there existed no basis for a clear attribution. Only its Louvain-like features, such as the quadratum nauticum inside the mater, were noticed. Nevertheless, similarities in the style of the engraved letters and numbers, as well as certain details of the construction, make it now possible to attribute this instrument to Petrus ab Aggere.

Despite its modest size of Ø115 mm, one side (Figure 7) shows a particular universal stereographic projection. This projection is inspired by Ali ibn Khalaf instead of being inspired by Al-Zarqallu (Latinized Azarquiel), whose influence is usually found on the reverse of the Louvain astrolabes. Both astronomers – Al-Zarqallu and Ali ibn Khalaf – worked in eleventh-century Andalusia and their designs have been included in the *Libros del Saber* (1277) of King Alfonso X.[15] His *Libros del Saber,* which was published for the first time in Castilian, was a compendium of the then available astronomical knowledge.

A striking feature of this astrolabe is the elaborate rete pattern consisting of two projections: one semicircle is delicately perforated displaying a universal projection with altitude circles for each 5° and azimuth circles for each 10°, the other semicircle of the rete contains a projection of the folded ecliptic (Figure 8). On a 'normal' astrolabe rete the projection of the ecliptic forms a circle, which is divided into two by the horizontal diameter so that the southern part forms a small arc and the northern part a much larger arc. On the Madrid astrolabe, this smaller southern arc is folded over the horizontal diameter so that both halves fit within

[14] Museo Nacional de Ciencia y Tecnologia. Discussed in Moreno, e.a., "Recently Discovered," 331-62.

[15] More information on these projections and their influence on medieval and Renaissance makers is in *ibidem*, 334-44.

Figure 6: Petrus ab Aggere (attributed), universal astrolabe. (Madrid, Museo Nacional de Ciencia y Tecnologia)

one semicircle. The southern strap has two star-shaped pointers for unnamed stars, while the northern arc has seven pointers, again without engraved star names.

Underneath the rete, there is a fixed plate with the corresponding markings: the upper semicircle contains a universal projection with parallels for each 2°. They are numbered every 10° as far as 40. The antemeridian and postmeridian hours

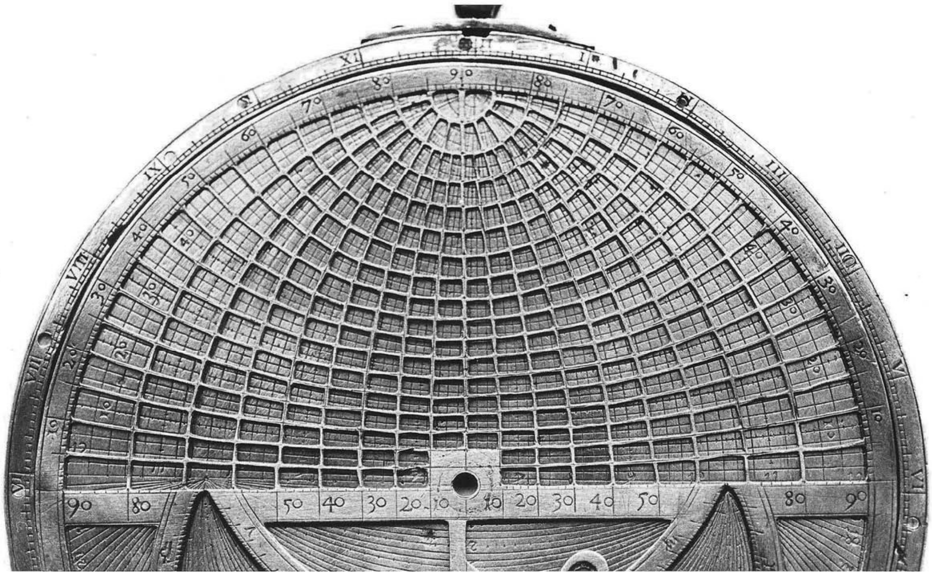


Figure 7: Petrus ab Aggere (attributed), universal stereographic projection, inspired by Ali ibn Khalaf. (Madrid, Museo Nacional de Ciencia y Tecnologia)

are engraved on the equator in Arabic numerals starting at the centre and moving towards the extremes from 6 to 12. The meridians on this line of the celestial equator are also marked off every 2˚. The lower semicircle is engraved with a set of universal horizons for each 3˚ of latitude.

The reverse of the astrolabe is no longer complete. However, there would have been a standard astrolabic rete which could rotate over a plate with projections for particular latitudes. One plate has survived (Figure 9). On one side of this surviving plate is the engraving "Elevatio Poli 411/2" (probably for usage in Valladolid), and on the other side is engraved "Elevatio Poli 40" (probably for usage in Toledo). Both faces show altitude circles for each 2˚ and both have "Horizon obliquus" engraved below the middle of the horizon. At the very bottom, close to the circle of the Tropic of Capricorn, we read "Circvli Positionvm" on both plates. There are no azimuth curves other than the prime vertical, which joins the east and west point through the zenith. Below the oblique horizon is a division of astrological houses numbered in Roman numerals from I to VII.[16] Because these curves are engraved for each tenth of a house, it looks as if they belonged to the same family as the altitude circles north of the oblique horizon. This apparent confusion is a particular feature of ab Aggere, which we will also encounter

[16] On such markings see North, *Horoscopes and History*, 1-8.

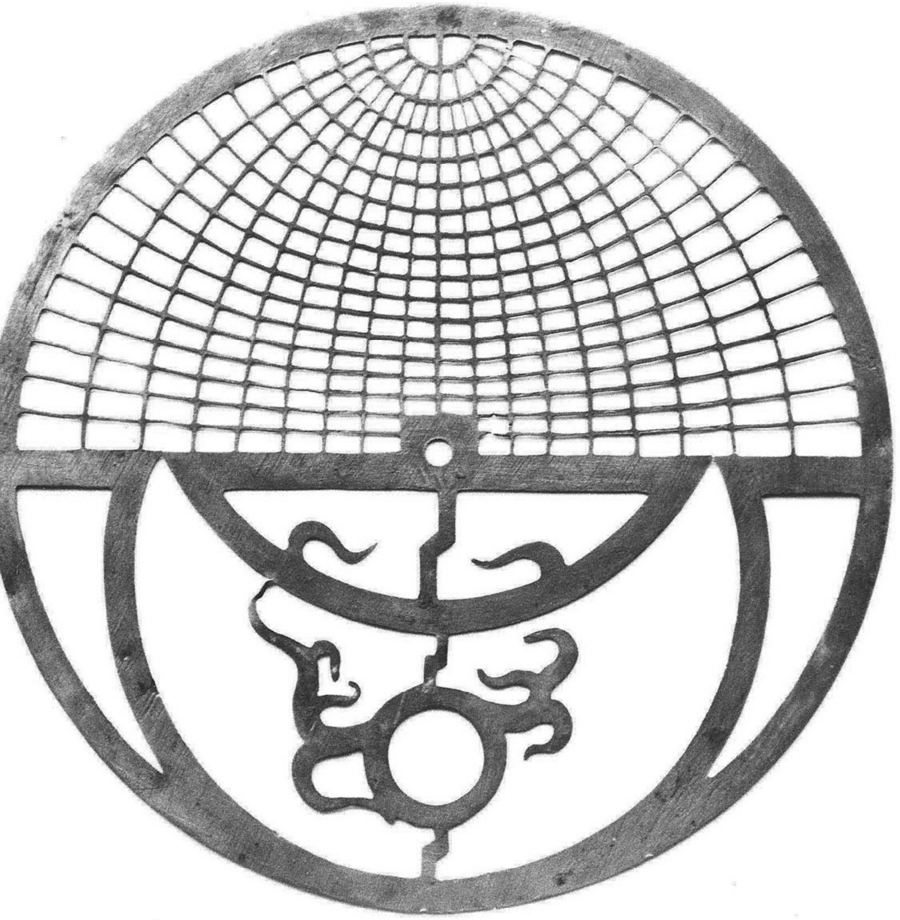


Figure 8: Petrus ab Aggere (attributed), rete with universal projection and folded ecliptic. (Madrid, Museo Nacional de Ciencia y Tecnologia)

on his re-engraved part of the Philip II astrolabes (which are discussed below). The inside of the mater is engraved with a *quadratum nauticum,* which displays a mixture of geographical terms in Latin ("Latitudo minor…, Latitudo maior…") and directions in old Castilian ("Norte, Sur, Leste, Oeste, …."). The unnumbered scale of the *quadratum nauticum* is divided only up to ten degrees.[17]

Astrolabes with retes on either sides are unrecorded, which makes this exem-

[17] Louvain astrolabes were also commonly engraved with a *quadratum nauticum*, invented by Mercator and Frisius, who included a diagram in his posthumously published *De Astrolabo [sic] Catholico*, 1556. For an illustration see Gunther, *Astrolabes,* 390.

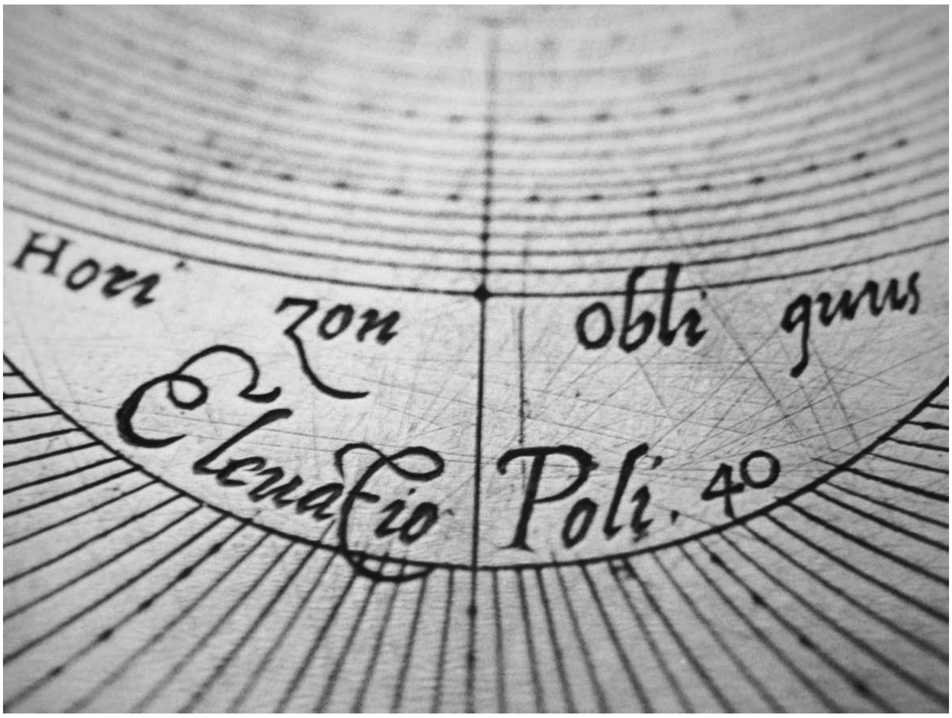


Figure 9: Petrus ab Aggere (attributed), latitude plate. (Madrid, Museo Nacional de Ciencia y Tecnologia)

plar unique, despite its incomplete state of preservation. Astrolabes with superimposed universal projections featuring a perforated rete with a universal projection are also extremely rare. In fact, apart from the one at hand, only three others are known. The first was made in Aleppo by Ibn al-Sarraj in 1328 and is now held at the Benaki Museum of Athens.[18] The second is an anonymous English instrument, datable to around 1609 and now kept at the Adler Planetarium, Chicago.[19] The third is similar to the second; it was made by Charles Whitwell in the late 16th century and is now kept at the Istituto e Museo di Storia della Scienza, Florence.[20]

The inspiration for the early Syrian instrument comes from the *Libros del Saber*, whereas both English astrolabes may be associated with *The Mathematical Jewel*, a treatise written by the English mathematician John Blagrave in 1584. The Madrid astrolabe is unrelated to the two English astrolabes, despite its chronological vicinity. It is tempting to assume that ab Aggere, in his function as court

[18] *Ibidem*, 340.
[19] Webster, *Western Astrolabes*.
[20] Turner, *Elizabethan Instrument Makers*, 187-90, n° 43.

mathematician, became acquainted in a general way with the medieval Arabic astronomical tradition and in particular the *Libros del Saber*. It is, however, also possible that he already knew about these projections from his time in Flanders, not through medieval instruments with such complex projections but through printed books. Indeed, in Louvain the school around Gemma Frisius had taken a particular interest in universal projections, an interest that had resulted in publications and instruments with stereographic and orthographic projections, among others.[21]

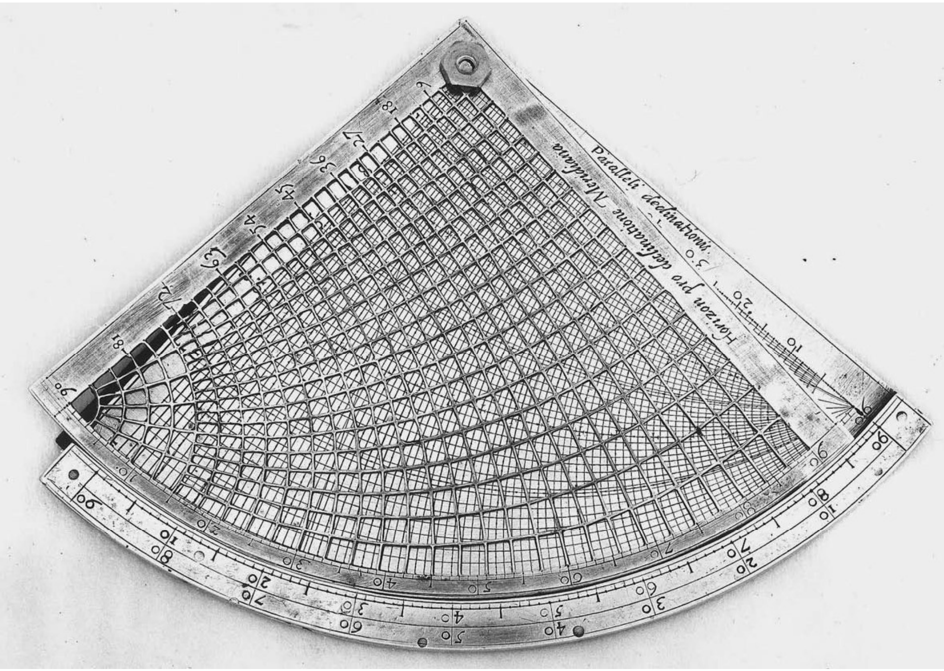


Figure 10: Petrus ab Aggere (attributed), universal astrolabic quadrant. (Chicago, Adler Planetarium, inv. A-108)

2. Chicago quadrant

The attribution of the Madrid astrolabe to ab Aggere also leads to the attribution to ab Aggere of the astrolabic quadrant at Chicago's Adler Planetarium (Figure 10).[22] The similarities between both instruments were noticed already in 1999,

[21] Madisson, "Hugo Helt," 7-11.

[22] Described without attribution, and illustrated in Webster, *ibidem,* n° 36 and Van Cleempoel, *Instrumentos cientificos,* 191-92.

but no attribution seemed possible then.[23] The instrument has intrigued historians a great deal because of its complex system of projections and its particularly fine execution. The projections here, as on the previous astrolabes we have examined, are inspired by those proposed by Ali ibn Khalaf. On the front there is a rete with the ecliptic as two superimposed projections, fitting within the quadrant (Figure 11). There are pointers for the following named stars: *Caput Draco, Hircus, Rostrum corvi, Caudacygni, Lyra, Spica, Caudaceti*. The straps of the ecliptic are engraved for single degrees and marked with the symbols of the corresponding zodiacal signs. The quarter circle on the periphery is also graduated for single degrees and numbered every 10˚ from 0 to 90. The rete can rotate over a set of astrolabic markings for 0˚ with altitude and azimuth markings for each 2˚. This combination would have allowed the user to find declinations on the meridian axis and on the right ascension on the outer scale.

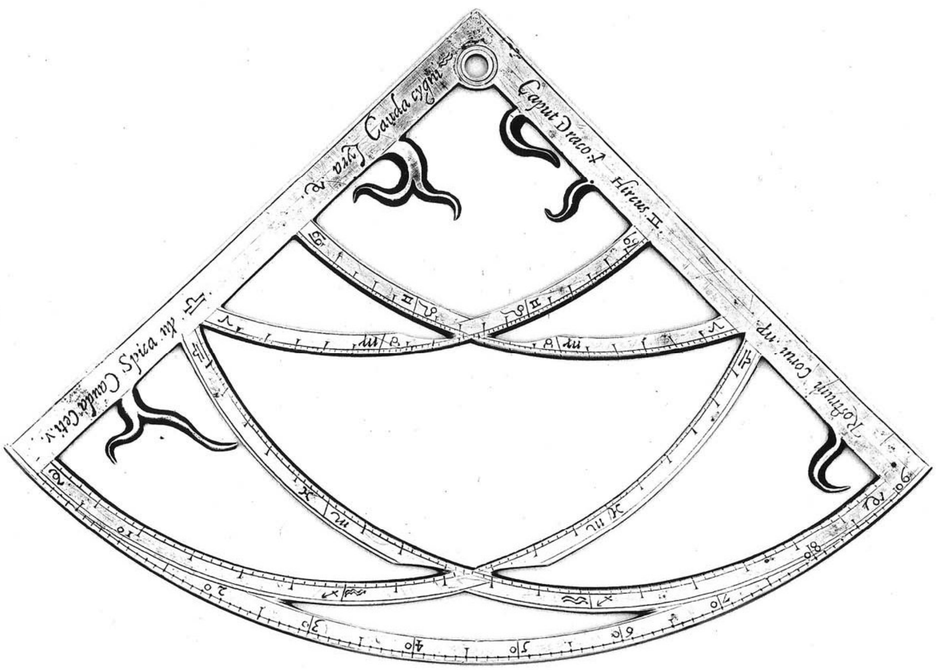


Figure 11: Petrus ab Aggere (attributed), universal astrolabic quadrant. (Chicago, Adler Planetarium, inv. A-108)

The reverse is engraved with a quarter of a universal projection with parallels for each degree, numbered every 10˚ (Figure 10). The curves for antemeridian and

[23] Moreno e.a., "Recently Discovered," 344.

postmeridian hours are singled out with small stamped arrows. They are numbered on the equator in Arabic numerals over two rows from 1 to 5 and then from 7 to 12, with the position of number 6 coinciding with the fixing hole for the rete. For this reason the number 6 has not been engraved. Like the Madrid instrument, this one also has a perforated rete, which displays a universal projection with altitude circles for each 5° and azimuth circles for each 10°.

The quadrant, too, resembles that of the Madrid astrolabe, possessing modest dimensions (87 mm) and a sober style of execution. Besides the projections, the numbers, and some few labels, there are no further engravings. It seems that during construction all attention went to a correct execution of the elaborate projections as well as the fine craftsmanship, notably of the perforated rete.

3. Philip II astrolabe

The so-called Philip II astrolabe was executed by Gualterus Arsenius in 1566 in Louvain. With a diameter of 600 mm, it is the sixteenth-century's second largest known astrolabe. Its association with Philip II comes from the inscription "Filippo Rege" on the front of the throne. The Museo Arqueológico in Madrid acquired it in 1856, and its first descriptions later in that century strongly emphasized its alleged royal provenance.[24] This romantic affiliation maintained its attraction until recent research revealed the insertion of the inscription to have been added shortly before 1856 in order to raise the price during the negotiation process.[25]

Garcia Franco's masterly survey of Spanish astrolabes (1945) first noticed a chronological anomaly on the engraved ecliptic inside the rete of the 'Philip II astrolabe': the signature gives the date of 1566, but the vernal point is 11 March, indicating that the calendar already adapts the effect of the Gregorian calendar reform of 1582. Before then, the vernal point coincided with 21 March.[26] Franco's hypothesis was that the rete had been adapted to the reform after 1582. But a detailed examination of the ecliptic reveals that only the engraving on the circular band of the ecliptic was erased and re-engraved.[27] This includes the calendar, zodiac, and the star names on the cartouches positioned on the inside of the ecliptic. Some marks of the original Gualterus Arsenius engravings are still visible. On the position of '10' March, for example, there are traces of a number '2', as 20 was

24 Janer, "El astrolabio de Felipe II"; Saavedra, "Astrolabe Belge."
25 Mañueco, "Nuevos datos."
26 García Franco, *Catálogo*, 202.
27 Van Cleempoel, "El 'astrolabio de Felipe II'."

replaced by 10.[28] A consequence of the reform was, indeed, the elimination of ten days, so that 20 March became 10 March.

One side of the two plates has also been re-engraved for the latitude of 40°30', corresponding to the location of the royal palace, El Escorial. There are also faint traces of Gualterus Arsenius' older lettering, but it is not possible to read the original latitude. A striking feature is the organization of the engraved curves, which differs conspicuously from the other sides. Indeed, they differ form the typical Gualterus Arsenius lay-out in that the arcs of the astrological houses completely occupy the area below the oblique horizon, an organization that is similar to that of the Madrid astrolabe. As with the latter, there is the same sense of confusion between the cups and the altitude circles.

The style of engraving of this plate is the same as that of the re-engraved calendar. There is also a relationship between the actions: the re-engraved plate shows a strong emphasis on astrology, which, in turn, requires a correct calendrical/zodiacal scale. As yet, it was not possible to associate these re-engraved parts with a particular maker, but I suggest that it was Petrus ab Aggere on the basis of engraving style as well as the shapes of the zodiacal symbols, which correspond closely to the Madrid-astrolabe and the Chicago-quadrant discussed above. The peculiar arrangement of the cusps of the astrological houses in combination with the almucanters below the horizon can also be considered as a 'signature', since no other maker applied this scheme.

Ab Aggere adjusted this important Arsenius astrolabe after 1582 to the reformed calendar and re-engraved one plate for astrological calculations on the latitude of El Escorial.

Conclusion

The group of instruments presented here allows us to recognize in ab Aggere an important and original instrument maker. First of all, we have seen a telling sequence of dates and place names on the signed instruments: 1558, Brussels; 1560, Toledo; and 1562, Madrid. These dates and places correspond to the location of the Spanish court under Philip II, who in 1556 succeeded his father Charles V at Brussels. The close ties between the Brussels-based court and the emerging Louvain School around 1540 has been the subject of earlier research.[29] Mercator made most of his instruments for Charles V and Nicolas de Granvelle. Up to 1558,

28 Illustrated in detail in Van Cleempoel, *Catalogue Raisonné*, 141.

29 Van Cleempoel, "Los tres astrolabios," 125-35. See also the description of an early Arsenius astrolabe by the same author in Checa, *Felipe II,* 681-82.

Gualterus Arsenius also made his earlier instruments for members of the Spanish aristocracy. In 1556, for example, he made an astrolabe with the Hapsburg and Tudor coats of arms on the throne, referring to the marriage of Prince Philip and Princess Maria Tudor in 1554.

It appears that Petrus ab Aggere worked for the Spanish court in Brussels at the latest by 1558. In August 1559, Philip II moved his court to Toledo, from where it subsequently moved to Madrid in 1561. Ab Aggere's signatures follow this progressive journey faithfully, thereby presenting strong contextual evidence that he formed part of court life as its royal *mathematicus*.

This evidence adds up to an interesting profile of emigration as well as of the traveling of 'materialized knowledge' in the person of Ab Aggere. The latter refers to knowledge that is needed to make instruments, such as engraving skills for projections and lettering, applied mathematical and astronomical knowledge, and the actual craft of manipulating and joining brass into a workable instrument. The story becomes even more fascinating once we take into consideration the two important unsigned instruments. They place ab Aggere into the Islamic tradition of astronomical research into methods of universal projection. Already in Louvain, Gemma Frisius started to research the medieval variations on the universal projection. He revived the projection of the eleventh century Toledo astronomer Ibn al-Zarqallu that is found on the back of almost all Gualterus Arsenius' Louvain astrolabes. Ab Aggere continues this fascination for universal projection and revives the one of Ali ibn Khalaf, equally active in eleventh century Andalusia. Despite the fact that it is not possible to decide between two possible circuits of circulation – ab Aggere discovered this projection upon his arrival in Spain or he already knew of it through his contacts in Louvain – it is still meaningful that he revived such a complex mathematical application in the country of its origins.

The attribution of these two unsigned instruments is possible thanks to similarities in construction details, but especially on the basis of the style of engraving and notably of the symbols of the zodiac, the numbers, the way in which the scale divisions were organized, and the general style of the lettering. But there is an important nuance: the style of engraving of the Madrid astrolabe, the Chicago quadrant, and the Philip II astrolabe differs slightly from that of the earlier instruments. This has hindered previous attempts at associating these instruments with ab Aggere. The liberating clue came with the discovery of the Spanish writing manual by Andres Brun (°1552), a calligrapher from Saragossa (Figure 12). His *Arte muy provecho sopara aprender de escrivir perfectamente* (1583) shows a style of cursive lettering that corresponds quite closely to that used on the astrolabe.[30] The

[30] Osley, "Andres Brun," 179-81.

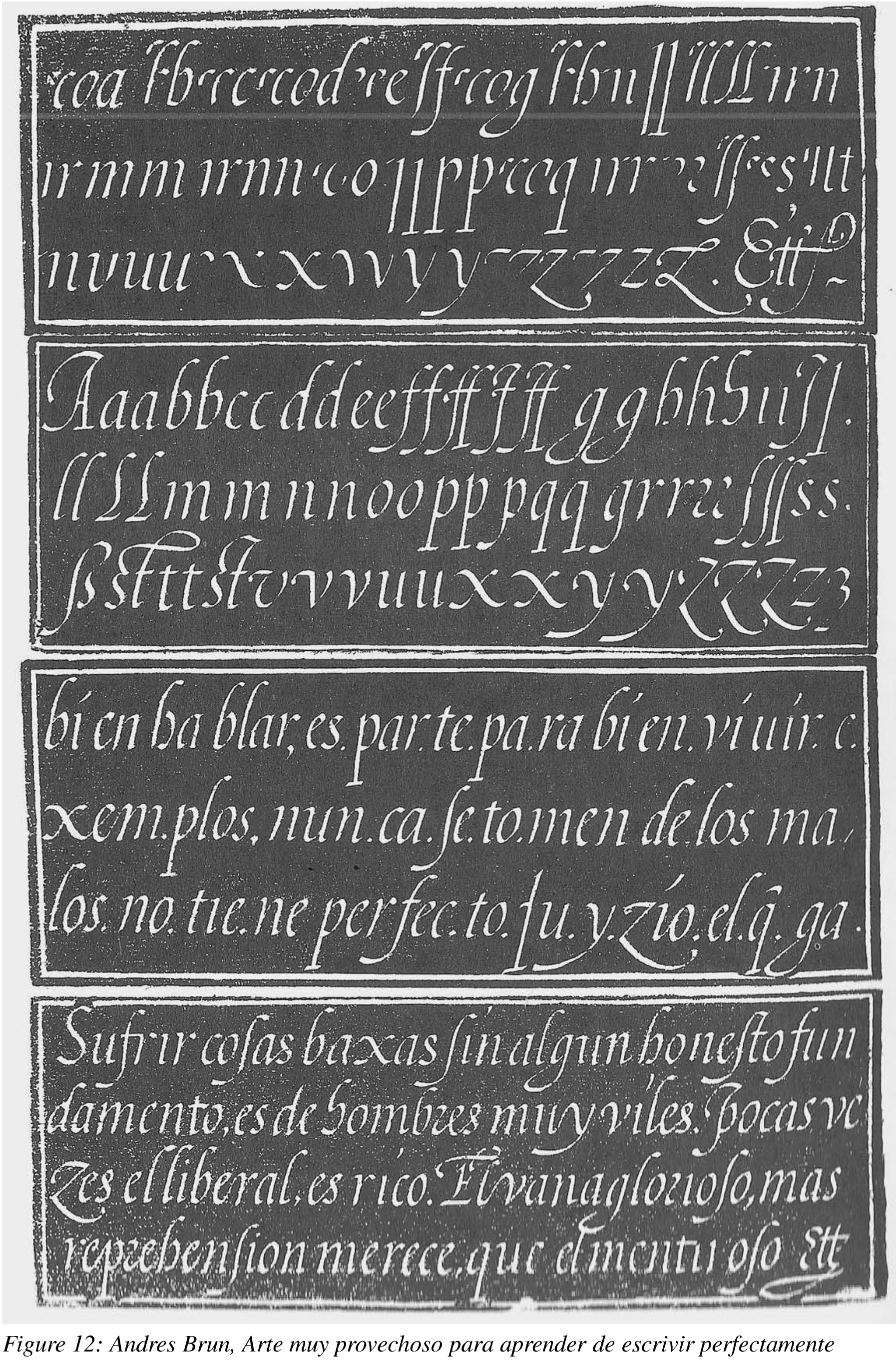


Figure 12: Andres Brun, Arte muy provechoso para aprender de escrivir perfectamente (Saragossa, 1583).

letters are more elongated and fluent than Mercator's, and they also end in longer and thicker serifs. As one might have assumed, ab Aggere adapted his style of engraving to local tastes and fashions and no longer took Mercator's letters as his sole reference. Still, his style of engraving zodiacal symbols remained very much the same.

As yet it has not been possible to ascertain ab Aggere's involvement in the establishment of the *Academia de Mathemáticas* in Madrid in 1584 by Philip II and Juan de Herrera.[31] It is clear though that his typology of instruments influenced other makers, such as Juan Cocart, Hieronymus de Arresse, and Juan del Pozo, all of whom made sundials very similar to those by ab Aggere.[32] The latter may thus be considered the first Spanish instrument maker of the Renaissance and therefore, somehow, the founder of a Spanish school of instrument making.

31 There is no reference to Ab Aggere in Maroto e.a., *Aspectos de la ciencia aplicada*.

32 All are described in illustrated in Van Cleempoel, *Instrumentos cientificos.*

Moving around the Ellipse. Conic Sections in Leiden, 1620-1660

Fokko Jan Dijksterhuis

In the eighth discourse of *La Dioptrique* (1637), René Descartes described the ideal shape of a lense in order to bring light rays to a point of focus: elliptic and hyperbolic. He did not want to bother his readers with difficult geometry as lens makers usually knew only elementary mathematics, thus introducing a practical and more intelligible method of drawing them:

> The ellipse or oval is a line that the mathematicians are accustomed to expose to us by cutting through a cone or cylinder, and that I have also seen sometimes employed by the gardeners in the compartments of their parterres, where they describe them in a fashion that is veritably very gross and little exact, but that makes, it seems to me, more comprehensible its nature than the section of the cylinder or of the cone.[1]

They would plant, Descartes explained, two pegs in the ground and pass a cord HIB around them (Figure 1). Then conducting a stylus around an ellipse, DBKV was drawn. This practical method differed greatly from the way mathematicians conceived of an ellipse. In Apollonius' *Conics* (around 200 B.C.E.), the ellipse was defined as a conic section, along with the hyperbola and parabola: curves produced by the intersection of a plane and a solid cone (Figure 2). Although more exact, Descartes did not want to burden his readers with the intricacies of

[1] Descartes, *La Dioptrique* (Leiden, 1637), 89-90. "L'Ellipse ou l'Ovale est une ligne courbe que les Mathematiciens ont accoustumé de nous exposer encoupant de travers un Cone ou un Cylindre, & que j'ay vu aussi quelquefois employer par des Jardiniers dans les compartimens de leurs parterres, où ils la descrivent d'une façon qui eft veritablement fort grossiere & peu exacte, mais qui fait, ce me femble, mieux comprendre fa nature, que la section du Cylindre ni du Cone. Ils plantent en terre duex picquets, comme par exemple l'un au point H, l'autre au point I, & ayant noüé ensemble les deux bouts d'une corde ils la passent autour d'eux, en la façon que vous voyés icy BHI. Puis mettant le bout du doigt en cette corde, ils le conduisent tout autour de ces deux picquets, en la tirant tousiours a eux d'esgale force, afin de la tenir tendue esgalement, & ainsi descrivent sur la terre la ligne courbe DBK, qui est une Ellipse."

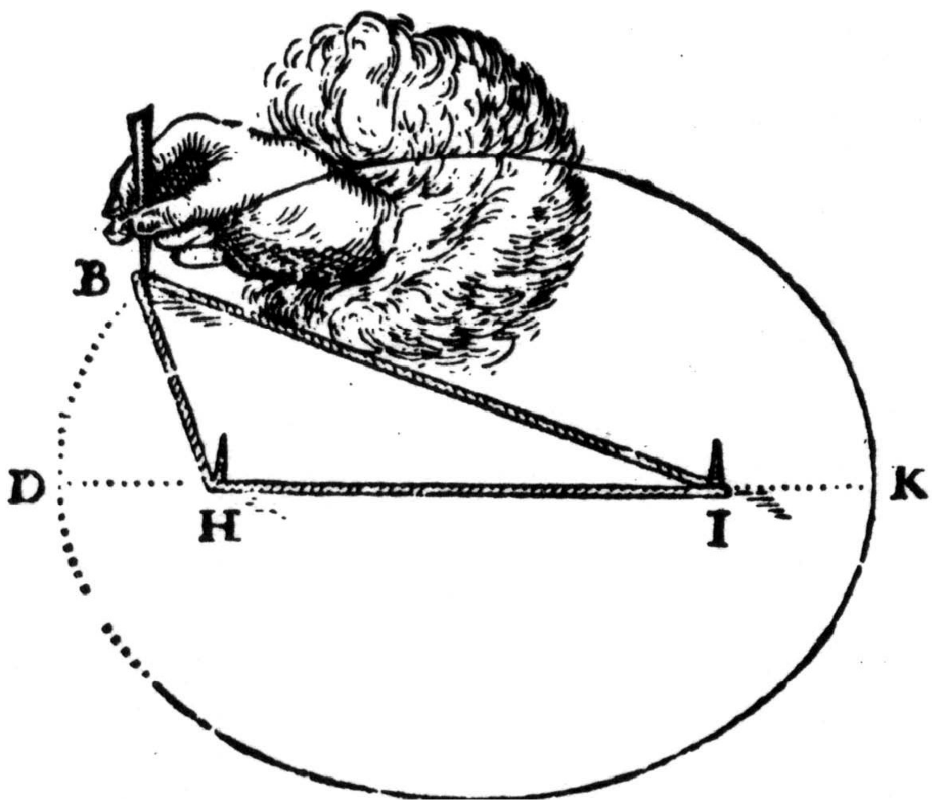


Figure 1: Gardener's ellipse in Descartes' La Dioptrique.

solid geometry and instead offered them an easier method of drawing an ellipse in the plane, and one more suited to their particular needs.

The gardener's ellipse has become a bit of an icon of seventeenth-century mathematics. It illustrates Descartes' new geometry, its application in lens design, and the manner in which he made his mathematical finds accessible to artisans. Most important, it presents an elegant and illuminating pictorial representation. The actual woodcut in *La Dioptrique* was made by Frans van Schooten Jr. (1615-1660), then an aspiring student of mathematics in Leiden. Van Schooten, however, did not merely draw the picture; he considered the gardener's ellipse an original contribution of his to Descartes' mathematics. He had been involved in the preparation of *Discours de la Méthode* and its essays, reading and commenting on the manuscript. In his comments on *La Géométrie* we find a sketch of the gardener's ellipse and a remark that he invented it (Figure 3).

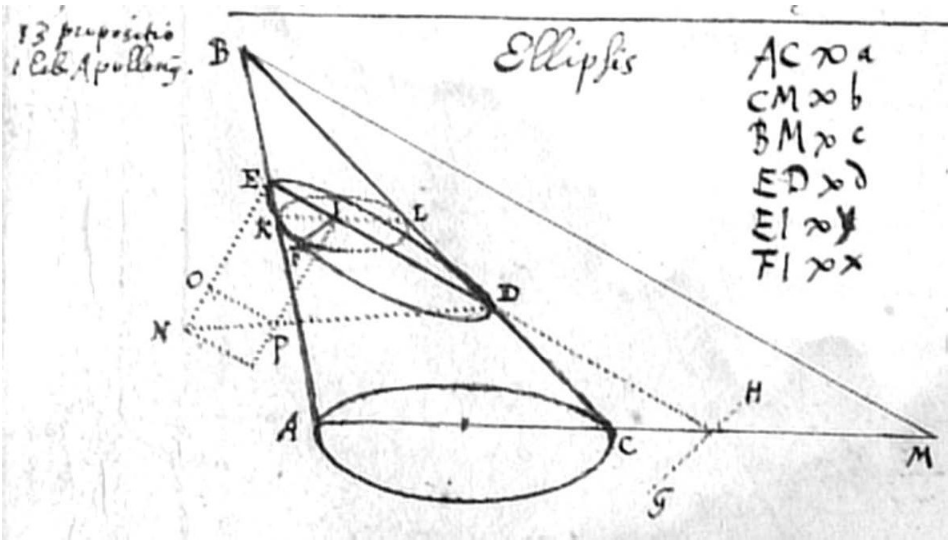


Figure 2: Ellipse as conic section, as drawn by Van Schooten. (University of Groningen, MS 108 fol. 93v)

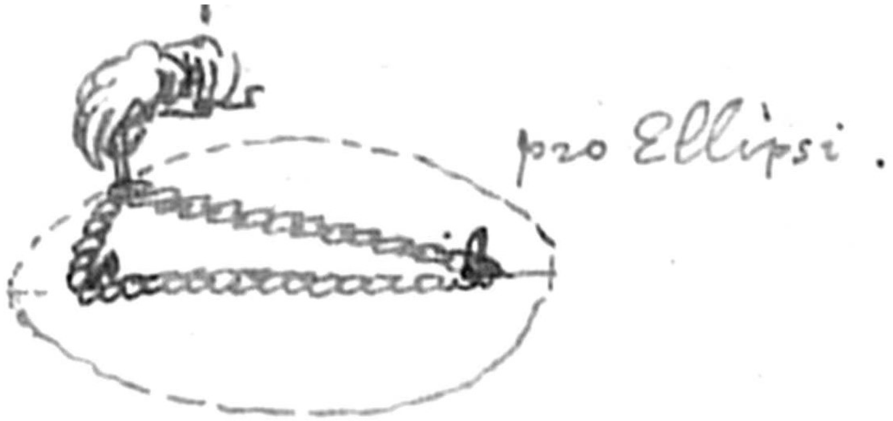


Figure 3: Gardener's ellipse in Van Schooten's notes to Descartes' La Géométrie. (University of Groningen, MS 108 fol. 13v)

The gardener's ellipse became a recurring topic in van Schooten's oeuvre. In his own *Organica* of 1646, it figures in a collection of instruments for drawing ellipses, hyperbolas and parabolas (Figure 4). These representations of the gardener's ellipse mark out van Schooten's career as a young student of mathematics who became involved in the learned enterprise of one of Holland's most important patrons, going on to become a professor at Leiden University. This is a trademark

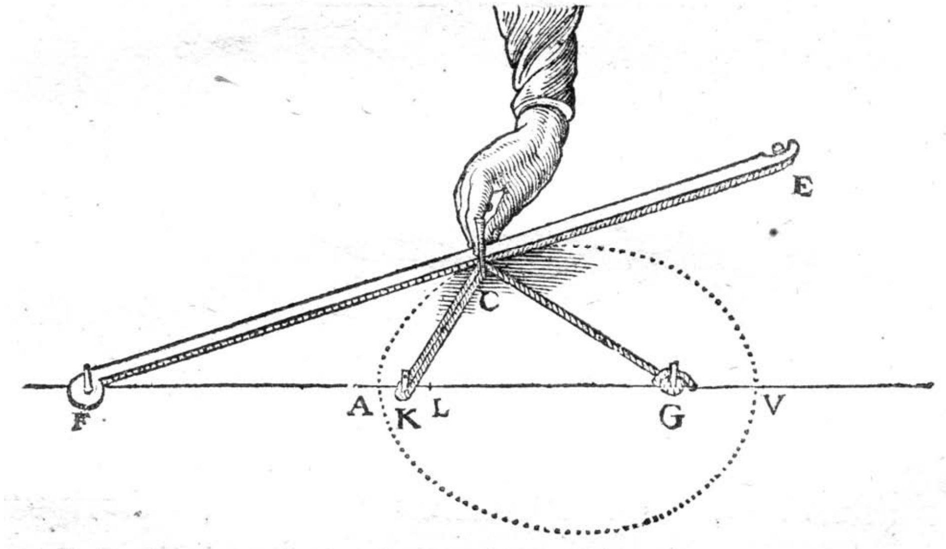


Figure 4: Gardener's ellipse in Van Schooten's Organica.

of his mathematics in which he developed a 'kinematic' approach to geometrical curves. Furthermore, the gardener's ellipses are exemplary of the particular way in which he combined three previously distinct worlds of mathematics: the classical geometry of the Greek, the new 'géométrie' from France, and the 'Duytsche Mathematique' of the Leiden engineering school.

Van Schooten encountered these different approaches to mathematics in his years of apprenticeship during the 1630s and early 1640s. His father Frans van Schooten Sr. (1581/2-1646) was the professor of 'Duytsche Mathematique', the program of mathematics in the vernacular aimed at training fortificationists. The other chair of mathematics at Leiden University was held by Jacobus Golius (1596-1667), who in addition held the chair of Arabic. Golius was a renowned philologist, uncovering classical sources in mathematics from the Arab world. He had personally brought to Leiden an Arabic manuscript containing the most original and complete version of Apollonius' *Conics*. Van Schooten studied under both his father and Golius, being initiated into the engineering mathematics of the 'Duytsche Mathematique' and the geometry of classical texts respectively. He knew the classical conception of conic sections at first hand, and during his subsequent involvement in savant circles in Holland and France, expanded his range in mathematics to include the new geometry of Descartes and other French 'géomètres'. Combining these worlds of mathematics, he succeeded in creating an approach to mathematics in which the generation of curves by continuous motion was a centrepiece. In the *Organica* of 1646 he elaborated a particular conception of conic sections that integrated artisanal curve drawing and geometrical analysis.

The central aim of this paper is to ascertain, firstly, how these various mathematical styles came to Leiden and, following this, how they were appropriated there. It traces the journeys of Van Schooten through various circles of mathematicians and describes Golius's acquisition of the Apollonius manuscript. Not only will this discussion necessitate an exploration of the central figures involved in the transfer of texts from the Arab world to Leiden, but also a look into the underlying structures that allowed this to take place. Mathematicians corresponded and exchanged letters, papers and ideas, and travelled to various geographical locations, meeting other mathematicians, scholars, businessmen and notables.

They moved through various cultural and social circles, taking with them treasures of all kinds: manuscripts, letters and artifacts that were bought and traded, sent and taken, copied and published, but also immaterial things, ideas, exchanged in writing, reading, conversation. Golius and van Schooten found various approaches to mathematics in the places they visited, appropriated them, reshaped, combined and reconfigured them in such a way that mathematical styles acquired new meanings that went beyond their original local values. This paper gives particular attention to the cultural, social and intellectual conditions that enabled Golius and van Schooten to travel, to meet fellow mathematicians and appropriate valued mathematical insights. Circulation of mathematical knowledge was embedded within broader structures of relations and exchanges, like the social stratification in Holland's cities, networks of learning in the Dutch republic as well as international diplomatic and trade interests in the Maghreb and the Levant. It is in light of this background that the movements of Golius and van Schooten are discussed.[2]

The first part of this paper tells the story of Golius' acquisition of the Apollonius manuscripts, starting from a broad perspective on Arabic learning in general and Dutch affairs in the Maghreb and the Levant, gradually closing in on Golius' travels and his homecoming in the 1620s. The mathematical discovery of the ellipse in the *Conics* is one chapter in the larger story of the philological acquisition and processing of Arabic texts at Leiden. The second part focuses in greater detail on the ellipse itself, following van Schooten's interactions between 1630 and 1645 within various mathematical circles in Leiden, Holland and France, arriving at an analysis of van Schooten's treatment of conic sections in the *Organica*. Finally, this paper briefly indicates how van Schooten's mathematics was taken up by his pupils in Holland. The ellipse – like mathematics in general – had differing manifestations, each with its own narrative and its own dynamics of circulation.

2 On circulation see Secord, "Knowledge in Transit."

Both Golius and van Schooten have been largely overlooked in the history of science. Golius is primarily known having brought to the attention of Mersenne and Descartes the primacy of Snellius over Descartes in the discovery of the sine law. His own mathematical activities, however, have hardly been discussed, despite the fact that he was an important link in the academic pursuit of mathematics in early seventeenth century Holland. Likewise, van Schooten is known as a translator of Descartes' *La Géométrie* and as the teacher of Christiaan Huygens and others. His own mathematical achievements have not been studied in any great detail. Nonetheless, he was a crucial figure in the reception of Descartes and in the mathematics of the Dutch republic. The *Organica* in particular has never been thought to warrant serious discussion – except in relation to its mention of instruments – although it is key to van Schooten's mathematical curriculum. This chapter offers a first study of Golius and van Schooten as mathematicians giving shape to mathematical knowledge in the Dutch Republic.

The Conics and Arabic Learning

In September 1627, in Aleppo, Jacobus Golius acquired a manuscript of Apollonius' *Conics*. It was just one result, albeit an important one, of a quest for Arabic manuscripts that had brought him to the Maghreb and the Levant in the course of the 1620s. Golius was but one member, however, of a larger community of Arabists in Leiden and other European centres of learning. In order to understand what brought Golius to Aleppo and Apollonius back to Leiden, a brief sketch of the cultivation of Arabic studies in Europe is necessary.

Study of Apollonius' *Conics* was an integral part of the Renaissance of learning that was expanded to Arabic and other Eastern languages in the late sixteenth century. The *Conics* is a prime example of a philological challenge in that only four of its eight books survived in Greek, spurring scholars not only to study and translate the remaining text but also to try and reconstruct the missing volumes, as well other works of Apollonius. François Viète and Pierre de Fermat, whose papers van Schooten collected during his journey to France in the 1640s, made notable reconstructions as well as new contributions, using the renovated texts as a starting point. Van Schooten himself published a reconstruction of Apollonius' *Plane Loci* in 1656, while Willebrord Snellius, professor of mathematics in Leiden and teacher of Golius, published reconstructions of three of Apollonius' works in 1607 and 1608. In the meantime, the lost books of the *Conics* had been found to have survived in Arabic. A first Arabic manuscript of the *Conics* that included three of the lost books was present in Rome in 1577. This started a quest to find and study Arabic manuscripts. The recovery of the *Conics* was a philological affair embedded within the general agenda of Arabic studies and all the men involved in recovering the *Conics* were at the same time busy retrieving textual and other sources of theology, history, literature, astronomy, metrology and medicine.[3]

The Levant was considered the cradle of wisdom and a command of Arabic was the means to unearthing these treasures. In the early seventeenth century Leiden became a leader among institutions dealing with Arabic studies and in the final decades of the sixteenth century Franciscus Raphelengius and Justus Scaliger laid the foundations for the work of Thomas Erpenius and Jacobus Golius. In 1599 the university board appointed Philippus Ferdinandus to teach Arabic, making him professor in 1600. Ferdinandus died in 1601 and the chair remained vacant for more than ten years until February 1613, at which time Erpenius was appointed. He had recently returned to Holland with a full command of Arabic and he had powerful supporters. Erpenius' grammar of 1613 became the standard for two centuries and Golius' lexicon of 1653 likewise remained key to Arabic studies until the nineteenth century. Erpenius and Golius amassed an important collection of Arabic manuscripts that transformed Leiden into an important centre of Arabic scholarship.[4]

The flourishing of Arabic learning in Leiden was as much a scholarly as a political and economic affair. The study of eastern scriptural sources perfectly fitted Leiden University's religious goals of Calvinist reinforcement, Islam even being seen as an ideological ally in the fight against Spanish papism. The establishment of Arabic studies coincided with the establishment of trade relations with the Levant. In the early decades of the seventeenth century the Republic extended its trade network: in the North towards Russia and in the South, through the Strait

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3 On Apollonius's works, see Toomer, *Apollonius,* Conics, xx-xxi. In the *Collection* Pappos listed the works of Apollonius of which only the first four books of the *Conics* survived in Greek. Latin translations of book I-VI were published by Memmo in 1537 and, mathematically and philologically much improved, by Commandino in 1566. Maurolico's *Emendatio et restitutio conicorum Apollonii Pergaei* was published only a century later in 1654. On Snellius's apollonian works, see Wreede, *Snellius*, 53-61. The Apollonius treatises were 'Cutting off of a Ratio', 'Cutting off of an Area', and 'Determinate Section'.

4 On the motives of Arabic philology, see Hamilton, "Introduction," 4. On early Arabic studies at Leiden university, see Juynboll, *Beoefenaars*, 36-58 and Toomer, *Eastern Wisedome*, 45-52. Raphelengius was a son-in-law of Christoffel Plantijn and had been involved in the printing of the Plantijn Polyglot Bible (1568-1572). He moved to Leiden in 1585 where he set up his own branch of the Plantijn Press and became professor of Hebrew. Erpenius passed over Jan Theunisz, who had received permission to teach Arabic in 1612. He was an Amsterdam innkeeper and had learned Arabic from the Morrocan ambassador and did not become professor because of his lack of command of Latin and his Mennonist creed.

of Gibraltar, into the Mediterranean, as well as to the West and East Indies. The circumstances in the Mediterranean, with the threat of Spain, piracy, and Ottoman power, required the focused attention of the Republic, and the setting up of trade relations called for active diplomacy with the Ottoman Empire. During the Twelve Year Truce (1609-1621) trade and friendship treaties with both Morocco and the Ottoman Empire were signed, embassies were exchanged and missions went to and fro between the Republic and the Maghreb and the Levant, all of which required a high level of linguistic skill. Erpenius had already proven his value in this regard when he translated a letter from Morocco for Stadholder Maurits in 1609, which probably increased his chances of acquiring the chair in Leiden. In the early seventeenth century a network of intellectual, ideological, political and commercial interests developed in which Leiden was a central node. It facilitated the travel of people and objects to and from the East in order to acquire the language and relevant textual sources as well as promoting the learning and dissemination of skills and knowledge regarding the language, the sources and their historical and cultural contexts. The university board was aware of the societal significance of Arabic learning and in their deliberations over the chair, commercial interests of teaching Arabic were explicitly mentioned.[5]

Arabic learning in Leiden in general, combined with the Republic's political and economical interests, added an impetus to Golius' pursuit of Arabic studies in particular. In the 1620s he made two journeys, to the Maghreb and the Levant, acting in the official capacity as a diplomat, during which he developed his command of Arabic and collected a wealth of texts and data. The next two sections describe these journeys and show the interconnectedness of Golius' official and scholarly interests, helping to explain the dynamics of exchange between Holland and the Arab world that eventually brought the *Conics* to Leiden.

Transfers with whe Maghreb

Jacob Gool, taking the Latin form Jacobus Golius, was born in The Hague in 1596. He came from a family of administrators in Leiden, and his father served the Raad van State (privy council) in The Hague. In 1612 he moved to Leiden to study mathematics with Snellius and in all likelihood studied under Frans van Schooten

[5] On Dutch attitudes towards the Arab world, see Wiegers, "De Nederlanden en de islam," 142-143. On Dutch trade and diplomacy with the Arab world, see Vries, *Nederland*, 442-448 and also Wiegers, *A Learned Muslim*, 11. On the decision of the university board, see Molhuysen, *Bronnen*, Vol. 1, 121: "... dat de ingesetenen deser landen, mits de Oost-Indische scipvaert genegen sullen sijn die Arabische spraecke, die aldaer veel gebruyct wort, te leeren, ... "

Sr. too. After completing his studies in 1616 defending a disputation *De natura visus,* Golius lived for a few years on his father's estate in Naaldwijk to pursue private studies of classical scholars, including Apollonius. In 1618, he returned to Leiden University to study Arabic where he became a student of Erpenius and a close friendship developed between the two men.[6]

In 1622 Golius got the opportunity to travel to the Maghreb. At the request of sultan Mulay Zaydân a delegation from the States General, under the leadership of Albert Ruyl, set sail for Morocco. Mulay Zaydân wanted a new harbour built in the Bay of Aïer at the north-west coast of Morocco and asked the Dutch for help, offering them privileged access to the harbour and a concession of saltpeter production. The Bay of Aïer lay in a rebellious part of Morocco and its very discovery was the result of a military expedition the monarch had sent there. In fact, Mulay Zaydân had already tried to get something of the ground, but to no avail. He was particularly keen on an alliance with the Dutch as his brother, with whom he was engaged in a civil war, had collaborated with the Spanish. The Dutch, however, had to negotiate carefully and secretly as the 1609 truce forbade any hostile action against Spain. Golius was assigned to the delegation as an engineer with the task of mapping the proposed location and of assessing the feasibility of the project. Reporting to the States General, Golius concluded that the Bay of Aïer was unsuitable for a harbour. Describing it in detail he explained that the entrance was shallow and blocked by several obstacles and the currents unfavourable to ships attempting to leave the bay. Adding a map to illustrate his argument, Golius concluded that even if a suitable harbour were constructed, "it seems nonetheless that [such a harbour] would redound to no benefit of the common good, because the trade with Barbaria would not be aided nor enlarged thereby, … ."[7] Golius also served the delegation as a diplomatic intermediary, as his command of Arabic enabled him to carry out the delegation's correspondence with the royal court. Evidently, Golius did an excellent job, and a missive he wrote for Ruyl was admired for its style and calligraphy.[8]

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6 On the life of Golius, see Juynboll, *Beoefenaars*, 119-124.

7 Golius, "Verbael, dienende by de teyckeninge van 't gatt van Eyir, gelegen op de westcuste van Barbarie," 24 Julij 1624 (Rijksarchief Staten Generaal, 7106). Published (with a French translation) in Castries, *Sources*, 1-III, 578-585; quotation on 584. "Ende ofte alschoon deselvige haven tot alle bequaemheyt te accommoderen ware, soo schynt nochtans, dat hetselvige tot geen voirdeel van 't gemeene beste soude konnen redonderen, want de negotie op Barbarie soude daerby nyet meer kunnen geholpen nochte geaugmenteert werden, alsoo deselvige op de reden jegenwoordich soo sterck gedreven wert, als den staet ende de middelen van 't selvige lant vereyschen ende konnen lyden." Golius received '96 pond van 40 grooten' in reward: Castries, *Sources*, 1-IV, 129.

8 On the background of the mission, see Castries, *Sources*, 1-III, 216 and Heeringa, "Bond-

Golius served the mission and the mission served him. He used his stay in Morocco to improve his learning and collect scholarly goods. He had ample opportunity to do so as the whole journey lasted much longer than expected, partly because the delegation was delayed by opposing forces at the royal court. They had to stay more than half a year in the coastal town of Safi before they could continue to Marrakesh and have an audience with Mulay Zaydân. Golius used this time to extend his command of Arabic, study local customs and scholarship and establish relationships with local scholars, and through the diplomatic contacts of the delegation, he introduced himself as a man of (Arabic) letters to the monarch and his courtiers.[9]

The Marrakesh court spokesman played a key role in Golius' success. Ahmad ben Kâsim (born ca. 1570) had scholarly interests of his own and had travelled extensively in the Christian world.[10] In fact, he had been instrumental in Erpenius' formation as an Arabist. Ahmad was a Morisco from Spain who had escaped to Morocco around 1600, where he established himself as a Spanish interpreter and secretary at the Marrakesh court. In 1610 he went to France on a private mission to help some fellow Moriscos. There he was aided by the Parisian Arabist Etienne Hubert, who in return asked for assistance in reading Arabic texts. Through Hubert, he met Erpenius, who was on his way to Geneva to further his (Calvinist) education, and the two developed a close relationship in which they exchanged literary, linguistic and theological learning. Erpenius admitted that Ahmad was the reason behind his decision to stay much longer in Paris than he had originally planned. Before returning to Morocco, Ahmad visited the Low Countries in 1613 where he stayed with Erpenius and was received twice by Stadholder Maurits. Ahmad had made his mark as a scholar, a role that saw him translate several mathematical works to and from Arabic.[11]

The two men charged with maintaining the contacts between the Ruyl delegation and the Marrakesh court thus shared a love of letters and they used their

genootschap," 82-83. On Golius' linguistic work, see Houtsma, *Oostersche correspondentie*, 26-27 and Castries, *Sources*, 1-III, 548.

9 They reached the Moroccan coast on December 11th, 1622 but reached Marrakesh only on June 28th, 1623, being admitted to audience with Mulay Zaydân on August 7th. On the proceedings of the mission see Gool, "Verbael," 580; Juynboll, *Beoefenaars*, 125-26 and Houtsma, *Oostersche correspondentie*, 26-27.

10 For the sake of convenience I write Ahmad. Orthographically correct is Ahmad ben Kâsim / Qāsim, with dotted 'h' and 'k'.

11 On Ahmad, see Wiegers, *A Learned Muslim*, 23-28 and 44-60. He translated a fifteenth-century astronomical treatise by the Jewish author Abraham ben Samuel Zacuto, and a Spanish treatise on gunnery by Ibrâhîm b. Ahmad Ghânim, among others.

respective functions to facilitate exchanges in matters of learning. At some point in 1624, Ahmad wrote to Golius in Safi:

Furthermore we let you know that we have bought six books for you, whose peers are not found unless with the Greats, beautiful and very clearly written, God bless you! no one possesses such a thing. But I have, in line with the friendship that exists between us, sent for buying them until the owners have sold them to us against their will. Because in the beginning they did not want to sell them to us and if they had not been our friends they would not have given them to us. But I kept on for twenty days tempting them to sell until I bored them and bought them for you.[12]

Besides acting as a middle man in the acquisition of texts, Ahmad provided Golius with access to private collections from which he had copies made. Golius ended up with a wide-ranging collection: a medical book by al-Musta'înî, a history of Marrakesh, a biographical dictionary by Ibn-Khallikân, a comment on the Maqâmât of al-Harîrî, and much more besides.[13] The basis of their exchanges was friendship attested to by the fact that, as far as I can determine, Golius did not pay him for his efforts. There is no documentation of what Ahmad got in return, except for one instance:

For my part I ask from God and from you to send me a crystal mirror, namely a nice large mirror, that I desire for my daughter who I want to marry off and whose wedding we want to celebrate, God willing.[14]

The Ruyl delegation was the vehicle of Golius' first journey to the Arab world. It would be mistaken to consider the worldly concerns of politics, trade and warfare of this mission as a mere pretext that enabled Golius to pursue his learned ambitions of acquiring knowledge and materials. Scholarship is not necessarily the ultimate aim in life of a scholar, and Golius certainly had other concerns at this

[12] Houtsma, *Oostersche correspondentie*, 31 (which includes the original in Arabic). "Verder laten wij u weten, dat wij voor u zes boeken gekocht hebben, welker gelijke niet gevonden worden, tenzij bij de Grooten, fraai en uiterst duidelijk geschreven, God zegene u! niemand bezit iets dergelijks. Doch ik heb overeenkomstig de vriendschap, die tusschen ons bestaat, gezonden om ze te koopen, totdat de bezitters ze ons tegen hun wil verkocht hebben, want in den beginnen wilden zij ze ons niet verkoopen en als zij niet onze vrienden geweest waren, hadden zij ze ons niet gegeven, maar ik hield bijna twintig dagen vol met hen tot verkoopen uit te lokken, totdat ik hen verveelde en ze voor u kocht."

[13] On Ahmad's services, see Juynboll, *Beoefenaars*, 126-28. On texts collected, see Houtsma, *Oostersche correspondentie*, 25-33.

[14] Houtsma, *Oostersche correspondentie*, 32. "Ik zelf vraag van God en van u mij een kristallen spiegel te zenden, namelijk een mooien grooten spiegel, welken ik verlang voor mijne dochter, die ik wil uithuwen, en welker bruiloft wij willen vieren, zoo God wil."

stage of his life. Diplomacy and scholarship were in fact intertwined enterprises. In the case of Golius and Ahmad, political and cultural relationships were inseparably mixed, and the exchange of learning and diplomatic traffic were two sides of the same coin.

On his return to Leiden, in July 1624, Golius showed the papers he had collected to his master Erpenius. They could not enjoy the treasures together for long though, as Erpenius fell victim to the plague and died in November. Golius finished the project Erpenius was working on, publishing a translation of the *Historia Saracenica*, an Arabic chronicle written by the thirteenth-century Egyptian Christian Georgius Elmacinus in 1625. Golius' preface to this edition explained the type of scholarly work that had been required for this edition: Besides philological labour on the manuscript (Erpenius had made a copy from the Heidelberg original), he had to try to consult the underlying sources. The preface can be read then as a research plan, for in the next years he would devote himself to exactly the activity of unearthing sources of Arabic learning.[15]

Both the diplomatic and scholarly achievements in the Maghreb and the execution of Erpenius' legacy added to Golius' credentials as a fine Arabist. In May 1625, Leiden's university board appointed him as Erpenius' successor and on July 3, he delivered his *Oratio de laudibus linguae arabicae*, in which he extolled the humanist value of Arabic, in particular in the light of restoring ancient literature, and the importance of acquiring original texts. Traveling to the Arab world, he argued, was therefore crucial to Arabic scholarship. Besides, collaborating with Arabic scholars would improve the young scholar's command of Arabic and greatly increase the speed of learning more than any solitary work at home would do. In fact, asking the university board for permission to postpone his teaching duties, Golius set about arranging a second journey.[16]

The Acquisition of the Apollonius Manuscript

Golius' next journey brought him to the Levant and won him international renown. While the travel was once again facilitated by the worldly interests of the state, the Republic now viewed scholarship as having a value in its own right. In its resolution the university board allowed Golius to undertake a one-and-a-half year trip to Aleppo, "to train himself in short time more perfectly in the Oriental lan-

[15] On Erpenius's death and Golius' publication work, see Juynboll, *Beoefenaars*, 106-107; 111-113; 128.

[16] On Golius's oration, see Molhuysen, *Bronnen*, 2, 121 and Juynboll, *Beoefenaars*, 128-129. See also the letter to Vossius quoted in Juynboll, *Beoefenaars*, 137.

guages to the better service of this Academy and Republic."[17] The terms were quite favourable for Golius: he would be allowed to keep his chair and his salary, and was certain of continuing his teaching upon his return. In addition, the board gave him two thousand guilders to purchase books for the library. Evidently, the authorities had great expectations concerning this Arabic exchange.

The opportunity to travel to the Levant presented itself when the new consul to Aleppo, Cornelis Witsen, prepared for his departure. At the intercession of Adriaan Pauw, the Amsterdam Pensionary who was also member of the university board at Leiden, Golius was appointed as 'cancellarius' to the consul. In the winter of 1625-1626 the party set sail, but the stay in Aleppo turned out to be rather non-conducive to scholarly progress. Golius fell ill and, due to the unruly situation in Aleppo, the affairs of the consulate were very time-consuming. Nevertheless, Golius managed to improve his linguistic skills and to travel to Antakya and Mesopotamia. In May 1627, Witsen returned to Holland and Golius was discharged of his duties. Instead of returning, he asked the university board an extension of leave, which was granted. He then moved to Constantinople where he resided for a year at the home of the Dutch ambassador to the Ottoman Empire, Cornelis Haga. The journey to the Levant thus shows a striking similarity to the Maghreb journey in the way it interwove commercial, diplomatic and scholarly activities.[18]

The Levant was a lively junction of these enterprises and Golius was only one of many Europeans traveling in the area, and far from the only Christian scholar. In fact, there was quite some competition over the acquisition of manuscripts. Golius used his time, position and contacts to establish scholarly relationships and study local languages, customs and geography. He was introduced to the elites and obtained access to libraries, apparently making some impression and becoming an asset himself. The sultan invited him to map and survey his empire, but Golius declined the offer. According to his funeral oration, he had made quite an impact with his medical knowledge as well. These learned contacts were by no means a one-way affair, as a visitor from Europe such as Golius brought wisdom as well as goods that were greatly welcomed.[19]

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[17] Molhuysen, *Bronnen*, 2, 123. College van curatoren en burgemeesteren, 18 Septemper 1625: "eene reyse van omtrent anderhalff jaer nae Aleppo" te ondernemen "om sich in corten tyt volcomentlicker tot beteren dienst van dese Academie ende Republycque in de Orientaelsche spraecken te konnen oeffenen, ... ende dat middeler tijt sal loopen t' zijnen prouffyte de gagie ofte wedden van de voors. professie, ende oock de selve professie blijven vacant, om tot zijn wedercompste by hem wederom bedient ende waergenomen te werden."

[18] Heeringa, *Bronnen*, 1, 504. Juynboll, *Beoefenaren*, 129-133.

[19] On scholarly bustle in Aleppo, see Toomer, *Eastern Wisedome*, 122-123. On Golius' tribula-

Golius' philological activities consisted of collecting texts as well as means to interpret them. Besides extending his command of language he gathered information about the background of texts – historical, geographical and astronomical data – which he could compare to those in his sources. To this end he also made new geodetic and astronomical measurements. Similar combinations of manuscript hunting and observation are found in the cases of other learned travelers to the East. For example, John Greaves (1602-1652), a future Savilian professor of astronomy at Oxford, traveled to the Levant in 1637-1640, and his notebooks survive. Like Golius, Greaves enjoyed the company of local scholars and the exchange of learning. He specifically sought to fix the latitude of Ptolemy's Alexandria and he exchanged knowledge of European and Arabic observatories and on astronomy in general. His special interest was metrology and he collected a wealth of information on ancient and modern weights and measures. Metrology was also important for Golius and it fitted the pursuit of philology. His mathematics teacher Snellius had done extensive studies of metrological issues.[20]

This multi-layered fabric of philological activities yielded a true treasure in September 1627 in Aleppo. Golius found a valuable manuscript of Apollonius' *Conics* and was able to copy it. It was the Banû Mûsâ manusript that contained Thâbit ibn Qurra's translation of books 5 to 7 of the *Conics*. This manuscript is regarded as the most original and complete version. In addition to the three missing books, the copy included a fascinating element: boxwood models of figures in the manuscript. There is no information about the actual make-up of the models, but I suspect they were templates. At his death in 1668, Golius still possessed the models, but it is unknown whether they still survive to this day. Not long after the copy was made, fortune smiled upon Golius even more brightly. The Dutchman David le Leu de Wilhelm bought him the original, considering the acquisition of service "for the public good,"[21] a further indication that Golius' philological quest was seen to be in the interest of the Republic in general.[22]

tions see Juynboll, *Beoefenaren*, 133-134; 141-142 and Schmidt, "Between Author and Library Shelf," 33.

20 On Greaves's activities, see Shalev, "Travel Notebooks," 85-97. On Snellius's metrology, see Wreede, *Snellius*, 119-121.

21 Huygens to Mersenne, December 23, 1646. Huygens, *Briefwisseling*, Vol. 4, 367. Also in: Mersenne, *Correspondance*, Vol. 14, 718. According to Huygens Le Leu bought it himself. Golius made a note in the manuscript that he got it from Le Leu in Aleppo: Toomer, *Apollonius*, Conics, xxii note 7. See also: Toomer, *Eastern Wisedome*, 122.

22 On the significance of the manuscript, which is now in Oxford, Bodleian Marsh 667, see Toomer, Apollonius, Conics, xvii-xix; lxxxv-lxxxvii. On the models, see Juynboll, *Beoefenaars* and *Catalogus Instructissimæ*, 138.

The vehicles of Golius' quest were diverse. First of all, by moving in person, he had managed to exchange and acquire information and manuscripts. He brought back data, notes, copies and original texts. Golius' travels and exchanges were facilitated by his dual persona as diplomat and scholar and the networks linked to both activities. Through consuls, merchants, interpreters and officials – local and foreign – he got access to people and papers. The acquistion of the Apollonius original in Aleppo shows how far the networks extended that supported Golius' activities. Le Leu was married to Constantijn Huygens' sister and the Huygens and Golius families were closely connected. This Dutch network also helped back home, allowing Golius to lobby for the Snellius chair from the Levant.[23]

In the course of 1629 Golius returned to Leiden, where he was given a warm reception. Constantijn Huygens wrote a laudatory poem in which he compared the catch of manuscripts with Piet Hein's capture of the Spanish 'Silverfleet'.[24] His fame quickly spread throughout the Republic of Letters as knowledge of the collection began circulating. Grotius wrote a laudatory letter to Peiresc, which included an index of 300 titles. Gassendi had visited the Dutch Republic in the summer of 1629 and when he returned to Paris, word of Golius' treasures spread quickly there too. In this way, Golius' status as a man of learning was consolidated and the university board reinforced it. Golius presented a catalogue of books he had bought. He had spent an additional one thousand two hundred guilders over the original two thousand. The board accepted this and granted Golius a personal reward of one thousand two hundred guilders on top of the previous amount. Finally, an overseas lobby for the Snellius chair proved successful when he was appointed to the chair of mathematics on November 21, 1629.[25]

Processing Manuscripts

Golius' Arabic travels, together with the later ones of his pupil Levinus Warner, were the most important of the seventeenth century. When Golius established him-

[23] On matters exchanged as well as tensions between wordly and scholarly interests, compare Schmidt, "Between Author and Library Shelf," 32-33. On Golius' lobby for the mathematics chair, see Juynboll, *Beoefenaars*, 136-137.

[24] "In Thesaurum Librorum Orientalium a J. Golio ex Oriente in Patriam allatorum. Quo Tempore Classem Hispanicam P. Heinius occupaverat." Worp, *De Gedichten van Constantijn Huygens*, II, 209.

[25] Grotius to Peiresc (September 6, 1630), quoted in Juynboll, *Beoefenaars*, 134-135. On Gassendi, see Mersenne, *Correspondance*, 2, 269-272 (letter 136). On the rewards for Golius see Molhuysen, *Bronnen*, 2, 146 and Juynboll, *Beoefenaars*, 136-137.

self in Leiden, his exchanges with the East continued. Through his brother Petrus in Syria and the travels of Warner and others, as well as Eastern visitors to Leiden, he continued acquiring manuscripts and other objects of scholarly interest. His collection of Eastern manuscripts was the richest of Northern Europe, and Golius developed into an Arabist of great merit and authority, publishing several Arabic texts that were used in teaching throughout Europe, including an expanded edition of Erpenius' grammar and, most significantly, the *Lexicon* of 1653.[26]

Arabic scholarship was a form of the philological processing of texts. European scholars transformed manuscripts into objects of study, translation and criticism, a process in which collection, exchange and reproduction played integral roles. Publication was only one feature, but a significant one nonetheless, of the philological processing of texts. Golius was in an advantageous position in Leiden where many of the means necessary for processing Arabic texts were to hand. He had already benefited from this by learning the language and scholarly skills, but Arabic philology not only required access to manuscripts and command of the language. A mastery of technologies and skills for reproduction was also demanded. Study and diffusion were mutually dependent as the production of Arabic textbooks, which were necessary for learning this language, required both Arabic typefaces and skilled people for printing to be possible. Leiden had a press that could handle the Arabic philology. In the late 1590s Raphelengius had cast a set of Arabic types for his press, which Erpenius initially had used. In the early 1610s, after the last compositor who mastered Arabic types had died, Erpenius set up his own press. He had a new set of types cast, much smaller and more elegant than those of Raphelengius, which were used for his renowned publications. Like his grammar, Erpenius' types became the model for Arabic typefaces. The Elzeviers Press acquired them from his estate in 1624.[27]

By no means all Arabic scholarship reached the press. This did not, however, mean that it was not disseminated. A case in point is Apollonius' *Conics*. Upon his return to Leiden, Golius had promised to publish an edition and translation of the Arabic version of books 5-7, but this project was never carried out. Golius had divided his collection into a section for the university, and a private corpus for his own use, keeping the finest pieces for himself (the Apollonius manuscript was for his private collection and the copy went to the university library). In 1646

[26] On the significance of Golius's travels, see Hamilton, "Introduction," 6. On the significance of his collection and publications, see Toomer, *Eastern Wisedome*, 48-50.

[27] On Arabic types in Leiden, see Toomer, *Eastern Wisedome*, 41-47 and Juynboll, *Beoefenaars*, 36-45. In Rome the first set of Arabic types had been made by the Medicean Press, after a collection brought from Antioch had been put at its disposal. It eventually published only one Arabic book, but the types were passed on and used elsewhere. Toomer, *Eastern Wisedome*, 23-24.

Constantijn Huygens complained of the work on the *Conics* that after 17 years still nothing had come out of Golius' hands. 'Our Pell' would have wanted it and would have done it much faster, he added. John Pell was an English mathematician then at the Collegium Arausiacum in Breda, the newly founded Orange college of which Huygens was one of the curators.[28] Pell had worked on an Arabic manuscript of the *Conics* brought to Europe by Christian Ravius (1613-1677). Golius had earlier borrowed and copied this very manuscript for his Apollonius studies. His own work proceeded slowly, while at the same time he impeded the work of others, preventing everyone from studying his manuscript and discouraging people like Pell from studying Apollonius. After Golius' death in 1667, the copy of the *Conics* in the university library was studied but the original manuscript remained in the hands of his heirs. The Banû Mûsâ manuscript was finally auctioned in 1696 and went to Oxford, where Edmund Halley used it for his 1710 edition of the *Conics*.[29]

In the meantime knowledge about and from Golius' treasure did circulate. Gassendi and Mersenne were particularly interested in the mathematical texts Golius had collected in the Levant, and particularly in the Apollonius manuscript. Mersenne having earlier published a translation of the first four books of the *Conics* in the first edition of his *Universae Geometriae Mixtaeque Synopsis* (1626). Golius sent a Latin paraphrase of his manuscript to Mersenne, together with an index of his collection, which Mersenne introduced into further circulation. Gassendi published the index in 1630 as *Catalogus Rarorum Librorum*, thus making the wealth of Golius' collection publicly known. Golius' paraphrase was studied by Claude Mydorge who made extensive notes and elaborated a discourse on conic sections, *Prodromi Catoptricorum et Dioptricorum*. In his *Organica* van Schooten would react directly to Mydorge, as we will see below. Being a student of Golius, van Schooten was even closer to the sources of Apollonius' *Conics*. Whether Golius allowed him to study the manuscript (which he apparently was unable to do on his own) or discussed it with him we do not know. He is alleged to have brought in van Schooten to draw the figures, and some are said to have been

[28] Huygens, *Oeuvres Complètes*, vol. 2, 555. "Il y a 17 ans que l'Apollonius est entre les mains du Professeur Golius, qui ne cesse de la promettre à l'esperance du publiq, et jamais n'en donne aucune apparence. Un très-sçavant personnage Conseiller de Son Altesse mary d'une de mes soeurs, le luy porta d'orient pour le bien commun. Je ne scay s'il n'y rencontre trop de difficulté. Notre Pellius voudroit fort l'avoir et assurement en viendroit promptement à bout, mais le moyen de l'arracher au premier sans le picquer ou affronter."

[29] On Golius's collection, see Witkam, *Golius*, 54-57. On Pell, see Toomer, *Eastern Wisedome*, 184 and Maanen, "Refutation," 328-330; 342-344. On Halley's edition, see Toomer, *Apollonius* Conics, xxiv-xxv. See also Beeston, "Marsh Manuscript."

indeed engraved – an account that I find very dubious. What we do know, however, is that van Schooten adopted an interest in conic sections and passed on knowledge of the *Conics*.[30] However, van Schooten did not merely rehash Golius' approach to Apollonius, prefering instead to combine it with other approaches to conic sections. We now leave Golius, sitting on his treasured Apollonius manuscript, and turn to van Schooten.[31]

The Dual Background of Van Schooten

Van Schooten was not only a pupil of Golius, the two men were also related. In the foregoing sections numerous instances of family ties have come up, and this is no coincidence. Kinship was the basic social structure in the seventeenth-century Dutch Republic and thus an important condition for circulation of knowledge.[32] Kinship extended beyond family ties to include social ties of a clanlike nature, and although Golius and Constantijn Huygens were not relatives, they were connected through kinship relations. Both came from regent families that played a prominent role in the government of the early Republic. Golius' father had been first clerk of the Council of State in The Hague. In that capacity he was assistant to the secretary of the Council, who was at that time Christiaan Huygens, Constantijn's father.[33] Huygens's patronage of Golius, and the acquisition of the Apollonius manuscript by his brother-in-law Le Leu, were supported by the long-standing connections between their families.

Van Schooten was of somewhat more modest descent than Huygens and Golius, but his family had established close ties to Holland's elites. His father, Frans van Schooten Sr., had worked himself up to becoming in 1615 the professor of Duytsche Mathematique at the Leiden Engineering School, the cherished brainchild of the Stadholder. Golius is said to have studied with Frans van Schooten Sr., while Frans van Schooten Jr. studied mathematics under Golius. Finally, the families were in fact related in conventional terms: Frans Sr. was married to a niece

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30 The figures of the manuscript in Leiden (Or14) have been inserted afterwards, and are rather sloppy. Van Schooten was a careful draughtsman, which suggests that probably Golius himself had made these drawings.

31 On Golius's paraphrase and Mydorge's notes, see Mersenne, *Correspondance*, 2, 383-391 (letter 148, 29 January 1630). It includes a facsimile of the letter. The first, two-volume edition of Mydorge's treatise appeared in 1631, expanded into four volumes in 1639. Mersenne included Mydorge's treatment of conic sections in the 1644 edition of *Universae Geometriae Mixtae* under the title "C. Mydorgii Libri IV de Sectionibus conicis."

32 See for example Frijhoff, 1650, 213-216. The archaic Dutch term 'maagschap' is used.

33 Juynboll, *Beoefenaars*, 119-21.

of Golius. So, Golius and van Schooten were part of the same clan, within which they had a sort of master-apprentice relation. These relationships formed the basis of their exchanges on mathematics.[34]

Van Schooten was raised in two traditions of mathematics: the classical geometry of Golius and the 'Duytsche Mathematique' of his father Frans van Schooten Sr.. With Golius, van Schooten encountered a scholarly approach to mathematics, focused on the study of texts and the restoration of ancient wisdom, and in which conic sections were defined, by Apollonius, as the intersection by a plane of a solid cone. With his father, van Schooten became familiar with the worldly pursuits of fortificationists, surveyors and other artisans. The 'Duytsche Mathematique' was a mathematics program taught in the vernacular at the Engineering school that Stadholder Maurits had established in 1600 at Leiden University. The program was set up by Simon Stevin by carefully selecting those parts of geometry that were of direct practical relevance. This bookish study was combined with practical training through the attendance of military campaigns in the summer. In this world, curves were things to be drawn on stone, in the soil, and on other material surfaces, rather than studied in the ideal realm.[35]

In the above discussion, we have seen how Apollonius' classic conception of conic sections was brought to Leiden. The way practices of curve drawing arrived in Leiden is less easy to trace. In the Renaissance much interest was given to drawing instruments. In particular, for perspective drawing artists and mathematicians devised all kinds of methods and instruments for pictorial ends. A circle in perspective is an ellipse and this raised the question of representing this pictorially. In the late fifteenth century a tradition of devising ellipsographs developed in Italy, largely remaining in manuscript form. In *Unterweysung der Messung* (1525), Albrecht Dürer described a range of instruments, including one to draw epicycloids. He also proposed a point-wise construction of the ellipse, although this in fact produced an oval. *Planisphaeriorum* (1597), by Guidobaldo del Monte, was a manual for the design of planispheres or universal astrolabes, and included an instrument consisting of a ruler sliding along a square to draw ellipses.[36] Stevin, in his *Van de Meetdaet* (On the Act of Measurement, 1605), discussed several methods of drawing curves and in the program for the 'Duytsche Mathematique' that Stevin wrote in 1600 a lot of drawing skills were prescribed, mainly to assist in the pro-

[34] On van Schooten's life, see Hofmann, *Frans Van Schooten*, 1-8 and Waard, "Schooten (Frans van)." On the family ties between van Schooten and Golius, see Juynboll, *Beoefenaars*, 122.

[35] On the Duytsche Mathematique, see Winter, *Hoger beroepsonderwijs*, 16-22 and Molhuysen, *Bronnen*, 389*-91*.

[36] On ellipsographs, see Raynaud, "Tracé continu" and Rose, "Methods," 376 and 383.

duction of accurate maps and plans. Ellipses and other conic sections were only mentioned with regard to the measurement of areas, and only to be discarded as unnecessary skills. Engineers did not need to know how to measure areas with curved boundaries, "but only they shall learn with rectilinear areas, there after curvilinear in the way of surveyors, measuring so an area by various divisions as in triangles and other planes . . . ."[37]

Curve drawing practices were generally said to be widespread in the crafts. Guidobaldo indicated as much and, in the *Organica*, van Schooten linked them to the world of crafts. It is difficult to establish whether constructions like these were actually used in the crafts as such practices are scarcely documented. I have not yet found an account of the gardener's ellipse in gardener's literature; if an elliptical flowerbed is laid out at all, for example in Boyceau's well-known *Traité du Iardinage* (1638), the plotting is not explained. The peg-and-rope construction was, however, well known, with the oldest account coming from Anthemius of Tralles (c.474-c.534), who described it in a treatise on burning mirrors. This text was mentioned by Guidobaldo and Stevin. Ignorant of his predecessors, Johannes Kepler, in his *Paralipomena* (1604), detailed the method in his explanation of the description of conic sections, explaining that the construction can be easily derived from proposition 52 of book 3 of the *Conics*.[38] The construction figured in the popular *Récréations Mathématiques* of 1624 which in 1636 had also been translated into Dutch. How exactly these practices ended up in Leiden is not documented, though van Schooten learned about them through the diffuse routes of craft traditions and his reading of men like Stevin and Guidobaldo.[39]

Whatever the reality of curve drawing practices in the arts, to van Schooten they meant an alternative perspective on conic sections that he saw relevant to their geometrical analysis. In 1646, in his *Organica*, van Schooten said that a gap existed between the classical approach to conic sections of Apollonius and the curve drawing practices of artisans. His aim was to bridge that gap. He wanted, in

[37] Molhuysen, *Bronnen*, 390*. "Het meten des rondts mette gedeelten van dien aengaende, voerts het vlack des cloots, de formen genaemt ellipsis, parabola, hyperbole ende diergelijcke, dat en is hyer nyet nodich, wantet den ingenieurs seer selden te voeren compt, sulcke metinge te moeten doen; maer alleenlyck sullense leeren met rechtlinige platten, daer na cromlinige landtmetersche wijse, metende alsoe een plat deur versceyde verdeelinge, als in dryehoucken of ander platten om te syen hoe t'een besluyt met het ander overcompt."

[38] Kepler, *Paralipomena*, 95. "Etenim ex 51. & 52. tertii Apollonii descriptio Hyperboles & Ellipseos efficitur facilima; potestque vel filo perfici."

[39] On the gardener's ellipse, see Raynaud, "Tracé continu," 302 and West, "Problems," 709-712. Guidobaldo, *Planisphaeriorum*, 101-103. Stevin, *Meetdaet*, 19-20. On the *Récréations*, see Heeffer, "Récréations Mathématiques," 79-86. One of the 1626 Paris editions included thirteen pages of commentaries by Mydorge.

other words, to bring together the world of scholarly geometry of Golius and the world of 'Duytsche Mathematique' of his father, and to do so, he elaborated a particular approach to conic sections he had developed in the years since his original training. During the 1630s and early 1640s, van Schooten moved through various mathematical circles in Holland and abroad where he broadened his outlook on mathematics, and on conic sections in particular.

The Social and Cultural Milieu of Van Schooten

During the 1630s, van Schooten became involved in the savant circles around Constantijn Huygens. Here he was introduced to René Descartes, who had been introduced to Huygens by Golius earlier. Huygens and Descartes were involved in a project to make the elliptical or hypberbolical lenses that were described in *La Dioptrique*. During the 1620s in Paris, Descartes had succesfully crafted such lenses in collaboration with Mydorge and the lens grinder Jean Ferrier. In Holland, Huygens offered to help Descartes in bringing together the required skills and had a hyperbola drawn and a lens made with it, but Descartes was not satisfied with the result. After another disappointing effort the next year, in 1637 Huygens enlisted van Schooten to draw an accurate hyperbola. Van Schooten thus took the place Mydorge had held in Paris: to draw the curves required for the lens shapes. Van Schooten's draughtsmanship was praised, but the lenses ground by some Amsterdam master were inaccurate and badly polished. After two years, the project was abandoned. The lens making enterprise supervised by Huygens may not have been fruitful in producing lenses, but it had brought together van Schooten and Descartes, a collaboration that would soon bear fruit.[40]

Huygens was at the centre of a circle that was engaged in the publication of Descartes' *Discours de la Méthode*. Manuscripts of the text circulated among its members and were critically read and commented upon. Van Schooten also participated and some of his notes have been preserved. Van Schooten was not a passive receptor of the teachings of the great philosopher. He commented upon Descartes' constructions for hyperbolas and parabolas and it appears that he originally introduced Descartes to the gardener's ellipse. His notes on the drafts contain a sketch of the gardener's ellipse including indications of van Schooten explicitly claiming

[40] On the relations between Huygens and Descartes, see for example Stoffele, *Christiaan Huygens – A Family Affair*, 66-71. On the collaboration of Descartes, Mydorge and Ferrier, see Schuster, "Descartes *opticien*," 272-77. On Huygens's lens project, see Ploeg, *Constantijn Huygens*, 33-37. Huygens, *Briefwisseling*, letters 1269, 1270, 1322, 1329, 1369, 1392, 1704, 1731, 1993. I discuss both in Dijksterhuis, "Constructive Thinking," 61-67.

his own contributions.[41] For the publication of the *Discours de la Methode* and its essays, van Schooten was employed as illustrator. The famous gardener's ellipse in *La Dioptrique* as well as the other illustrations in the first edition are by his hand.[42]

The gardener's ellipse in *La Dioptrique* may serve as a testament, not so much to van Schooten's servitude as to the reciprocity of their relationship. According to Descartes, van Schooten was one of the few who really understood *La Géométrie*. With the latter contributing a critical eye and knowledge from new mathematical spheres to the project. Descartes, in turn, showed van Schooten a new perspective of geometry, in which algebra was used for analysis, and new meanings of conic sections, in particular in optics. Their conceptions of conic sections differed however. In *La Géométrie*, Descartes defined conic sections in the classical Apollonian manner, considering plane constructions like the gardener's ellipse acceptable as geometry but insufficient as regards the definition of such curves. Van Schooten would oppose this conception and in the *Organica* argued that a plane construction sufficiently defined a curve and was thus mathematically sound.[43] While van Schooten had probably had private students for some years, in June 1635 the board of Leiden University formalised his teaching by giving him permission to replace his father, who was at that time troubled by sickness. In addition van Schooten continued his movements through mathematical circles and these now took him abroad. Traffic of mathematical papers between France and Holland already existed, as we have seen above, and van Schooten got involved in these affairs, studying papers of Florimond Debeaune (1601-1652) and letters received by Descartes, apparently for the sake of his reworking of *La Géométrie*. In the late 1630s, he became involved in the project of publishing an edition of Viète's works. This was an initiative of Mersenne, who wanted to give Viète's writings a wider circulation than the partial printing (in quite limited edition) earlier and who had called in the Elzeviers of Leiden. In a 1638 letter to Mersenne, the Elzeviers asked to send corrections as well as an unpublished manuscript. At this point, it is likely that the Elzeviers took the initiative of dispatching van Schooten to France in person to collect valuable mathematics. It is unknown how exactly the Elzeviers facilitated the trip or whether some third party covered the costs. This kind of project in

41 University of Groningen, MS 108, 13v: "ad questionem illarum D.ill. Decartij. demonstratio pro describenda linea hyperbola. f.a.s.i. [= franciscus a schooten invenit]."

42 On the reading of *Discours*, see Huygens, *Briefwisseling*, letter 1277. On van Schooten's notes, see also Maanen, *Facets*, 23.

43 On Descartes' praise for van Schooten, see Waard, "Schooten (Frans van)," col. 1110. Descartes later called him a boaster; Mahoney, *Mathematical Career*, 58. On Descartes' definition of curves, see Bos, *Redefining*, 317-25; 335-38; 346-49.

which manuscripts and prints were collected for new editions was, however, routine for the publishing house. At any rate, van Schooten's trip was supported by the alignment of the scholarly interests of the Descartes circle and the commercial interests of the Elzeviers.[44]

In 1641, van Schooten traveled via London to France. He first went to Blois where he encountered Debeaune and then to Paris where he stayed primarily with Mersenne. He was introduced to numerous mathematicians – Pierre de Carcavi (1600-1684), Claude Mylon (1616-1660), Gilles de Roberval (1602-1675), Claude Hardy (1598-1678), Ismael Boulliau (1605-1694), and probably Mydorge as well – and got access to various mathematical writings. Among other things, conic sections were a central feature of scholarly discussions in these French circles and van Schooten's interest was thus further confirmed. He took home with him a wealth of connections and knowledge, part of which in paper form, including a transcript of Fermat's writings now preserved at the Groningen University Library. By 1643 van Schooten was back in Holland and back within the Huygens circle.[45]

Van Schooten was now no novice anymore. He had seen the world – the world of the new 'géométrie' – and he was ready to embark on a mathematical career of his own. First of all he prepared the *Opera Mathematica* of Viète, published by the Elzeviers in 1646. Following this, he obtained the chair of his father, who died in December 1645. Succeeding his father was no matter-of-course business, even though he had already replaced him in his capacities as an academic at the university. Van Schooten was an Arminian and he had a serious competitor in the person of Jan Stampioen – another ambitious mathematician who had been working himself up among the elite circles of The Hague. Stampioen was, however, at a disadvantage. In 1640, Golius and van Schooten Sr. had decided against him in his dispute with Descartes over algebra. Eventually the support of Descartes, Elisabeth of Bohemia and Constantijn Huygens won van Schooten, the chair, and he was appointed in February 1646. Thirdly, and lastly, van Schooten began publishing his own mathematical works, starting in 1646 with *Organica Conicarum Sectionum in Plano Descriptione*.[46]

The *Organica* can be seen as a pivotal work in van Schooten's career. Dedi-

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44 On the Elzevier Viète project, see Hofmann, *van Schooten*, 3-5 and Willems, *Les Elzeviers*, 149-150 (letter from Mersenne to the Elzeviers of March 8, 1638). On the Elzeviers publishing activities, see also Ottenheym, "Vitruvius Edition."

45 On the French trip of van Schooten, see Waard, "Schooten (Frans van)," col. 1114 and Hofmann, *Van Schooten*, 2. The Fermat transcript is University of Groningen, ms.110.

46 On Stampioen, see Dijksterhuis, "Stampioen," 939.

cating it to the board of the university, it was the openning number in the career of the new professor of 'Duytsche Mathematique', bringing together the various styles of mathematics van Schooten had encountered during his formative years and established him as a mathematical scholar. He appropriated his findings for his own work, reflecting upon them and confronting them with his own views and findings. He redefined the ellipse by transferring, transforming and assembling ideas and practices he had encountered during his formative years as a mathematician. The *Organica* was no mere 'Collectio'. Van Schooten transformed his catches into a conception of the conic section of his own: a plane curve generated by continuous motion.

The Plan of the *Organica*

The full title of van Schooten's debut runs *Organica Conicarum Sectionum in Plano Descriptione, tractatus. Geometris, Opticis; Praesertim verò Gnonomicis & Mechanicis utilis* (Mechanical description of conic sections in a plane. Useful for geometers, opticians and that in particular for gnonomers and mechanics). A decade later, van Schooten included the *Organica* in his *Exercitationum Mathematicorum* (1657), a collection of tracts on various mathematical subjects. In 1660, he translated the collection into the vernacular, where the title of the *Organica* runs in Dutch, *Tuych-werckelijcke beschrijving der kegelsneden op een vlack*. It warrants mention that 'organica' did not have our modern connotation of 'organic', but meant 'mechanical', and this is precisely the sense in which van Schooten translated it into Dutch: mechanical description. The title thus clarified van Schooten's intentions: to expound the plane description of conic sections by mechanical means.

In the preface of the *Organica*, van Schooten first explained how the ancients had set out the doctrine of conic sections in its classic geometrical form. He explicitly wrote that his teacher Golius had brought the complete *Conics* of Apollonius from Arabia and was intending to translate it. Van Schooten then discussed the various uses of conic sections in optics, perspectives, gnonomics, and so on, before finally explaining that in daily practice those curves were drawn mechanically in the plane, listing a range of uses: architects, carpenters, and masons for making templates for cutting stones; turners for making frames; gardeners for laying out flower beds.[47] Then came the raison d'être of the *Organica*:

[47] Schooten, *Organica* (1646), preface to the reader (n.p.); Schooten, *Tuych-werckelijcke*, 281.

> Why, as the description of conic sections in the plane is useful to so many trades, what wonder it is that in the promotion of the doctrine of conic sections the excellent mathematicians have cultivated her of old, and that as a rule, and in this century in particular, new growth is added? But what seems to me curious, is that no-one until now (insofar I know) has taken this trouble, namely that someone is found, who has dealt with the mechanical description of conic sections, and demonstrates it in every case.[48]

This then, was van Schooten's plan: to treat the plane generation of ellipses, hyperbolas and parabolas in a demonstrative way.[49]

In his dedicatory letter, van Schooten discretely said that the ancients may have treated the plane description of conic section, but that traces thereof were lost. Yet, his message was clear: an inexplicable gap between the geometrical analysis of conic sections and their material generation existed. The issue had been addressed recently, van Schooten said, although not satisfactorily in his opinion. He had heard that Franciscus Aguilonius (1567-1617) had planned a treatise on this topic, but had not lived to complete it. Van Schooten did not refer to Aguilonius's *Opticorum* (1613) in which several methods of generating the ellipse in the plane are treated, which is surprising as the *Opticorum* was highly valued in the Huygens circle.[50] Van Schooten also mentioned a former student of his father, Christiaan Otter (1598-1660), who had not published his findings.[51] Mydorge, van Schooten's Paris counterpart, discussed the plane description of conic sections extensively in his *Prodromi*.[52] The *Prodromi* can be seen as a scholarly crystallization of Mydorge's draughtsman's skills that had served Descartes, in the same way van Schooten's drawing experience made its way into the *Organica*. Van Schooten's approach to curve drawing, however, differed greatly from Mydorge's, and in this light, the *Organica* was a direct response to the *Prodromi.*

Mydorge generated conic sections by point-wise geometrical constructions

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[48] Schooten, *Organica* (1646), preface to the reader (n.p.). "Cum ergo ad tam multa negotia Conicarum Sectionum in plano descriptione utilis sit, quid mirum, se vel ab ultimâ antiquitate praestantissimi Mathematici Conicorum doctrinam adeò sedulò sibi excolendam duxerint, semperque ei, praecipuè verò hoc erudito seculo, accessio nova facta sit? Verùm quod mirandum mihi videtur, est, quòd nemo hactenus (quod sciam) Spartam hanc sibi ornandam susceperit, ut nempe aliquis inventus fuerit, qui de Organicâ Conicarum Sectionum in plano descriptione tractatum conscribere sit aggressus, eamque quovis casu demonstrare."

[49] Schooten, *Tuych-werckelijck*, 280.

[50] Aguilonius, *Opticorum*, 470-77. These were pointwise constructions, a elaborate variation on the gardener's ellipse and the instrument Guidobaldo had described.

[51] Sassen, "Levensberichten," 113.

[52] Mydorge, *Prodromi*, 81-83.

based on properties derived from the classical definitions.[53] According to van Schooten, Mydorge's methods were not practical in that they were not executable when describing large curves on walls, floors and in gardens. Moreover, "... this method requires the manifold finding of points and the dexterity of a trained hand, at the same time that one, for a neat execution of the work, is also known with the nature of the line."[54] Van Schooten desired methods that were executable without skillful hands and mathematical insight. His method of curves did not require a full physical and intellectual command of the matter, as "... the mechanical description ... puts the prescribed line, as if by itself, with one stroke before the eyes."[55] What followed was a presentation of a series of clever but simple mechanisms for generating ellipses, hyperbolas and parabolas, as well as straight lines.

The two approaches to conic sections van Schooten described in his preface in fact represented the two worlds of his erstwhile teachers, classical 'geometria' and 'Duytsche Mathematique', and in the *Organica*, he aimed to integrate them by grounding the doctrine of conic sections in curve drawing practices on the one hand, and demonstrating the geometrical validity of these practices on the other.[56] The bridge between these two worlds consisted of an idiosyncratic conception of these curves, which was expressed in the form of instruments that generated drawing motions. Van Schooten thus stood with a foundation in both worlds, devising mechanisms for particular situations in which ellipses, hyperbolas, and parabolas might be drawn and, at the same time, elaborating the mathematics underlying and implied in the mechanisms.

This particular approach of van Schooten was also a reaction to the new geometrical conceptions that had been developed by French 'géomètres' in particular

[53] See for example Mydorge, *Prodromi*, 102. Mydorge also simplified a number of Apollonius' theses.

[54] In Dutch, van Schooten uses the idiosyncratic word 'afgeveerdichtheyt', which is closest to the verb 'delegate'. In Latin he uses 'manus exercitate solertiam', which in modern Dutch would be 'vaardigheid'. Schooten, *Tuych-werckelijck*, 281. "... : aengesien die manier het veelvoudig soecken van punten en de afgeveerdichtheyt van een geoeffende handt aldaer vereyscht, gelijck mede, datmen daerenboven, tot een nette uytvoering van het werck, de natuer derselve linien bekent hebbe."

[55] Schooten, *Tuych-werckelijck*, 281. "Het welck dan in de Tuych-werckelijcke manier geen plaets en heeft, also deselve de voorschreve linien, gelijck als van selfs, met eene treck terstont voor oogen stelt." Van Schooten added that pantografic methods were also unsuitable as they required the drawing of the curve in advance. Ibid.: "Vorders so heeft ons die Tuych-werckelijcke manier boven andre behaegt, dewelcke uyt een aen-een-verknochte beweging zijn oorspronck neemt, die verwerpende, waer door men dese linien met een passer, tot dien eynde gemaeckt, beschrijven kan. Nademael men aldaer deselve linien eerst beschreven moet hebben, om, aen de passer vast gemaeckt zijnde, alleen te konnen dienen tot beschrijving van diergelicke andre."

[56] Schooten, *Organica*, 295; *Tuych-Werckelijcke*, 275.

in which conic sections were understood as plane curves. Generating curves by continuous motions was in line with Descartes' new understanding of geometrical curves, an approach which involved defining the curves in terms of the motions that generated them. Van Schooten went further than Descartes, however, by defining conic sections in terms of this drawing method. He also responded to Mydorge's ideas about the plane generation of conic sections. The *Organica* was, therefore, a synthesis of the classical geometry of Golius and the 'Duytsche Mathematique' of van Schooten Sr. , and as such was an intervention in the ongoing mathematical debates of the day. In the *Organica* van Schooten assembled the various approaches in mathematics he had encountered in his years of apprenticeship, transforming them into a doctrine of conic sections of his own.[57]

Mental and Material Machines

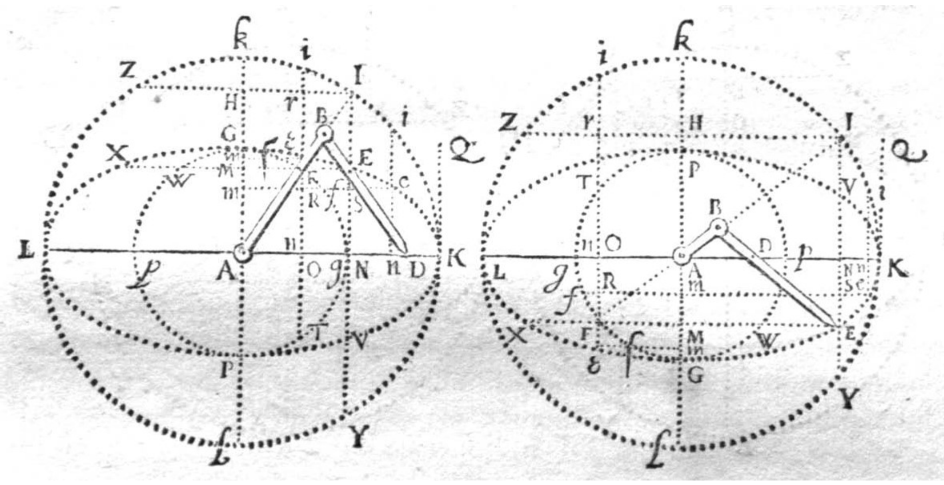

Figure 5: Van Schooten, Organica, 309.

Van Schooten presented several instruments to draw ellipses, based on various ways of defining a curve. The first instrument was based on the diameters of the ellipse being given. It consisted of a pairing of simple rulers joined at their endpoints in B (Figure 5). The other endpoint of the first ruler is fixed in A, and an equidistant point on the second ruler is drawn along a line AD. Another point on the second ruler – either between BD or on its extension – then traces out an

57 On Descartes's definition of conic sections, see Bos, *Redefining*, 335-36.

ellipse. The second instrument is similar, but in this case the second ruler is replaced by a triangle making the pivoting point of line BD effectually ex-centric (Figure 6). The result is a rotated ellipse.

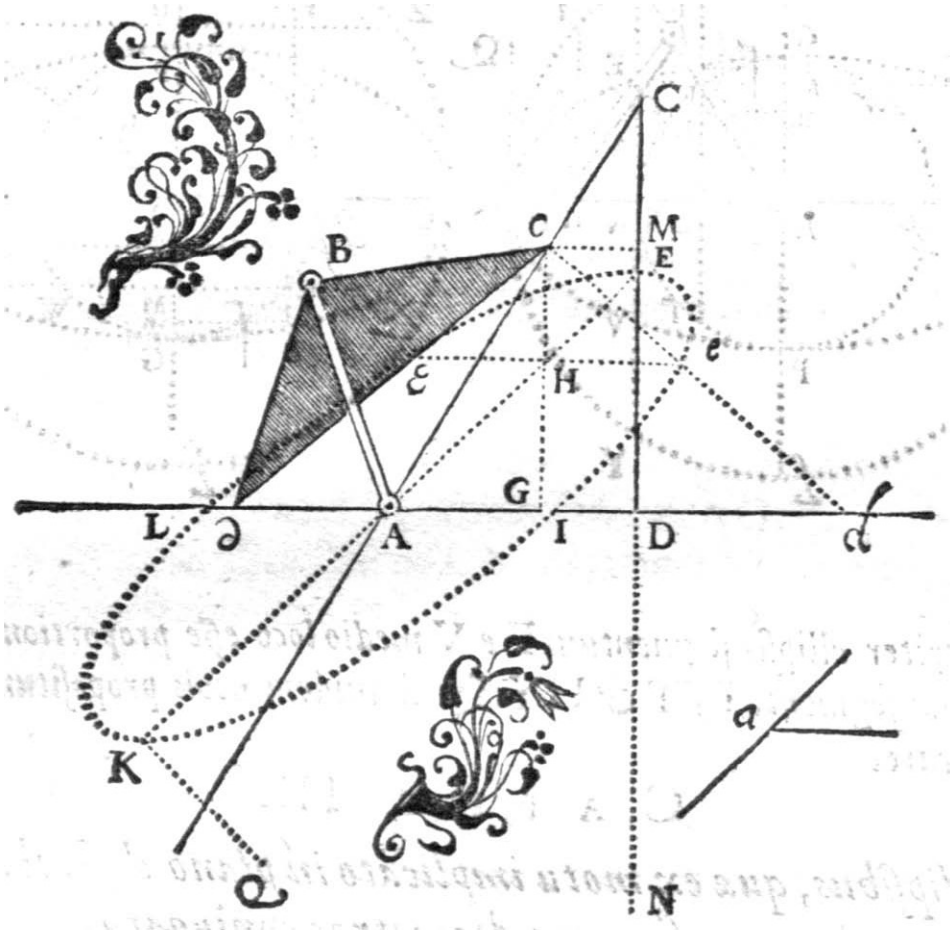

Figure 6: Van Schooten, Organica, 314.

These are, however, not in fact instruments in the proper sense of the word. Rather, they are mental mechanisms that explain the geometry of the description. In the subsequent chapters van Schooten discussed the instruments once again. This time, however, he presented them as concrete instruments, depicting them in a three-dimensional way with hands guiding the motion and explanations of the make-up and construction of the rulers (Figure 7).

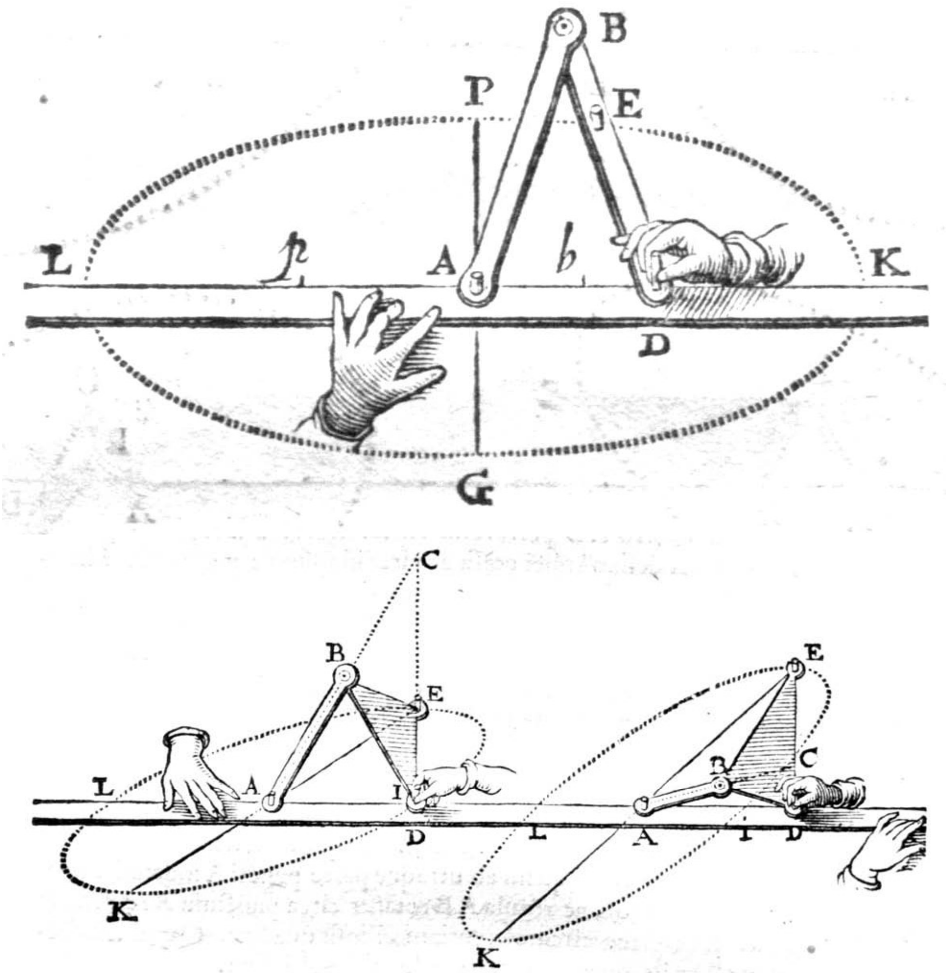

Figure 7: Van Schooten, Organica, 322 and 327.

Van Schooten thus carefully distinguished between the intellectual and material operations of his drawing instruments. This distinction is expressed in the chapter titles: “On ellipses that are described … ” versus “On the way to describe ellipses … .” This was part of van Schooten’s integration of the intellectual and material realms of curve drawing. He first laid down the geometry of his mechanisms – including proofs that the generated curves are indeed ellipses – and then elaborated on their material realization. He thus offered the artisans, for whom he had devised these instruments to assist in the drawing of ellipses in a continuous motion, the geometrical certainty that the curves described were indeed accurate.

This was not a mere subordination of artisanal practice to geometrical formalism, though. By grounding his doctrine of conic sections on the very drawing practices of artisans – drawing by continuous motion – he transformed the formal geometry as well, adapting it to artisanal reason. In this sense he went beyond his father: whereas the original 'Duytsche Mathematique' consisted of a practice-oriented selection of geometry as it was, the *Organica* appropriated the geometry to a practitioner's needs. Van Schooten thus integrated classical 'geometria' and 'Duytsche Mathematique' by transforming both and thus mutually enriching them.

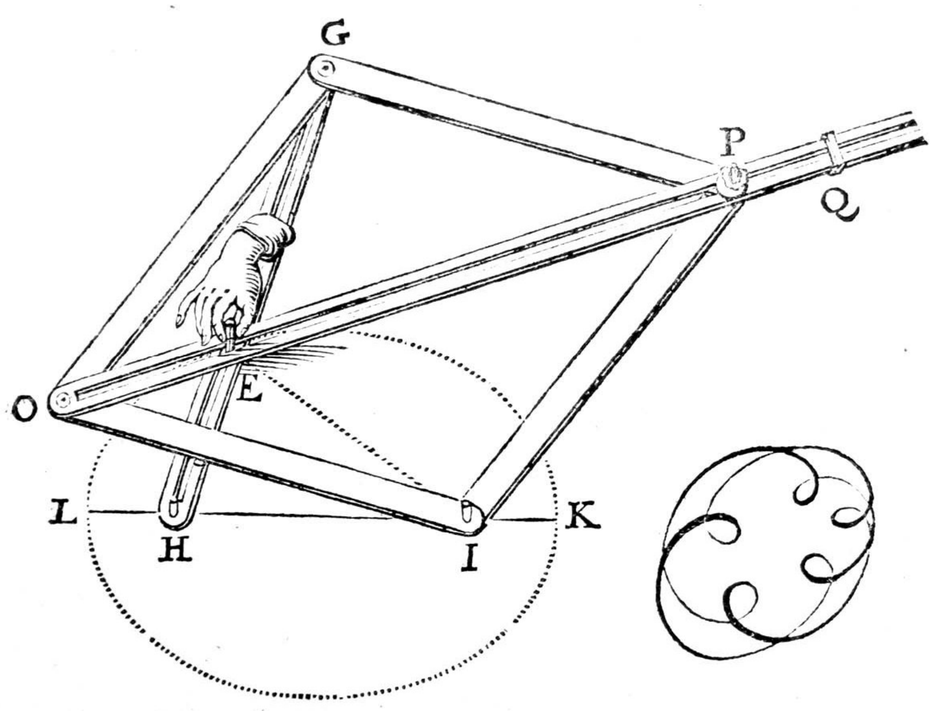

Figure 8: Van Schooten, Organica, 318.

Further indications of the ways in which van Schooten adapted geometry to drawing practices are the instruments that embodied the particular mathematical properties of conic sections. Instead of its diameters, an ellipse can also defined by its foci and vertices. For an ellipse with foci H & I and vertices L & K, van Schooten constructed an instrument that gave the tangent at once. OI, IP, PG and GO are equal and no shorter than LI. They make a variable parallelogram that rotates around I. O and P are joined by a movable ruler OPQ. Ruler HG is connected at G and rotates around H. When a stylus is placed at point E, the intersection of

GH and OP, an ellipse LEK is drawn by moving the stylus. At each point E, ruler OPQ is tangential to the ellipse. The drawing of a tangent now also became a matter of "putting the line by itself with one stroke before the eyes." Likewise, van Schooten explained how his instruments offered clues to the quadrature and rectification of curves. In this way the mathematical analysis of conic sections was accommodated to the plane drawing of curves.

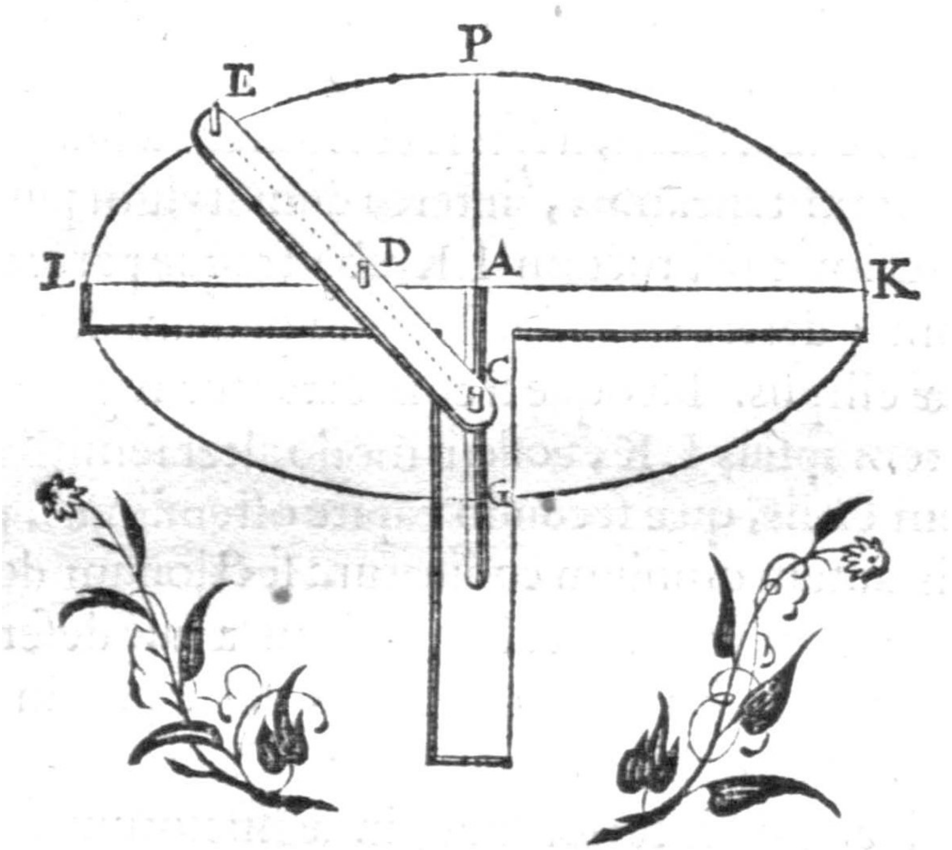

Figure 9: Van Schooten, Organica, 326.

In the *Organica* the gardener's ellipse also returned. van Schooten presented it as an example of a mechanism particularly useful in optics. He explicitly referred to *La Dioptrique* (Figure 4). Van Schooten explained how the peg-and-rope construction could be understood in terms of the classical theory of conic sections, referring to proposition 52 of the third book of the *Conics*. Van Schooten also discussed a mechanism similar to Guidobaldo's instrument, something he would most certainly have been familiar with (Figure 9), as a manuscript attributed to his brother contains a copy of the *Planisphaeriorum* including a carefully drawn depiction of the instrument.[58]

Whether the instruments in the *Organica* were actually realized, and whether they were intended to, remains to be seen. I have not found any traces of such instruments, neither by van Schooten, nor by students of the *Organica*. However, for his account of conic sections to be legitimate they did not need to be reproduced in paper, wood, or brass. Both the 'mental' and the 'material' instruments in the *Organica* are specific geometrical constructions, in this case with the purpose of generating conic sections. To know *what* an ellipse is, is to know *how to* draw it and in this regard van Schooten's drawing instruments were thinking instruments, literally 'organons'.[59]

Further Distributions

The instruments of the *Organica* apparently did not leave the paper, but van Schooten's take on mathematics did travel further. The *Organica* showed that the new professor of 'Duytsche Mathematique' was not only a competent teacher of engineers but also a true 'géomètre', something that appealed to the elite circles in which he had been working his way up. In his private lessons, van Schooten attracted a range of students from the Dutch patriciate. The most notable were Christiaan Huygens – Constantijn's second son, later one of Europe's leading geometers; Johannes Hudde – from a family of Amsterdam regents and future burgomaster and governor of the Dutch East India Company; and Johan de Witt – from a family of Dordrecht regents and who would become Grand Pensionary of Holland. With van Schooten they studied *La Géométrie*, elaborating and extending Descartes' new geometry, the students effectively assisting their teacher in the preparation of a Latin edition, in which van Schooten made *La Géométrie* accessible by expanding and clarifying the argument through notes and commentaries. The first edition of the *Geometria* was published in 1649, but the work of his students made its way into the second, expanded edition of 1659-1661. van Schooten's *Geometria à Renato Des Cartes* was widely read, and in this way his appropriation of the new geometry became known throughout Europe's Republic of Letters.

58 University of Groningen, Ms 107.

59 On the relationship between action and contemplation in early modern mathematics, see also Dijksterhuis, "Constructive Thinking."

The conic sections of the *Organica* appeared in the *Geometria* as well, in an appendix containing De Witt's *Elementa Curvarum Linearum*. The origin of the *Elementa* was a treatise on conic sections which De Witt had apparently produced around the time he had studied with van Schooten, during his student years at Leiden university from 1641 to 1645. During the preparations of the second edition of the *Geometria*, van Schooten suggested that his former pupil review the text for publication. De Witt agreed, but, as he was becoming increasingly busy in the affairs of the state, he did not have much time to devote to it. Their correspondence suggests that van Schooten had a rather substantial role in the creation of the *Elementa.* The first book of *Elementa* contains a geometrical exposition of the generation of conic sections in the plane including the determination of their properties from it. The second book took the topic a step further by analyzing them algebraically. Ideologically, the *Elementa* also went further than the *Organica*, and, according to De Witt, the plane generation was not just an alternative approach to conic sections, but an improvement as it returned them to their natural place, the plane:

> I thought it absolutely against the natural order, which in mathematics one should respect as much as possible, to seek the origin of these curves in a solid and then to transfer them to the plane.[60]

Such seditious talk against classical authorities, one would not hear from the obliging professor of 'Duytsche Mathematique'.[61]

The further dissemination of van Schooten's mathematics followed the networks of patronage as they extended to other towns such as Amsterdam. There Abraham de Graaf ran a private mathematics school where he trained navigators, bookkeepers and the like. De Graaf was a protégé of van Schooten's student Hudde, who was, for example, instrumental in securing a place for De Graaf's son Nicolaas as the cartographer of the V.O.C.[62] In 1676 De Graaf published a compendium on mathematics in which he elaborated his particular conception of the field, *De Geheele Mathesis* (The Entire Mathematics). This text was informed by Cartesian visions of mathematics and knowledge in general, including

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60 Witt, *Elementa*, 42: "... originem earum è solido peti atque inde ipsas in planum transferri naturali ordini, qui in Mathematicis quàm maximè observandus est, omnino contrarium duxi; ..."

61 On the development of De Witt's *Elementa*, see Japikse, "Witt (Johan de)," col. 1459-1460; Witt, *Brieven*, Vol. IV, and Witt, *Elementa*, 4-7.

62 Wijnman, "Graaf (Abraham de)" and Wijnman, "Graaf (Isaac de)." Evidence of the close relationship is the appearance of Hudde's dioptrics – which was never published – in De Graaf's publications.

a separate chapter on algebra, which ended with an appendix on conic sections in which De Graaf combined De Witt's geometrical generation in the plane with Kinckhuyzen's algebraic method.[63] In his exposition he used van Schooten's instruments and he referred his readers to the *Organica* for a full treatment (Figure 10).[64]

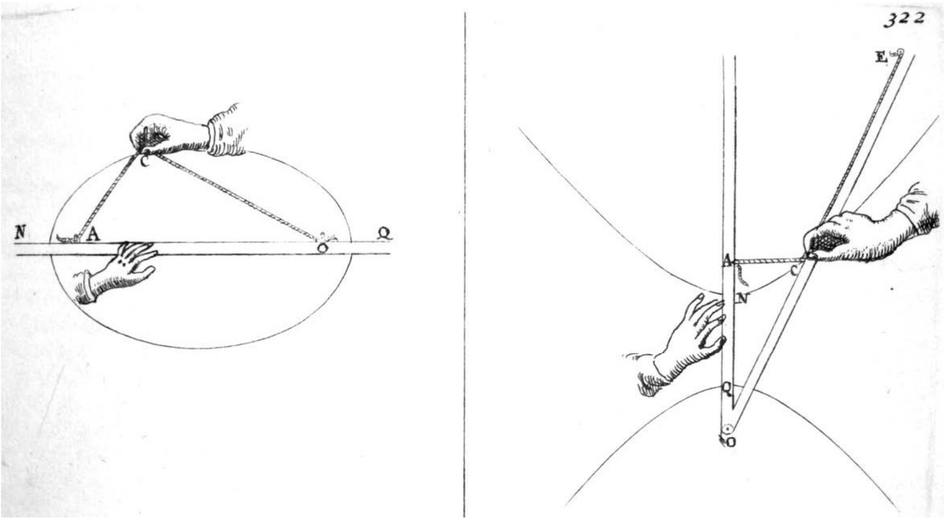

Figure 10: Abraham de Graaf, De Geheele Mathesis (n.p.).

Conclusion

Van Schooten's take on ellipses in the *Organica* integrated various approaches to mathematics, and to conic sections in particular. This paper has explored how these various forms of ellipses came to van Schooten's attention, discussing in particular detail the travels of Golius that brought Apollonius' *Conics* to Leiden. From Golius' first mission to the Maghreb to van Schooten's settling in Leiden movements of all kinds of things mathematical took place. Mathematicians corresponded and exchanged letters, papers and ideas. They traveled themselves, to various geographical locations to meet fellow mathematicians, scholars, businessmen and notables, and to trade wisdom, papers and objects. They moved through diverse cultural and social circles to exchange valuables, appropriate ideas and practices and to acquire status. However, mathematical treasures, both material

63 Graaf, *Geheele Mathesis*, 315.
64 Ibid. 322.

and intellectual, were not just transferred from one place to another, they were transformed and had new meanings attached to them. Golius turned the Apollonius manuscript into an object of philological value and practice, van Schooten infused the classic geometry of conic sections with more recent conceptions of geometrical curves and practices of drawing.

In this paper, I have paid particular attention to the dynamics of these transfers, attempting to highlight the underlying conditions for the exchanges. People ascribe different values to things, be it economic, social, or cultural, and this makes them movable. For Golius an Apollonius manuscript was significant for his Arabic studies and thus desirable, as it was for the university in its quest to amass a collection of texts and the Republic's quest to establishing power, wealth and reputation. Golius himself was an asset of sorts, possessing mathematical, linguistic and diplomatic skills that served the Republic's missions into the Maghreb and the Levant. As was van Schooten for someone like Huygens, providing an opportunity to realize, for example, his project of making lenses for Descartes. For van Schooten the knowledge of various applications of conic sections he encountered with Golius, in the 'Duytsche Mathematique' and with the French 'géomètres', became invaluable to securing a position in Leiden that established him as a professor and at the same time granted him access to the patriciate.

Such exchanges of mathematical knowledge and the encounters between mathematicians were supported by social, political and cultural structures of the time. The vehicles of knowledge transfer reveal an interesting blend of intellectual and worldly interests. The Republic's Mediterranean missions that facilitated Golius' scholarly exchanges served an amalgam of economical, political, military, and cultural interests. Golius' learning opened up diplomatic relationships, which at the same time facilitated his exchange of scholarship. The acquisition of manuscripts provided a means to serve the Republic's interests, as these manuscripts carried philological riches as well as exchange value for diplomatic and commercial purposes. Learning was business. Van Schooten's mathematics at the same time secured him positions as an educator and provided his patrons with adornments; scholarly and worldly interests were interdependent. In the worlds of mathematics in the Dutch Republic, affairs of knowledge and of learning were integral ways of managing economic, cultural and social affairs. [*]

* I would like to thank the editors of this volume for their valuable comments on earlier drafts of this article. My colleagues at the University of Twente – Lissa Roberts, Adri Albert de la Bruheze, Nil Disco, Tim Nicolaije, Arjen Dijkstra – and Jan Hogendijk gave instructive suggestions for the argument of the article. This article is part of the NWO-funded research project "The Uses of Mathematics in the Dutch Republic" (016.074.330).

How to Become a Seventeenth-Century Natural Philosopher: The Case of Cornelis Drebbel (1572-1633)

Vera Keller

A Dutch engraver, engineer, and alchemist active in London and Prague, Cornelis Drebbel, is known today more as a charismatic inventor than as a natural philosopher.[1] In his own time, however, he gained fame as an artisanal philosopher who claimed to gain knowledge of nature through his own body. Drebbel's vernacular natural philosophy travelled across cultural and linguistic regions in astonishing ways. Most remarkably, academic and Latinate readers responded enthusiastically to Drebbel's texts, even as they transformed those works in important ways. The printed editions of Drebbel's works thus allow us to trace circulation between a culture of artisanality sure enough of its own authority to stake claims to knowledge in print, and an academic culture appreciative enough of artisanality to support those claims through both erudition and elegance.

Drebbel tied his knowledge to a carefully crafted persona. His was a persona which belittled education and authority, which had little respect for disciplinary or social bounds, and which could effortlessly combine disciplines such as alchemy, pneumatics, and mechanics to discover universal natural truths through art. His slim, vernacular texts presented a particular manner of philosophizing and type of philosopher. He prided himself on his ability to transmit his own bodily knowledge to others using things more than words. In constructing his text, Drebbel devised strategies for indicating to his readers how they might arrive at bodily knowledge through the manipulation of matter. He crafted his texts as material carriers transmitting his bodily knowledge to the bodies of his readers. Drebbel hoped to transform his readers into artisanal philosophers themselves, so that all might partake equally in knowledge of nature and of God. The abolishment of the inequities that existed between postlapsarian men would result. For Drebbel,

1 The standard reference remains Jaeger, *Cornelis Drebbel en Zijne Tijdgenooten*.

equal interactions produced knowledge, and in turn, the sharing of knowledge could reform human interaction.

Learned readers integrated Drebbel's texts and his persona within the literate networks sustaining sociability in the Republic of Letters. In this process of integration, Drebbel's text and persona were transformed through both text and image in ways that better adapted him to the world of learning. By incorporating Drebbel and his works into their own practices of sociability, learned readers indicated their regard for Drebbel as a source of knowledge. While circulating that knowledge, however, they also tempered its author's aggressive artisanality.

The various editions of Drebbel's work point to how such transformations occurred in the process of circulation. In his major work, *On the Nature of the Elements*, Drebbel had abjured all citations and pointedly opted for a taciturn style. He repeatedly encouraged his readers to grasp natural knowledge with their hands through the use of a contrived demonstration depicted in early vernacular editions. Reclothed for its 1621 Latin edition, *On the Nature of the Elements* appeared with extensive paratexts drawn from the *album amicorum*, or book of friends. These paratexts framed Drebbel's natural philosophy within learned sociability, legitimizing its author as an authority accepted by the literate world. The material carriers in this story – the vernacular text, Latin translation, and *album amicorum* inscription – matter as indicators of different social sites of knowledge production. Following such material carriers allows us to trace movement and transformation between those sites.

Space does not allow an examination of all Drebbelian editions; I will concentrate here upon the early vernacular editions and Latin translations. In particular, the translation edited by the inveterate traveler and Hamburg literary agent Joachim Morsius in 1621 allows us to discover the networks through which Drebbel's work circulated and came to the press. The evidence for such networks does not survive accidentally. Morsius documented his network in excruciating detail. He highlighted such networks in order to embed both himself and a model artisanal philosopher within the Republic of Letters.

A Crafted Text

Ultimately, four short texts by Drebbel reached the press. His major work, *On the Nature of the Elements*, offered a complete natural philosophy in under six thousand words, from the genesis of the world to the constant motion of the elements through heat, cold, wind, and storms, to how that motion could be employed by man to perfect nature through alchemical processes. Drebbel's investigation of the universal source of motion in nature motivated his search for a perpetual motion based in the qualities of the elements. His letter dedicating his perpetual motion to King James I and describing both his process of discovery and his manner of writing natural philosophy was first published in a Dutch translation in Drebbel's hometown of Alkmaar in 1607. Morsius published Drebbel's short treatise on the quintessence in Latin in 1621. Finally, in 1630, Morsius' friend Gottfried Hegenitius excerpted, translated, and printed (in a guidebook to the Netherlands) a letter Drebbel had written to his Alkmaar friend Ijsbrandt van Rietwijck. By the end of the eighteenth century, over twenty-five editions of Drebbelian works had appeared, often including all or an assortment of these texts as well as extensive paratexts.

The date of *On the Nature of the Elements* has been debated. Fritz Burckhardt reported having seen a 1604 Dutch edition printed by Gillis Rooman of Haarlem.[2] This edition, which included a dated portrait, no longer survives. A German translation printed in 1608 in Leiden is the earliest extant edition, and the edition I cite here.

There is evidence, however, that a 1604 edition did exist and that, furthermore, it was an edition Drebbel had a hand in producing. Johann Ernst Burggrav, an associate of the academic alchemist Johann Hartmann, published German and Latin translations of *On the Nature of the Elements* in 1628.[3] He described how he had first encountered the work about twenty years previously. Drebbel had written the work in Dutch and had only a few examples printed to send to "good friends and to philosophers." Burggrav thereafter translated it into German, and since that edition had proved so popular, he decided to re-issue the work in 1628.[4] Indeed, the 1608 Leiden translation was printed by Heinrich van Haestens, the same printer who issued Burggrav's own first work in 1610.

The 1604 portrait Burckhardt described does survive, and it was copied closely in the 1608 edition and in the first Dutch edition now extant (1621). The only other image in the 1608 and 1621 editions depicts a contrived demonstration referred to in the text. I argue that Drebbel did indeed have a 1604 edition issued, and that that work was reproduced relatively faithfully in early vernacular edi-

2 Burckhardt, "Zur Geschichte des Thermometers," 3.

3 Burggrav termed himself a "domesticus" of Hartmann in the preface to his 1620 edition of Clodius.

4 Burggrav, preface to *Von der Natur der Elementen* (1628): "bin ich damaln durch einen vertrauweten Freundt dieses Tractats, von der Natur der Elementen, welchen Cornelis Drebbel damaln in Niderteutscher Sprach verfertiget, und etlich wenig Exemplaria für sich drucken lassen, und allein guten Freunden unnd Philosophis mitgetheilet, theilhafftig worden, welches Büchlein ich hernacher in die hochteutsche Sprach ubersetzt, und in Druck damals befördert."

tions. In 1619, Isaac Beeckman recorded reading a Dutch edition. Thus he, like Burggrav, may have encountered one of the exemplars Drebbel circulated only among "good friends and philosophers."

Such readers would have encountered through both image and text a carefully crafted persona of an artisanal philosopher. As Drebbel wrote in both *On the Nature of the Elements* and his letter on the perpetual motion, he claimed to discover everything he knew about nature with his own hands and without the help of the ancients or of any man.[5] He hoped the reader would not fault him for not "strengthening" his texts with ancient authorities. However, he claimed, he had not read any such works and gave the reader only what he himself had received from nature.

Drebbel presented himself as someone who learned about nature through his hands and who could transfer that knowledge to his readers without the prolixity to which other philosophers fell prey. Contrived demonstrations and analogies with common objects provided a shortcut to knowledge. In chapter four of *On the Nature of the Elements,* he included a contrived demonstration showcasing his new theory of the wind, and referred as an explanation to the figure of this demonstration in the text.[6] Heating an empty retort with its mouth in a vessel of water made air shoot out of the retort and bubble through the water. Then, when the retort cooled, the water rose within the retort far above the level of the surrounding water in the vessel. This demonstrated, according to Drebbel, the way the elements followed a cycle of transmutation from one to the next, rarifying and condensing through heat and cold, and producing such movement in nature as winds, storms, and the cycle of life.

In chapter four, Drebbel also provided other examples from daily life that illustrated similar points. He argued that the elements were not restricted by any

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[5] Drebbel, *Von der Natur der Elementen* (1608), hereafter cited as *On the Nature of the Elements*: "Dieses lieber Bruder habe ich von der natur geschriben wie ich solches mit der handt befunden," and Drebbel, *Wonder-vondt*: "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." Drebbel, *On the Nature of the Elements*, Vorwort: "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."

[6] *Ibid.,* chapter four: "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 Feuwer legen, wie diese Figur auss weiset unnd mitbringt." Borrelli discusses the importance and development of Drebbel's theory of the wind in the context of other theories of wind in the period in Borrelli, "The Weather Glass and its Observers."

proportion in their transmutation from one state to the next but could expand by thousands of times, producing explosions of pneumatic force. This countered what was considered at the time to be the Aristotelian theory of decuple proportions.[7] He gave a roasting apple that gives out wind and the fast wind that shoots out of a hot iron oven when water is dropped upon it as examples.

Yet Drebbel's example of the retort was special, not only for demonstrating additional phenomena such as the rise of the water back up the retort, but as a contrived demonstration. The example of the retort, singled out for depiction in a figure, was not just an example from daily life. Nor were readers expected to act only as virtual witnesses.[8] Rather, the fact that Drebbel offered advice as to the material to be used in the retort suggests that he thought readers might attempt to test it themselves. He argued that the more the retort was heated, the more it would fill with water upon cooling. Thus a stone retort was better than glass, since at high temperatures the glass would crack, but the level of the risen water could only be observed in a glass retort. Francis Bacon and Robert Boyle would later offer the same advice.[9]

Drebbel's text and its accompanying figure not only suggested the construction of a special demonstration of his account of the elements, but could also be linked to the very famous machine Drebbel had constructed to illustrate what he considered his discovery of the universal principle of motion – his perpetual motion. Drebbel himself stressed the relationship between his natural philosophy and his machines. In his letter on the perpetual motion, he constantly connected making (*maecken*) to understanding (*verstandt*), knowledge (*kennis*), and science (*wetenschap* or *scientie*). He both discovered his natural philosophy and demonstrated and validated it through working machines.

Drebbel described his quest to discover this motion through a series of unsuccessful machines; at first, he had tackled the nature of water with great zeal, hoping that by bending pipes in strange ways he could make it climb upwards by itself, but it was all in vain. At last, he built his successfully moving device, proving his understanding of the *primum mobile*, which was but one "little twig of the perpetually moving tree grafted upon true knowledge of the elements," and which allowed everyone to see the truth of his writings. Such knowledge allowed him to

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7 Bacon later attacked the Aristotelian decuple proportions in *Instauratio Magna,* 70-71.

8 Shapin and Schaffer, *Leviathan and the Air-pump,* 55.

9 Drebbel, *On the Nature of the Elements*: "dan so fern du das glas sonder brechen gar heiss machen kanst, so wirdt die Retorta, wan sie kalt wirt, mit Wasser erfullet sein, darumb ist eine steinerne Retorta viel bequemer, aber die verfüllung zu sehen, ist eine glaserne viel besser." Bacon, *Instauratio Magna*, 87-89 and Boyle, *Works,* 303.

build other working machines as well. For instance, by understanding the cause of the wind, he could make an instrument which produced wind, and through his knowledge of the ebb and tide, he could make an ebbing and flowing motion.[10]

His device proved his knowledge since it was based on the nature of the elements rather than upon mechanics. That is, Drebbel did not seek to build a mechanical perpetuum mobile based on dead quantities rather than living qualities and deploying an arrangement of weights and springs to operate against the course of nature. He sought to build a chemical movement based in the nature of the elements, and thus indicative of knowledge of them. Today we might interpret a motion based in the expansion and contraction of air quantitatively, but to Drebbel such a motion was qualitative. It is not only incorrect to translate Drebbel's "living instruments" as mere "working models" as Jennifer Drake-Brockman did, but such a translation obscures Drebbel's understanding of his machine as based in natural qualities and not mechanics alone.[11]

Promoters of perpetual motion frequently argued that while it was impossible to build a mechanical perpetual motion, it should be possible to do so by drawing upon natural qualities, since nature herself circulated in perpetual motion.[12] Likewise, Drebbel cast his perpetual motion as a natural, qualitative motion, which could then be applied to other sorts of motions, even mechanical ones, to render them perpetual.

Just as Drebbel spliced material demonstrations into his text and grafted his perpetual motion onto the nature of the elements, he fused mechanics and the transmutation of the elements within his machine; his perpetual motion included mechanical parts, namely an astronomical clock kept in motion through the expansion and contraction of the elements. This was not Drebbel's only invention fusing knowledge of the elements and mechanics; his self-regulating oven, for instance, depended upon Drebbel's understanding of the expansion of the air as well as air's role in combustion in order raise and lower a lever controlling air

10 Drebbel, *Wonder-vondt*: "Ghelijck (o Coningh) in dit tegenwoordige Instrument meught sien en proeven, alle nae lust, die waerheyt van mijn schrijven: dit is een twijchken van den eeuwighbewegenden Boom, ghegriffet op de ware kennis der Elementen" and "Voorts also *verstae* die oorsaeck des Windts, *maeck* Instrumenten die geweldelijck windt gheven, en door de *kennis* van ebbe en vloedt, *maeck* een Instrument ... ... [emphasis mine]."

11 Drake-Brockman, "The Perpetuum Mobile of Cornelis Drebbel," 129. For the correct translation see Vermij, "Putting the Earth in Heaven."

12 Mögling, *Perpetuum Mobile,* 40 and 44, and Gabbey, "The Mechanical Philosophy and its Problems."

flow to a fire. Boyle praised the oven as an example of the fusion of mechanics and chemistry.[13]

Drebbel thus crafted a machine-based but non-mechanical natural philosophy. His natural, or living, motions not only demonstrated his knowledge, but allowed it to be understood by others without excess verbiage. He boasted to King James that he could demonstrate his understanding of the prime mover "as well with living instruments, as with natural reasoning, so that I therefore should have no need to write much." Drebbel acknowledged that there were many who didn't think it possible for mankind "to 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. . . . ."[14]

As Drebbel's friend and editor G. P. Schagen wrote in his preface, such a "living instrument" successfully rendered difficult knowledge accessible. "If this knowledge was common among astronomers," said Schagen, "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 reasoning) that the Earth goes around every 24 hours, but this Alkmaarian philosopher can demonstrate the same not only with reasoning but also with living instruments."[15] Some readers greeted the idea that the construction of machines could offer easy, rapid, and bodily knowledge with enthusiasm; Abraham Frankenberg and Georg Philipp Harsdörffer, for instance, cited Schagen's pronouncement in support of Copernicanism.[16]

In 1619, the academic alchemist responsible for introducing alchemy to the curriculum at the Steinfurt Academy, Heinrich Nollius, recommended that the student of astronomy consult such "living globes."[17] Both the Rosicrucians and

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13 Boyle, *Works of Boyle,* Vol. 13, 298.

14 Drebbel, *Wonder-vondt*: "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 cloecke verstanden niet willen ghelooven, dat wy dese verburghen oorsaken met onse vernuft moghen begrijpen, waerom tot bewijs dat verstae die oorsaeck van't Primum mobile. So maeck een cloot, die hem eeuwelijck bewegen can, nae den loop des hemels . . . ."

15 See Schagen's preface: "Soo dese wetenschap onder de Sterkondigers ghemeen was soo en soudemen niet behoeven soo veel stellingen en rekeningh der Planeten en ander Sterren maer de Ster-konst soude licht zijn en Copernicus soude bloeyen. Want die bewijst (met reden) dat het Aerdtrijck alle 24. uren ront om gaet: Maer desen Alckmaersche Philosooph can 't selfde niet alleen met reden maer oock met levendige Instrumenten bewijsen."

16 Frankenberg, *Oculus Sidereus,* paragraph xiv, and Harsdörffer, *Deliciæ physico-mathematicæ*, 309.

17 On Nollius, see Moran, *The Alchemical World*, 122-29.

Cornelis Drebbel had constructed such living microcosms, according to Nollius. "In England," he said, "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 Cornelis Drebbel, a philosopher not to be despised."[18] Nollius recommended that his students consult such "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]."[19]

Daniel Mögling, future court physician and mathematician to Landgrave Philipp III of Hessen-Butzbach, shared Nollius' appreciation for the pedagogic opportunities offered by manmade microcosms.[20] While still a student, Mögling wrote in support of the Rosicrucians under the pseudonym Theophilus Schweighart. In his *Prodromus Rhodo-stauroticus*, Mögling echoed Nollius' advice, advising the reader to seek out philosophers who have themselves built perpetual or prime 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. These microcosms would allow them to observe the course of nature directly, rather than having to read long descriptions.[21]

The reception of *On the Nature of the Elements* benefited from Drebbel's fame as an internationally successful inventor of these devices. Readers sought to understand his machines in light of his text, and vice versa. For instance, they correctly

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18 Nollius, *Naturae Sanctuarium,* 61: "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."

19 Ibid., 684: "Consulendi ergo & compellandis sunt veri Philosophi, qui manu sua perpetuum mobile confecerunt, atque non tantum in eius confectione mundi creationem ostendere, sed etiam in eo confecto & elaborato cursum astrorum, Elementorum, & omnium naturam compendiose monstrare poterunt."

20 On Mögling, see Moran, *The Alchemical World,* 172.

21 Mögling, *Prodromus rhodo-stauroticus*, n.p.: "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, müssen wir hiervon die jenige Philosophos ersuchen, welche solches perpetuum mobile selbsten 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 Eygenschafft compendiose, augenscheinlich vorzeigen können."

noted the relationship between the movement of the retort demonstration in *On the Nature of the Elements* and the workings of his perpetual motion machine. In his *Perpetuum Mobile* of 1625, Mögling advised the reader who wished to understand Drebbel's perpetual motion to consider the retort described in chapter four of Drebbel's short *On the Nature of the Elements*.[22]

Drebbel's text did not appear to his readers in isolation. Readers connected his text to Drebbel's persona, to his easy and pleasant brand of empiricism, and to the famous machines which, in lieu of ancient authorities, validated his theories. In a liminary poem found in the first extant Dutch edition (1621), an anonymous poet advised readers to trust sight more than reason or reasoning ("reden"). The poet invited the reader to spend some time with Drebbel, promising that the reader would immediately acquire what he sought.

According to this poet, the experience of reading *On the Nature of the Elements* transported the reader to Drebbel's side. There they might enjoy a sensual experience – hearing thunder, seeing lightning, rain and hail, and feeling cold, heat, wind or quiet. The feeling that the book provided a material encounter with natural knowledge was strengthened by the reader's previous knowledge of Drebbel's celebrated machines. To the reader, Drebbel proved what he had described in words not by citing other authors, but by having built "natural" instruments that appeared to be alive.[23] The public presence that attended a famous inventor allowed readers to approach his texts with his persona and his celebrated inventions in mind. Those inventions helped to validate his natural philosophy through material means, increasing the sense that his was a knowledge found in the body, although delivered in texts.

The relationship between body, machine, and contrived demonstration also allowed Drebbel to shorten his text, offering his readers a knowledge based as much as possible in things rather than words. As the keystone to Drebbel's entire theory of the elements, Drebbel not only referred back to the retort demonstration when discussing seasonal changes, the transmutation of the elements, the genera-

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22 Mögling, *Perpetuum Mobile*, 26: "Wer mehrere Nachrichtung begehret, lese das kurtz … Von Natur der Elementen … vornemblich aber das vierdt Capittel desselven von der Retorten." For more on Libavius, Nollius, Mögling and their interpretations of Drebbel, see Keller, "Drebbel's Living Instruments."

23 Drebbel, *On the Nature of the Elements*, Dutch 1621 ed., liminary poem: "Hier gy muegt den Donder hooren/ Van te vooren, bald'ren gram,/ Daer volgt naer een Bliksem-vlam. / Regen, Hagel, Snee om d'ooren,/ Me kond spooren, (als gy wilt)/ Koud', of Hitte, Wind of Stilt" and "Die 't beschreven doet versterken,/ Met Tuyg-werken, die in schyn/ Levend', (doch Natuerlyk) zyn."

tion of all things, and the clarification of matter for the philosopher's stone, but he suggested time and again that his readers consider this example on their own.

For instance, after detailing the seasonal changes in heat and cold and movement of rain, clouds, and storms in chapter five, Drebbel suggested that by considering such changes, his readers could properly understand his "example of the wind" better than he could have described it in words. That was why he had not written any more than absolutely necessary. At the conclusion of chapter six, when Drebbel described how wind can shoot down from clouds, he again suggested that it would be possible to prove his account through Latinate "reasonings" (*Rationibus*), but those who already understood the previously discussed causes would be able to understand this phenomenon better than he could describe it in words.[24]

Isaac Beeckman was one of those readers who took Drebbel's advice. In 1619, Beeckman described how wind sometimes shoots in one direction out of the clouds.[25] Referring to chapter six (from the first edition of *On the Nature of the Elements*), Beeckman went on to provide his own example from daily life similar to the both the demonstration and the examples Drebbel had given in chapter four; air expands within and shoots out of clouds the same way air, smoke, and powder expand and shoot out of bombs. Furthermore, the pages of Beeckman's journal are full of his research into the nature of heat and wind through his various plans for and construction of versions of Drebbel's perpetual motion.[26]

Circulating Personae and Texts

Drebbel cast his reticent style as part of a spiritual and social attitude towards knowledge and to whom it belonged. Drebbel contrasted himself with those who sought fame by setting themselves up as greater authorities than others through the writing of books. "Aren't we all brothers?" When we test ourselves, we find that we have all been created by God as kings with all of nature as our inheritance.

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[24] Drebbel, *On the Nature of the Elements*: "Darumb mein Bruder wan du dis im grunde betrachtest, wirstu recht verstehen, die vorgehende exempel vom winde, mehr dan ich schreiben könte, derowegen habe ich nicht mehr geschriben, dan zum fundament und zu dem, das wir weiter verstehen werden, notig" and "welche ursachen man mit naturlichen Rationibus beweisen kündte, aber der vorgehende ursachen verstehet, wirdt das volkömlicher verstehen, dan ich beschreiben kondte."

[25] Beeckman, *Journal,* Vol. 1, 346: "Den 10 November te Middelb., occasionem praebente *cap. 6* libri Drebbelij Alcmariensis, gedruckt te Haerlem, *Van den natuyre der Elementen*, int Duytsch."

[26] Beeckman, *Journal,* Vol. 2, 201, 202, 363, 372 and Vol. 3, 203-4, 302-4, 358, 367.

He emphasized that his work was a "little book" or pamphlet, while criticizing the vanity of those who wrote "fat books" in praise of God.[27]

It was pride that led to the fall, and to the different opinions, factions and misunderstandings between men. It was also pride which prevented mankind from understanding Nature. As Drebbel described in his letter on the perpetual motion, such lack of understanding caused the different lots of man. "The gifts of God" however, offered all the ability to understand nature, if such gifts were well practiced.[28]

This emphasis on the practice of gifts reflects the motto Drebbel selected, "*Oeffen uw gaven recht*" (Practice your gifts rightly). Drebbel inscribed this motto in the various albums he was asked to sign, presenting himself in the vernacular and emphasizing practice. His signature can be found today in the album of the Bohemian alchemist Daniel Stolcius, the young Austrian nobleman Otto von Herberstein, the patrician Nürnberg law student Jakob Fetzer, the wealthy and learned Haarlem alchemist Daniel van Vlierden, and the Hamburg literary agent Joachim Morsius.

Such books were standard appurtenances of Northern European students upon their academic peregrinations. Students gathered erudite inscriptions in several classical languages from their peers and their teachers at the places of learning they visited. The books were arranged according to a social hierarchy, and thus required inscribers to clarify their standing among a collection of individuals frequently encompassing many ranks and nationalities. Drebbel often stands out in such collections. His inscription is the only vernacular one in van Vlierden's collection of inscriptions full of Leiden luminaries, for instance. Shockingly, Drebbel appears on page ten of von Herberstein's book, far ahead of his social superiors such as Isaac Casaubon (twenty-second). Von Herberstein clarified the reason for Drebbel's importance, noting around Drebbel's inscription that he was the author, or inventor, of the perpetual motion ("Autor perpetui mobilis").[29]

Drebbel, little caring for social or academic hierarchies, may well have en-

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27 Drebbel, *On the Nature of the Elements*: "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?" "ich . . . . understundt mich gegenwertiges Buchlein deinent wegen lieber leser zu verfertigen"; "sollen wir grosse Bücher schreiben, Gott dar mit zu loben? Ist es nicht eittelheit?"

28 Ibid.: ". . . 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." "Der hochmüt den menschen verfuhret unnd ihne verhinderet die Natur zu verstehen." "Onverstandt is de oorsaeck van den verscheyden wil, oordeel en leven des Menschen."

29 For von Herberstein's attitude toward rank, see Zöllner, "Aus dem Stammbuch des Otto Heinrich von Herberstein," 314.

joyed disrupting the social order. As his associates, the Küfflers, informed 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." Drebbel did not care for schooling, but "as he grew in age, he continued to grow in inventions, without the help or reading of books, which he had always disdained." He was also "quite old before he understood any Latin, and he did not know how to speak it."[30] Hartlib reported that Drebbel opposed the discipline required by traditional academic instruction fiercely. "The binding ones-selfe to any Rule whatsoever dose hinder mightily a Mans free-Invention. Therfore Drebbel would not suffer his children to bee taught in schooles."[31] Drebbel himself announced his lack of Latin in his letter to King James on the perpetual motion.[32]

Given Drebbel's social egalitarianism, his general opposition to literate culture, his aversion to the citation of authorities and his confidence in his ability to know nature through the work of his hands, it is shocking indeed to find *On the Nature of the Elements* not only read, but applauded and taught within academic curricula. Within just a few years of the 1608 edition, the academic alchemist and rector of the Coburg academy, Andreas Libavius, for instance, translated the entire work into Latin and appended a line-by-line commentary in a massive work intended for students.[33] Heinrich Nollius frequently cited *On the Nature of the Elements* at length (both from the German and in Latin translation) within his hefty quarto chemical textbook of 1619.[34] Peter Lauremberg, at the time professor at the Hamburg Gymnasium, translated the work into Latin, and Joachim Morsius printed his translation in 1621.

The Herborn professor Johann Heinrich Alsted reprinted Morsius' edition within his comprehensive 1626 philosophy textbook, and subsequently his edition of Drebbel was extracted from the compendium and reprinted separately in Geneva in 1628. Alsted called the work a "short and golden treatise" and the "key

[30] Peiresc, Bibliothèque Municipale Inguimbertine, 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." Ibid., 408v: "Il me dict qu'en croissant d'aage il aloit tousiours croissant d'inventions, qu'il procedoient de la vivacité de son esprit, sans ayde ny lecture de livres qu'il a tousiours mesprisé… Et qu'il etoit desia fort avancé en aage qu'il n'entendoit point le latin et ne le scavoit pas parler… ."

[31] Hartlib, *Ephemerides*, 1639, 30/4/35A.

[32] Drebbel, *Wonder-vondt*: "Maer alsoo mijn meninghe niet en can volcomen uytbeelden, noch in de Engelsche, noch in de Latijnsche tael, so hebbe dat in Duyts geschreve."

[33] Libavius, "Apocalypseos." On Libavius, see Moran, *Andreas Libavius*.

[34] Nollius, *Naturae Sanctuarium*, 11, 61, 126, 148, 152, 236, 279, 752. Szydlo mentioned Nollius' citations of Drebbel in *Water which does not wet hands*.

to physics." He recommended Drebbel as one of the two greatest writers on the nature of the elements ever, praising in particular the way this alchemist and mechanic ("chemicus" and "mechanicus") was able to demonstrate the usefulness of the knowledge of the elements using so "few words" ("paucis ... verbis"). Alsted answered the question "Who has best described the generation of wind, rain, and other meteors?" simply with "Cornelius Drebbel in *On the Nature of the Elements*."[35] In his marginal comments on Drebbel's text, Alsted repeatedly praised Drebbel as an autodidact, and he noted Drebbel's lack of Latin.[36]

A Ramist preference for knowledge found in and for use can help explain the enthusiastic reception of Drebbel's works.[37] The new discipline of academic alchemy, in particular, brought together artisanality and academic culture.[38] In translating, commenting upon, and recommending Drebbel's works, academic alchemists indicated their respect for knowledge found through practice. In so doing, however, they transformed those works. Translated and incorporated within extensive academic compendia, Drebbel's vernacular pamphlet merged with learned Latin verbosity, obscuring Drebbel's crafted, taciturn style. The relationship between pamphlet, machine construction, and the persona of a vernacular artisan was important to Drebbel's appeal, yet circulation to other social sites transformed that relationship.

Thus, Libavius, for instance, did not consider Drebbel's retort demonstration in chapter four of much importance. He interpreted Drebbel's entire account of the elements as *Decknamen* concealing a series of alchemical processes, which he revealed in his commentary through comparison with an extensive alchemical corpus. Although Libavius pointed out that Drebbel's theory of the wind differed from Aristotle's, he considered the retort demonstration in chapter four not as the

35 Alsted, *Compendium philosophicum,* 22: "Quaenam utilitas ad nos redeat ex solidâ & accuratâ cognitione quatuor elmentorum? Id paucis ostendam verbis C.D. summi mechanici & chymici. Sic autem ille in brevi & aureo suo tractatu de natura elementorum ... Confer C.A. Qui duo authores ita scripserunt de elementis, ut jure merito omnibus scriptoribus anteponantur" and 165: "Quisnam omnium optime descripserit generationem ventorum pluviarum, & similium meteororum? Cornelius Drebbel in tractatu de naturâ elementorum. Vide sub finem hujus compendii physicae." The other writer on the elements whom Alsted recommended ("C.A.") was Cornelius Agrippa. I owe thanks to Howard Hotson for clarifying this point.

36 *Ibid.,* 288, 292, and 293.

37 Hotson, *Commonplace Learning,* 121.

38 For the introduction of alchemy to the university see Moran, *Chemical Pharmacy Enters the University;* Debus, "Chemistry and the Universities in the 17th Century," and Hannaway, *The Chemists and the Word.*

keystone of Drebbel's entire account of movement, but as a digression that had nothing to do with the mysteries of the philosopher's stone.[39]

Peter Lauremberg offered yet another interpretation of *On the Nature of the Elements* in his translation. He greatly admired Drebbel's untutored style, finding within the popular and unassuming text "writing of a new character, and by a new author."[40] Even more praiseworthy was the harmony Lauremberg discerned between Drebbel's philosophy and ancient theories. He interpreted the work as divided into two distinct sections. The first part on the nature of the elements was Aristotelian, while the final two chapters dealt with alchemy. In the latter, "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."[41]

Lauremberg's interpretation of Drebbel's theory of the elements as Aristotelian did not lead him to call the text secondary or derivative. He accepted Drebbel's claim to personal knowledge discovered through his own hands, and admired Drebbel's innate, uneducated knowledge. It granted the author great glory, 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."[42] The fact that many (though not all) of the findings of this modern artisan corresponded with ancient theories only increased his prestige.

Lauremberg's translation appeared without the figure of the retort or the reference to the figure in the text, although he did stress how through the retort we can sense the phenomena Drebbel described both visually and manually.[43] When Alsted reprinted Lauremberg's translation within his philosophical compendium, chapter four was entitled "How the wind & rains are generated, illustrated by three

[39] Libavius, "Apocalypseos," 370: "Nihil ista habent mysteriorum. Digressio est ad declarandos motus ventorum & generationes."

[40] Lauremberg in *Tractatus Duo* (1628), 3: "Quod dum facio, inveni scriptum charactere quidem novo, novoque auctore dispaluisse in vulgus, sed tamen sapere nativum generositatem antiquioris Philosophiae."

[41] *Ibid.*: "chemicae quidem duo illius postrema capita, in quibus abstrusioris sapientiae fundamenta tam aperte deteguntur, ut & agnosci: & videri & palpari facile possint ab eo, cui non prorsus frigidus obsistit circum praecordia sanguis. Peripateticae vero, quicquid reliquum est argumenti de elementorum naturis, transmutationibus, pluviis, tonitribus, fulguribus, ventis."

[42] *Ibid.,* 5: "Ea tamen res non tam dedecore quam gloria esse potest Drebelio: non tantùm quia cum prisca, solida, & genuina Philosophia conspirant ea quae propint; ut multo magis, quia ipse ingenii sui excellentia meditando atque experiundo sequutus est id, quo multi multorum praeceptorum & librorum adminiculis usi, raro, atque aegre perveniunt."

[43] *Ibid.*: "Id oculis & manu palpabimus."

examples."[44] Thus, the specially contrived and depicted demonstration of the retort received the same attention as the common examples of the roasting apple and the hot iron oven. Some of the important differences between Drebbelian and scholastic stoicheology, such as the former's highly variable rate of expansion between the elements and new theory of the winds, received less emphasis in Lauremberg's translation than in the early vernacular editions.

Lauremberg was very aware of the ways in which books transform authors. He took *On the Nature of the Elements* as an example for how content depended upon the form in which an author's work circulated. 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. We carefully handle, inspect, and turn over both books and coins, and if they bear something memorable on their front, we read and 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?"[45] Unfortunately, continued Lauremberg, efforts to interpret the work had been hindered by its appearance in Dutch, which many people don't understand, and by the terrible German translation, which did not follow "the author's own opinion."[46] He viewed it as the responsibility of those producing the book to fashion a beautiful and authoritative impression of the author's opinions, so that it might circulate for the benefit of the Republic of Letters.

Lauremberg fashioned Drebbel's text into an elegant coin well suited for circulation. Morsius, the editor, also gave the translation a dress designed to celebrate and promote circulation within the Republic of Letters. Approximately thirty percent of Morsius' edition was not written by Drebbel, but by a wide cast of charac-

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[44] Alsted, *Compendium philosophicum*, chapter four: "Quomodo generentur Venti & Pluvia. Quae res illustratur tribus exemplis."

[45] Lauremberg in *Tractatus Duo* (1628), 3: "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. Utrosque curiose 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 Drebelii de Elementis, quod sollicita & diligenti manu quotusquisque non tractavit paucis retro annis?"

[46] *Ibid.*: "Hoc solum faciliori eius intellectioni obstare videbatur, quod Belgice esset conscriptum, quam dialectum non omnes aeque 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 delitescebat, neque omnia transtulit, neque satis dilucide aut Germanice."

ters. In selecting liminary poetry and writing his paratexts, Morsius drew upon and advertised the circulation of Drebbel occurring in the world of academic peregrinations, scholarly networking, and *album amicorum* inscriptions. Such circulation celebrated the harmony between Drebbel the artisanal philosopher and the learned world, which, given Drebbel's aggressively vernacular stance, was no small feat.

Morsius' paratexts smoothed possible lines of contradiction or rupture between a "new writer" and the mores of a learned readership. They further cast the relationships between members of that readership as far more harmonious than they in fact were. Morsius' advertisement of circulation portrayed a virtual society that existed only as a textual phenomenon. Morsius' construction of an idealized Republic of Letters in print allowed him to smooth over differences and to encourage further circulation.

Morsius employed his editions of Drebbel's works to expand his own reputation and the idea of the Republic of Letters in general to include alchemy and hermetic philosophy. The son of a wealthy Hamburg goldsmith, Morsius received a fine humanist education at the University of Rostock. After his university studies, Morsius travelled to the Netherlands. He selected Leiden, home to ample academic luminaries and publishing houses, as a convenient springboard into the life of a literary agent. There he edited the personal letters of great Leiden luminaries such as Scaliger and Clusius and other short tracts.

So far, there had been nothing greatly unusual about Morsius' career, but it was about to take a surprising turn. Having read the Rosicrucian tracts, Morsius was excited about the possibilities alchemy offered for the reformation of knowledge.[47] He decided to explore the world of alchemical publishing, and he chose to pursue the manuscripts of Drebbel for his first edition.

Before undertaking a trip to England, where he would meet Drebbel himself, he first sought out Drebbel's Dutch friends such as Daniel van Vlierden of Haarlem and Ijsbrandt van Rietwijck of Alkmaar. He visited van Vlierden in September 1619, and van Rietwijck one month later.[48] It was through such visits that Morsius collected the small treatises and personal letters he published. Around van Rietwijcks'Rietwijcks inscription in his album, Morsius later noted that Drebbel had written a letter to Rietwijck which had been printed by Gottfried Hegenitius, and that he owed Drebbel's *On the Quintessence* to Rietwijck.[49]

47 Schneider, *Joachim Morsius*.

48 Morsius, Lübeck MS. 4a 25, 2, 223v.

49 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 Rietwijck, see Hegenitius, *Itinerarium*, 73.

In the networking practices that led up to the production of Morsius' edition, we find Drebbel circulating as a means of increasing sociability among those admiring this new artisanal philosopher. When he reached London, Morsius became acquainted with the patrician Nürnberg law student, Jakob Fetzer, signing his album in November 1619. Drebbel had already signed Fetzer's album the previous July.

Fetzer had included in his lavish volume a series of images depicting the region's curiosities, from London Bridge to the cassowary. Morsius offered Fetzer an image of the famed perpetual motion machine installed at Eltham palace outside the city, together with poetry drawn from Virgil and from his friend Thomas Seghetus.[50] Morsius identified the image of the perpetual motion itself as that of another friend, Cornelis Drebbel ("Effigies perpetui motus Cornelii Drebelii amici," see Figure 1). Interpreting the perpetual motion as an emblem for Drebbel's theory of the elements as a whole, and 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 knowledge of divine things."[51] In early albums, images often served as the heraldry or emblems of individual inscribers, especially noble ones. Here, however, the image did memorialize a single individual, but built ties between Morsius and Fetzer via Drebbel, while linking the construction of courtly wonders to the knowledge of nature.

We find a very similar use of a depiction of Drebbel's perpetual motion in Morsius' own album (Figure 2). The images appeared not as part of a series as in Fetzer's album, but on the page of the undated inscription of the Kurlander Daniel Rohrman, suggesting that Rohrman himself drew the image or more likely commissioned it from a professional artist as a tribute to Morsius. In his inscription, Rohrman identified the machine as Drebbel's perpetual motion, citing Lucretius on the constant motion of all things. The image thus served as a representation of how the world worked through movement, an idea Rohrman could have drawn from Drebbel's own *On the Nature of the Elements*, but which he expressed instead in elegantly classical form.

In using Drebbel's machine as the image to demonstrate his affection for Morsius, Rohrman, like Morsius, connected multiple identities and relationships. In

50 Seghetus' much lengthier poem can be found in *Delitiae Poetarum Scotorum*, 490. Seghetus inscribed Morsius' album at Lübeck Ms. 4a 25, 167 and 188v. On Seghetus, see Odložilík, "Thomas Seget."

51 Morsius, album of Jakob Fetzer, Cod. Guelf. 231 Blank., fol. 309r: "contemplationis divinarum rerum eximium principium nosse naturam et separationem elementorum."

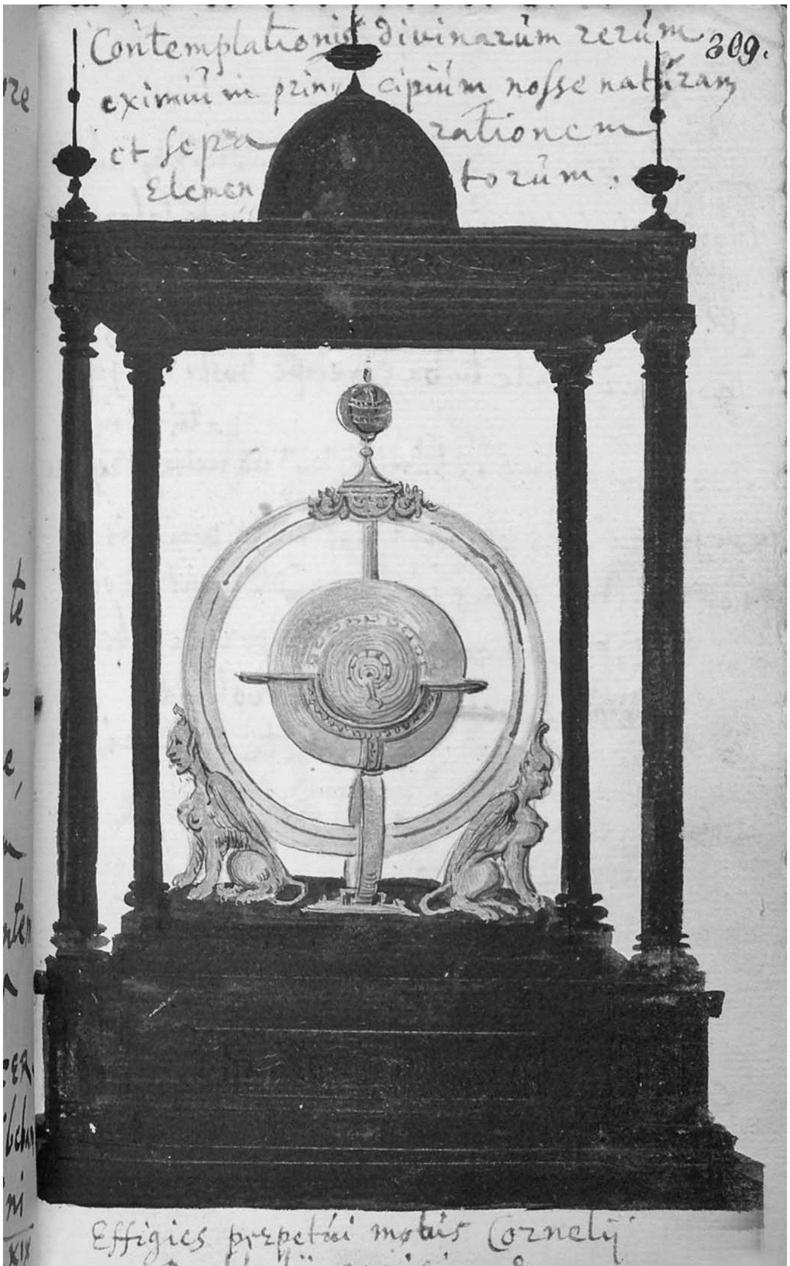

Figure 1: Drebbel's perpetual motion in Fetzer's album, with an inscription by Joachim Morsius. Herzog August Bibliothek Wolfenbüttel, Cod. Guelf. 231 Blank., fol. 309r.

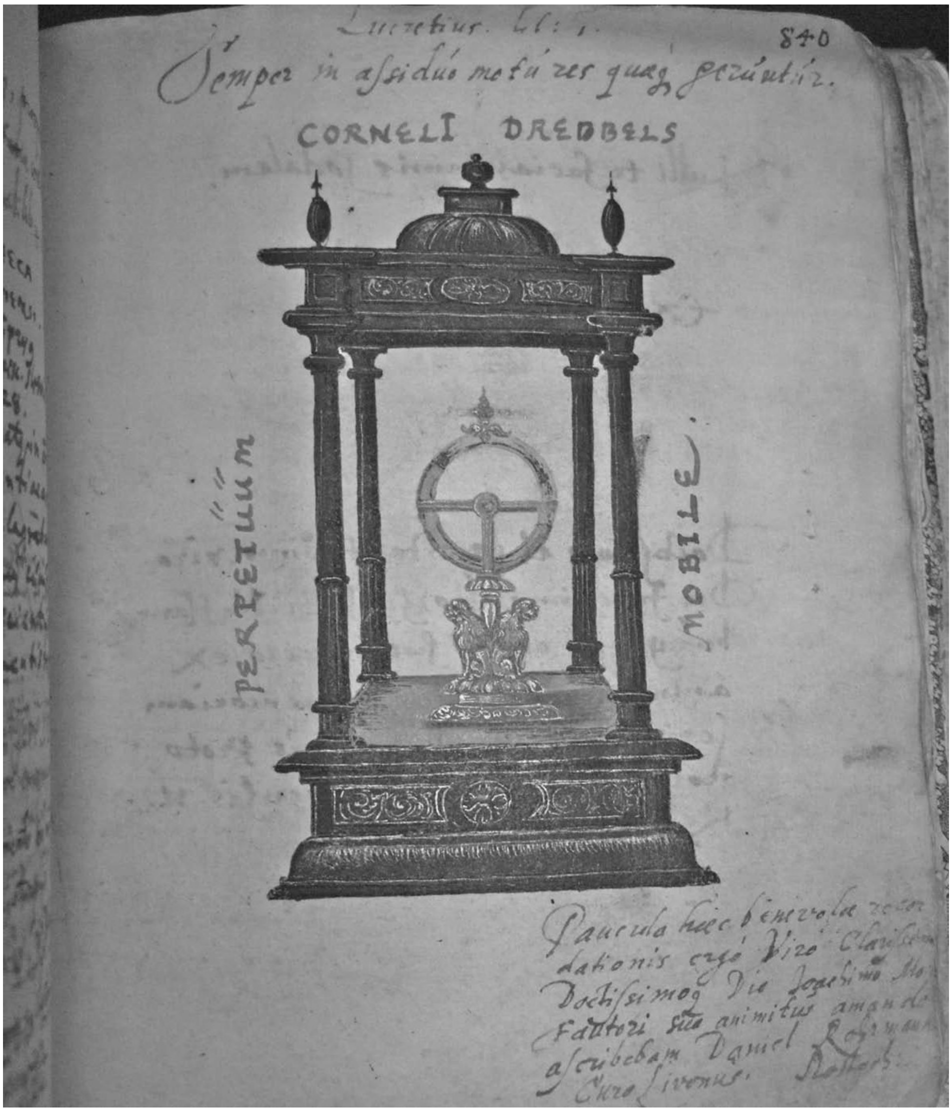

Figure 2: Drebbel's perpetual motion in Morsius' album, with an inscription by Daniel Rohrman. Stadtbibliothek Lübeck Ms. 4a 25, Vol. 4, 840r.

triangulating identities, Rohrman and Morsius entangled different media and the authorial stances such media implied. The beautifully drawn perpetual motions found in the albums emphasized decorative design and rich materials, such as the ebony tabernacle, the gilt machine, and (in Rohrman's version) the velvet cloth upon which it rested, rather than technical detail. For instance, the central globe with its dials depicting the motions of the heavens was entirely absent from Rohrman's version, while a pair of decorative lions appeared in lavish detail.

Attention to decorative or symbolic detail can also be discerned in the figure of the retort demonstration in *On the Nature of the Elements*: the vessel of water was decorated with sphinxes, just as was the perpetual motion depicted in Fetzer's book. Yet the figure of the retort demonstration encountered within a slim vernacular text suggested ways for readers to avoid verbiage and reliance upon ancient authorities by directly experiencing Drebbel's theories for themselves. By contrast, elegant depictions of the perpetual motion within extensive, eclectic and intertextual albums suggested ways of dilating, in elegant Latin verse no less, upon the meaning of Drebbel's machine, the significance of his persona, the social relationships between his admirers, and the harmonies between his practices, his theories and classical philosophy.

These luxurious drawings served as presentation objects offered to readers of the album, just as Drebbel had presented the original machine to King James I. The drawings of the machine functioned as representations of a persona, like heraldry, but in a manner emphasizing the integration of learned circles rather than a single individual. While the machine Drebbel built for King James I demonstrated and validated his natural philosophy through constant movement, the drawings of the machine validated the appeal of Drebbel's philosophical persona through their circulation within the Republic of Letters.

Unlike Drebbel's own taciturn motto with its emphasis upon vernacular practice, album inscriptions smoothed over possible tensions between his machine-based artisanal knowledge, classical philosophies, and learned sociability. Yet even Drebbel's vernacular motto circulated in Latin dress within Morsius' album. On the pages preceding Drebbel's inscription in Morsius' album, Joachim Olearius, a pastor in the village of Petschow outside Rostock, inscribed a lengthy tripartite poem in both German and Latin on the motto "Ofend u gaven recht" of the "philosopher, alchemist, and mechanic" Cornelius Drebbel of Alkmaar.[52]

[52] Olearius in Morsius, Lübeck MS. 4a 25, Vol. 2, 342r-343v: "philosophi hermetici et mechanici."

Selecting Praise

After extensive travel and sociability among Drebbel's acquaintances and admirers, the time came for Morsius to publish the translations and manuscripts he had acquired. Morsius' first edition of Drebbel's works, published in 1621 in Hamburg with a dedicatory letter signed March 1620 at Leiden, included Drebbel's letter on the perpetual motion and his *On the Quintessence*. Morsius carefully selected dedicatees and liminary poetry, deciding how best to advertise his extensive networking while forging new ties.

Morsius chose to dedicate *On the Quintessence* to Heinrich Nollius, who, as we have seen, enthusiastically praised Drebbel in his textbooks of 1619. Morsius explained to Nollius how he decided to join the knowledge of nature and hermetic medicine to his study of public law, philology and sacred and profane history. The first evidence of his foray into alchemical letters was this little work of Drebbel's. He 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.[53]

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 already dedicated the work to the Luneburg senator George Schumacher. Morsius appended his own dedication to Schumacher, describing how he had first been introduced to him by Heinrich Nollius, and asking him to send regards to the learned Johann Adolph Tassius.

Morsius chose yet another dedicatee, Daniel van Vlierden, for Drebbel's letter on the perpetual motion. He recalled how, before he had set out for Britain, he and van Vlierden had enjoyed such wonderful conversations about the "mysteriarch" Drebbel. Morsius mentioned how he had received *On the Quintessence* from their mutual acquaintance Ijsbrandt van Rietwijck. He also advertised another connection which might interest van Vlierden. He had received the letter on the perpetual motion from the famous Hungarian alchemist at London, Jan Banfi Hunyades, who was now a very intimate friend of his.[54] In each small tract Mor-

[53] Morsius in Drebbel, *De quinta essentia*: "Cum juris publici, philologiae & historiarum sacrarum, profanarum, omnium gentium studio, excellentissime Nolli, 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."

[54] *Ibid.*: "Saepissime in memoriam redeo congressus nostri suavissimi, in sacro tuo secessu eremiteo, ante Britannicam meam profectionem de mysteriarchâ omnium seculorum commendatione

sius 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.

Morsius went beyond dedicatory letters in his campaign to advertise and extend his dizzying array of relationships. He included numerous liminary poems praising not Drebbel, but himself. A diverse population, including noted alchemists, but also professors, noblemen, poets, clerics, and lawyers, contributed these poems.[55] Each poem was signed and dated, recalling *album amicorum* inscriptions. Indeed, the inscriptions of Peter Finxius, Ambroysius de Bruyn, and Johann Grassaeus can be traced back to the surviving three volumes of Morsius' four volume album. The poems appeared in the printed text arranged on the page just as they were within the manuscript album. To a population habituated to the practices of album inscriptions, such liminary poems set the text within the social practices of learned travel and scholarly networking.

By printing Grassaeus' album inscription in a volume dedicated to Heinrich Nollius, Morsius showcased his contacts and his skills as a literary agent. Morsius 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 editions of Drebbel's works, including his own comment noting Grassaeus' authorship of t he *Arca aperta.*[56]

The *Arca aperta*, despite its Latin title, was, like Drebbel's *On the Nature of the Elements*, a slim vernacular alchemical work championing artisanal knowl-

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dignissimo, Cornelio Drebbelio. Ejus *Tractatum insignem de quintâ essentia,* ab optimo & rarissimae eruditionis J. C. Isebrando Rietwyck Alcmaria ad me directum his diebus in communem usum cultorum sincerioris chemiae produxi ... 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 a sagaci & industrio naturae indagatore, Ioanne Ungaro Hunniadino, familiare meo carissimo, Londini oblatam tibi eam dicare mihi visum."

55 Morsius' first edition of Drebbel's works had liminal poetry signed by professor of medicine at the Ernestina University in Rinteln Peter Finxius, the Dutch poet active in London Ambrosius de Bruyn, the Polish baron and alchemical enthusiast Martin Gorasky, the famous alchemists Michael Maier, Hadrian van Mynsicht, and Johannes Grassaeus, as well as the cleric Gerhard Culmann and the poet Georg Heinrich Berkenduschius. The expanded second edition contained liminal poetry signed by the lawyer and poet Christopher Schwanmann and by Paul Blocius, rector of the Luneburg school.

56 Morsius, Lübeck, 4a 25, 2, 442v. In Morsius' first edition of Drebbel's works in 1621, Grassaeus was identified by his full name. In the second edition, *Tractatus Duo*, Grassaeus was identified only as "J.G."

edge. 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. Nollius admired the *Arca aperta,* but did not know the identity of its anonymous 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 artificiossimi* printed at Frankfurt by Johann Bringer."[57] By naming Grassaeus in the edition of Drebbel dedicated to Nollius, Morsius introduced yet another favored vernacular author to an academic alchemist.

In selecting liminary poems from the hundreds he had already collected in his massive album, Morsius integrated varied individuals who were unknown to each other, yet who seemed united in praise of his edition. Grassaeus was at the time engaged in a polemic with Michael Maier, yet Morsius joined the two feuding alchemists in seemingly unanimous approbation.[58] The virtual associations Morsius built acquired an enduring and robust existence through print. 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 in the original Latin, as evidence that once upon a time "there was a united society of adepts, some of whose writings still survive."[59]

Conclusion

Drebbel's story shows that to be a philosopher in early modern Europe, you did not need to be a gentleman, go to school, know Latin, or socialize with other philosophers. In the absence of such qualifications, you did need to cross a bridge over significant cultural, linguistic, and theoretical divides to gain acceptance in learned circles. Many historians have studied the locales bringing together early modern European artisans and the learned, including courts, printing houses, cities, and councils of trade.[60] As a wonderworker at the court of King James I, Drebbel did enjoy a certain amount of access to the learned. Yet by and large his identity as a philosopher did not emerge from his own locale. Compared to his reputation on

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57 Nollius, *Naturae sanctuarium,* 108: "... autoris, 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."

58 Leibenguth, *Hermetische Poesie des Frühbarock*, 39.

59 *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."

60 *Ash, Power, Knowledge, and Expertise*; Barrera-Osorio, *Experiencing Nature*; Harkness, *The Jewel House*; and Smith, *The Body of the Artisan.*

the Continent, in England Drebbel was considered much more as an inventor than as a philosopher.

Drebbel was not only an artisan who rubbed shoulders with philosophers in a particular place. He was also an artisan who became a philosopher for diverse populations in many far distant sites. This transformation did not occur through the personal interaction of Drebbel and the learned, but through the material carriers of books and drawings as they circulated across Europe.[61] Varying interpretations of his philosophy and even differing versions of his persona rested in part on the divergent forms such media took. The book represented the author's persona, and as the book changed, so too did the authority of its writer.[62]

Drebbel claimed philosophical authority by pointing to a special relationship between his text and materiality. Instead of lengthy citations from written authorities, he relied for proof on a contrived demonstration, examples drawn from everyday life, and the fame of his successful, physico-mechanical devices. Reading *On the Nature of the Elements* transported the reader into the presence of the elements. The aura of the rough artisan which attended this little, vernacular text encouraged its readers to relate the text to objects, and, as in the case of Isaac Beeckman, to recreate the phenomena discussed in the text.

The original, vernacular editions of this text alone, however, would not have established Drebbel's philosophical authority for many readers without the imprimatur and additional re-packaging of the work by Drebbel's editors and translators such as Libavius, Lauremberg, Alsted, and Morsius. Drebbel's aggressive contempt for ancient authorities, disregard for formal education, and appeals to everyday experience were not designed to appeal to the Republic of Letters. His statements about the potential of the untutored common man to share in the equal knowledge of nature were so egalitarian that they have lead some historians to assume that he must have been an Anabaptist.[63] His scorn for vain authors who sought to make a name for themselves by writing "fat books" was not entirely empty posturing. As Burggrav noted, Drebbel printed only a few copies of the first (no longer extant) edition of his little book. There is no evidence that he had anything to do with the over twenty editions which followed, including translations into German, French, and four independent Latin translations.[64] How did

61 Compare Lux and Cook, "Communicating at a Distance."
62 Cf. Daston and Sibum.
63 Snelders, "Alkmaarse Natuurwetenschappers," 119.
64 Latin translations were by Libavius (1613), Lauremberg (1621), Burggrav (1628), and Luppius (1702).

such a text come to be studied and cited in academic textbooks, dissertations, and debates across Europe?

In Drebbel's case, the spans that held up a bridge between artisanal and philosophical worlds included a culture of courtly curiosity and learned travel, an alchemical tradition defining philosophers as practicing adepts, and a practically oriented, pedagogical Ramism which introduced alchemy to the academy. Drebbel was not prominent among the architects who brought these spans together. He worked to secure patronage from his employers but did little otherwise to curate his reputation for a wider audience or for posterity. Instead, agents and networkers such as Joachim Morsius joined the worlds of courtly wonder, theosophic adepts, and academic publishing to engineer Drebbel's reputation as a philosopher for the Republic of Letters.

Drebbel's pan-European celebrity as an inventor, artisan, and alchemist preceded his philosophical status. While Drebbel's identity as an inventor supported his claim to maker's knowledge, his role as an orchestrator of courtly wonders also placed him in a culture of collecting and learned travel which rendered his inventions more palatable as luxurious collectibles for international travelers. In the drawings of the perpetual motion within the albums of Fetzer and Morsius, textures of velvet and gilt softened the harsh edges of Drebbel's artisanality. These drawings emphasize the wondrous, secret knowledge of the adept over the common experience of the exploding apples and hissing irons found in Drebbel's text.

Renown as a courtly inventor alone did not, however, ensure status as a philosopher. Via his album inscriptions and album-derived paratexts, Morsius went on to tie the courtly wonder of Drebbel's perpetual motion to the worlds of both alchemical adepts and academic alchemists. The liminary poetry he selected from his album tied Drebbel's work to his own world of intensive networking and travel, a world in which Drebbel himself only participated from the sidelines, if at all. Morsius thus integrated the vernacular artisan as a philosophical authority within the Republic of Letters through the networking practices of learned sociability. Such a feat of social re-engineering might seem to stretch the most flexible network. Yet, as Morsius' album illustrates, he worked hard to expand his network in many other ways as well.

Morsius' extensive network connected lawyers, doctors, noblemen, humanists, academics, clerics, alchemists, religious enthusiasts, and artisans. He linked feuding individuals, introduced readers to their favorite anonymous authors, and tied the study of alchemy to humanist disciplines. While Drebbel grafted alchemy onto machines and spliced both into his vernacular texts, Morsius united disparate sites and styles of knowledge production in his Latin editions. Both deployed the same text in different ways, expanding not only what counted as knowledge, but who could be counted as knowing. The constructive work linking the worlds of vernacular and Latin learning occurred in the material carriers of Drebbel's texts as they passed from vernacular to Latin and between different readerships.

Translations from the vernacular are an understudied phenomenon, which reached a peak in the first decades of the seventeenth century.[65] This movement was not only a manner of linguistic translation. The material character of the book, the experience of reading it, and the use to which such books were put also shifted in translation. Nor did all Latin editions of the text suggest similar interpretations. When Libavius translated Drebbel's text, *On the Nature of the Elements* jumped not only from the vernacular to Latin, but from a very slim, inexpensive octavo to an extremely hefty folio with extensive apparatus aimed at a new academic alchemist. To that audience, Libavius emphasized the sophistication of Drebbel's hidden textual allusions and downplayed the importance of contrived demonstrations.

Lauremberg, in his elegant translation, kept the little text spare, treating it as a beautiful, antique coin in which Aristotle could be found reincarnated. In this translation, the encyclopaedist Alsted admired the work as a taciturn, "masculine philosophy." As one who was himself struggling to control the tangle of polymathy, Alsted hoped reprinting such a work within a philosophical compendium would encourage budding philosophers to hack luxuriant overgrowth down to produce a more fruitful crop of carefully pruned knowledge.[66] The splicing on of Morsius' extensive paratexts in the form of album inscriptions made the text branch out once again into the far-reaching network of learned sociability, expanding further the work's possible readerships.

Libavius, Lauremberg, Alsted, Morsius and his network would not have read the text in the same way. Yet the care they took to re-fashion, re-interpret, and debate Drebbel pointed to their respect for his text. Learned readers disagreed in their interpretations of Drebbel's work just as they debated the meaning of other philosophical authorities. They did not treat him only as an ingenious inventor, but as the author of a complex work worthy of interpretation by each reader according to his own "genius," as Lauremberg put it.

The Silesian John Jonston, for instance, discussed Drebbel in a work arguing that the world was not declining. Jonston brought forward Drebbel's impressive

65 Burke, "Translations into Latin in early Modern Europe."

66 Alsted, *Compendium philosophicum*, 254: "Mascula philosophia me delectat. Utinam & vos, qui in tenerâ & lubricâ aetate mavultis disputare, quàm amputare! Amputare, inquam, stolones luxuriantium ingeniorum."

inventions as evidence for the progress of the mechanical arts. He did not stop there, however. He also discussed Drebbel's written natural philosophy in his section on theoretical physics, where he concluded, "I know not whether Drebbellius hath not exceeded the Ancients in his Book of the Elements."[67] Jonston did not reach a decision about whether Drebbel had indeed conquered Aristotle. What is amazing here is that there was a contest at all between an unlearned, vernacular artisan and the master of those who know. Drebbel the philosopher had arrived.

67 John Jonston, *Of the Constancy of Nature*, 83 and *De constantia naturae*, 68-69.

Noah's Ark Restored (and Wrecked): Dutch Collectors, Natural History and the Problem of Biblical Exegesis

Eric Jorink

Introduction

The fascination with collecting rarities is one of the most striking characteristics of early modern learned culture. From Naples to Uppsala, from Dublin to St Petersburg, large collections were built up by princes, universities and *virtuosi*. Mummies, monstrosities, birds of paradise, the bones of giants, Chinese calendars, unicorn horns, Amerindian feathered ornaments, scientific instruments, armadillos, Roman coins, insects and countless other rarities were apparently haphazardly brought together in a single room. Over the last decades, historians of science have increasingly become fascinated by this culture of collecting, and have stressed the role of both the individual objects and the collections in general.[1] It has become clear that it is somewhat anachronistic to regard the early modern collections as direct precursors of today's museums. Paula Findlen and others have stressed the role the cabinets played in early modern learned culture, calling them "sites of knowledge."[2] As to the content of the collections, attempts have been made to discern a pattern in the way objects were collected and ordered: as characters in God's Book of Nature, *artificialia* versus *naturalia*, the four elements, the doctrine of signatures or the sense of wonder they evoked, empirical science *vis-à-vis* textual based natural history, and so forth. In like wise, various interpretations have been given for the motivation of individuals and institutions to start collecting: the strive for status and fame, as an investment, an instrument to display the latest scientific knowledge, as a means to create a community of discourse, or as a tribute

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1 See, for example: Impey and MacGregor ed., *The Origins of Museums*; Pomian, *Collectioneurs, amateurs et curieux*; Kenseth ed., *Age of the Marvellous*; A. Grote ed., *Macrocosmos in Microcosmo*; MacGregor, *Curiosity and Enlightenment*.

2 Findlen, *Possessing Nature*, 97-154.

to God the almighty Creator. The boundary between the various motivations was often a fluent one.

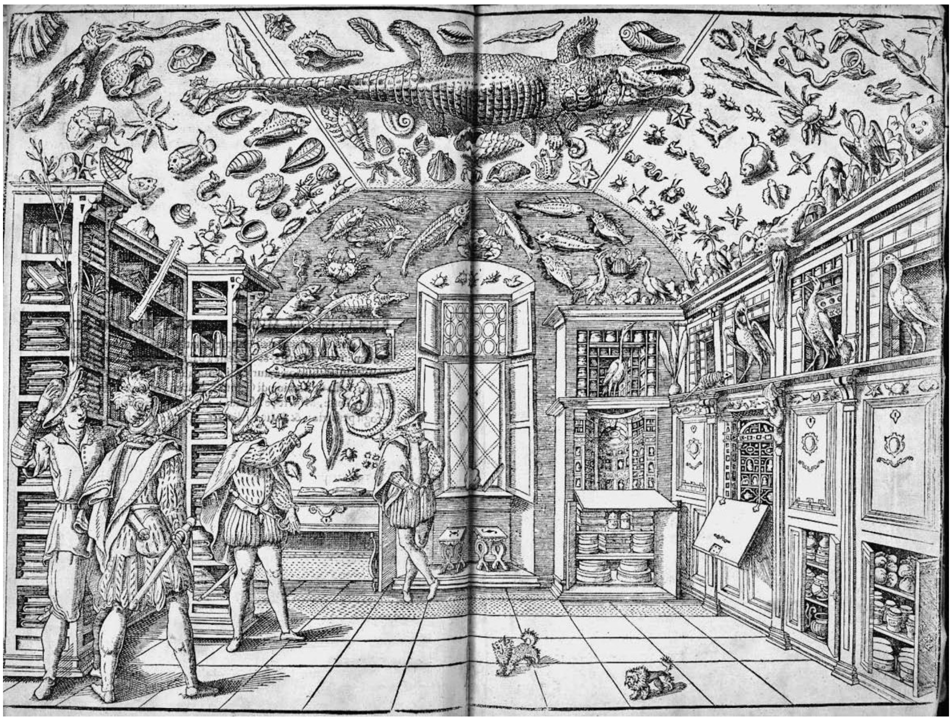


Figure 1: The cabinet of Ferante Imperato, between res and verba. Taken from Imperato, Dell'Historia naturale (1600). (Courtesy Royal Library, The Hague)

The Netherlands was not exempt from the fashion of collecting.[3] Bernardus Paludanus (1550-1633), the town physician of Enkhuizen, was the first to build a substantial collection at the end of the sixteenth century, following the Italian examples by, among others, Ferrante Imperato (1550-1625; see Figure 1) and Ulisse Aldrovandi (1522-1605). The expanding economy of the Northern Netherlands, the flood of unfamiliar artefacts from the newly discovered trade regions in East and West, and the emerging intellectual life were all factors that contributed to the fact that Dutch collections soon came to rank among the most prominent in Europe, attracting many visitors from abroad. It is rather telling that the great humanist scholar Joseph Scaliger (1540-1609) undertook the trouble of travelling to

3 See: Smit ed., *Hendrik Engel's Alphabetical List*; Bergvelt and Kistemaker ed., *De wereld binnen handbereik*; Van den Boogert ed., *Rembrandts schatkamer*; Sliggers and Besseling ed., *Het verdwenen museum*.

Enkhuizen in order to see Paludanus' collection only a month after he settled in Leiden in September 1593. Scaliger, by far the most famous scholar of his time and the ultimate expert in the vast and difficult discipline of biblical chronology, signed Paludanus' *album amicorum* on 3 October.[4] An account, written a year later by a visitor to Paludanus, speaks volumes:

> The other day I visited Paludanus [...] He showed me his collection, which had such varied and numerous items that I scarcely believed they existed in nature. Nature herself seems to have moved into his house, entire and unmutilated, and there is nothing written down in books that he cannot present to our eyes. That is why the great man Joseph Scaliger gave all his rarities (which were both numerous and spectacular) to Paludanus, saying, "Here are your things, which I have possessed unjustly."[5]

The intention of this chapter is to focus on one specific aspect of some early modern Dutch cabinets of curiosities. As I have demonstrated elsewhere, Dutch collections in general should be understood from the lively discourse on the Book of Nature in the Republic.[6] According to Dutch Reformed orthodoxy, the Book of Nature was the second revelation of God, which should be read in terms of God's holy word. The objects collected in the Dutch cabinets were considered characters in the Book of Nature, referring to the divine Author. In this contribution, I will elaborate further on this idea, by focussing on some specific collections.

First, I will demonstrate that one of the initial forces behind the culture of collecting was the humanist attempt to illustrate the texts of the ancients by means of tangible objects. Scholars like Paludanus and institutions like the newly founded university of Leiden had the explicit aim of illustrating the works of Aristotle, Dioscorides, Theophrastus, Galen, Pliny, and of course the Holy Scripture. The objects collected were not 'matters of fact' with a stable, essentially unproblematic meaning.[7] The meaning of an object is not an immanent given, but depends on the constantly changing mental and temporal context. The objects collected by sixteenth-century scholars had an infinite number of connotations and were entangled in a web of associations and allusions. In other words, they were intertextual and even partly metatextual, narrative, symbolic, and in need of exegesis. The objects served primarily the purposes of illustration and meditation, and derived their meaning from the intellectual context in which they were collected. What was described by the writers of antiquity and in the Bible could be sought

4 The *Album amicorum* by Paludanus is kept in the Royal Library in The Hague. For Scaliger's inscription see: KB Ms 133 M 63, fol. 29r. On Scaliger see: Grafton, *Joseph Scaliger*.

5 Ogilvie, *The Science of Describing*, 41. Unfortunately, the original source in Latin is not given.

6 Jorink, *Het Boeck der Natuere*, 267-360; Idem, *Reading the Book of Nature*.

7 Cf. Daston, "Baconian Facts"; Cook, *Matters of Exchange*.

in nature, and much research went into the question of whether a particular object matched the text. In the short term, the scholarly collectors remained convinced that they could survey the whole world and the whole of history. There was no boundary between the geographical and temporal dimensions of God's creation. It is no coincidence that sixteenth-century scholars did not appeal exclusively to the classical idea of the *musaeum,* but also harked back to Paradise, the Ark of Noah, the Tower of Babel or the Temple of Solomon. These biblical accounts were sacred history. Moreover, they provided the intellectual matrix by which the world was understood: the origin of man and all living creatures and the spread of languages and peoples around the earth. The contemporary preoccupation with *prisca scientia* or *prisca theologia*, much stimulated by Scaliger's chronological exercises, prompted the desire to restore the Garden of Eden, or to reconstruct the Ark or the Temple.[8] In an intellectual culture that increasingly stressed the visibility of knowledge, collectors of curiosities were at least partly motivated by the wish to illustrate biblical history and evoke it by means of objects. This enterprise could take many guises. Well known, for example, is the description and spectacular model of the Temple made by the Amsterdam Sephardic rabbi Jacob Judah Aryeh Leon, better known as Templo (1603-1675), which aroused great interest in the Netherlands and elsewhere.[9] Another way to honour God was to start a collection of objects, a passion shared both by Protestants and Catholics. While the display of relics as – say – pieces of wood of the Cross, or the bones of martyrs according to Protestants was popish superstition, both denominations agreed that the collecting of mummies, stones of the Temple or of holy mountains, or of natural objects mentioned in the Bible served a religious purpose at various levels. The objects collected were silent witnesses from the past, but also tangible things, vividly re-telling and illustrating the text of the Bible. They were as much signs of God's creative power in Nature as letters of the Book of Nature, to be deciphered by the Word of God.

However, in the second part of this paper, I will argue that the humanist quest for objects led to the paradoxical result of not illustrating and affirming the status of the ancient texts but, instead, of eroding it. Travels of discovery, philology and natural history proceeded hand in hand. This was a development that took place

8 Walker, *The Ancient Theology*; Bennett and Mandelbrote, *The Garden, the Ark, the Tower, the Temple*; Brown, "Noah's Flood."

9 Offenberg, "Jacob Jehuda Leon." Leon published in 1642 an (often reprinted and translated) *Afbeeldinge vanden Tempel Salomonis* (Amsterdam, 1642) in which he announced "welckers model den autheur is hebbende, als een yder by hem selve sien can." The image of the Temple in the Dutch Republic, and efforts to reconstruct it, are a subject worth studying in greater detail.

all over Europe, but which made its implications first felt in the dynamic culture of the Dutch Golden Age. Humanist collectors had allowed the Trojan horse inside, or so it seemed. The collections down to the end of the sixteenth century pointed in all directions, in both space and time, and were embedded in a textual framework. In the course of the following century the interchangeability between words and things that had been non-problematic in the past was called into question. This came jointly with debates on the status of Aristotle and Pliny and the emergence of radical biblical criticism. What kind of animal was Leviathan or Behemoth? Was the Hebrew *re'em* (see e.g. *Numbers* 23:22; *Psalm* 92:10) correctly rendered by the Dutch word "eenhoorn" (unicorn), and was the precious horn kept in so many cabinets really coming from this biblical animal? A new generation of scholars asked themselves to what extent all the unfamiliar animals from the New World fitted into the biblical chronology of the Flood, the Ark and the Tower. The very same objects that around 1600 had illustrated the Bible, now at least seemed problematic, and sometimes even to contradict the Word of God.

Paludanus and the Leiden Connection

As is well known, the early modern collections were based on the idea of the Greek μουσεῖον, a place dedicated to the Muses for study, inspiration and contemplation.[10] The term *musaeum* did not have purely spatial connotations, but was a broad philosophical concept, as the number of synonyms in use in the early modern period shows: *arcus, theatrum, microcosmos, bibliotheca, thesaurus, pandechion, studio, oratorio, laboratorio, archivio, orbis in domo, Wunderkammer*.[11] One of the roots of the early modern collections was the study (*studiolo* or *scrittoio*). Humanists surrounded themselves not only with classical texts, but increasingly also with artefacts such as ancient coins and all kinds of *naturalia*.[12] There was no sharp dividing line between words, images and objects. "If Nature," Findlen writes, "was the text from which the Renaissance naturalists chose their materials, then their museums were literally the 'con-texts'."[13]

The search for texts and objects was essentially a search for comprehensive knowledge of God's creation, and was thus by definition religiously inspired. The texts and *naturalia* to be found in the libraries were also the manifestations of a

[10] Findlen, "The Museum."
[11] *Ibid.*, 59; Lugli, *Naturalia et mirabilia*. For a contemporary overview of these terms see: Neickel, *Museographia*, 1-2; 405-11.
[12] Momigliano, "Ancient History and the Antiquarian"; Leibenwein, *Studiolo.*
[13] Findlen, "The Museum," 64.

search for the Adamic knowledge of nature that had been lost. This is the context in which the scholarly fascination with *naturalia* and etymology has to be seen: both inquiries ultimately had their roots in the Garden of Eden.[14] Considerable influence was also exerted by the North Italian universities, where the teaching of medicine had been backed up by anatomical theatres, botanical gardens and collections of curiosities since the middle of the sixteenth century. The teaching of medicine did not get off the ground in the Dutch Republic until the foundation of Leiden University in 1575. Almost every member of the first generation of Leiden professors of medicine had studied in Padua.[15] Many of them had visited neighbouring Bologna during their period of study, where in 1568 the exuberant professor of medicine Aldrovandi started a botanical garden and a collection of *naturalia* that was soon to be without parallel.[16] Contemporaries regarded him as a second Pliny whose ever-expanding collection brought the wonders of the world within reach of hand and eye. Information reached Aldrovandi from every corner of Europe and the other continents, which he catalogued and complemented with his exhaustive knowledge of the classics. As Findlen justifiably claims: "For Aldrovandi, the encyclopedia was located neither in the text nor in the object alone: rather it was the dialectic between *res* and *verba* that fully defined the universality of his project."[17] The work published during and after Aldrovandi's lifetime and collected in the monumental *Opera omnia* (1599-1668), as well as the vast quantity of tidily arranged manuscripts in his archive, reveal a boundless confidence in the possibility of obtaining a picture of the whole visible world and embedding it in a system of cross-references. A proper appreciation of Aldrovandi also has to take into account the explicit religious dimension of his work. This was expressed not only in allegorical explanations of each item and in pious exhortations to conduct natural inquiry, but also in the collection of all the natural objects mentioned in the Bible, from locusts to Leviathan and from myrrh to the blood of Christ. Aldrovandi's surviving archive reveals his obsession with the identification of all kinds of *naturalia* mentioned in the Bible.[18]It is important to note that this tendency, manifest in the work of the Roman Catholic Aldrovandi, was much fostered by the emergence of Protestantism. The idea of *Sola Scriptura*,

14 Céard, "De Babel à la Pentecôte"; Bono, *The Word of God*.

15 De Ridder-Symoens, "Italian and Dutch Universities."

16 Findlen, *Possessing Nature*, passim; Olmi, *L'inventario del mondo*.

17 Findlen, *Possessing Nature*, 65.

18 See the following manuscripts in Biblioteca Universitaria Bologna, Fondo Aldrovandi: 48 *Methodus theatri biblici*; 49 *Index theatri biblici*; 50 *Lexicon latino-hebraico et syro-chaldaicum rerum quae in Sacris Biblis leguntur*; 51 *De cruce*; 52 *Index de cruce*; 53 *Index rerum naturalium Sacrae Scripturae*; 54 *Theatrum biblicum naturale*.

the intimate relationship with the letter of the Bible, created many problems with regard to translation and identification. It is illustrative that when Martin Luther was working on his German translation of the Bible, he complained that he had great difficulty in finding the right German equivalents for the Hebrew and Greek names of biblical animals.[19] For a long time translators of the Bible and naturalists had had the greatest problems in relating biblical flora and fauna to the world and terminology of their own day. The extremely influential *Historia animalium* by the Protestant philologist and physician Conrad Gessner (1516-1565), which was published between 1545 and 1555, should be seen in this light.[20] The *Historia animalium sacra* (1612) by Wolfgang Franzius (1564-1628), professor of theology at the Protestant bulwark of Wittenberg, was also extremely popular.[21] Franzius discussed almost every animal mentioned in the Bible and tried to identify it. All the same, generations of philologists and translators of the Bible were to continue to struggle with the problem of identification (which has not yet entirely disappeared even today). It might be clear that, from a contemporary point of view, much depended of the perspective of the collector (or his visitors) concerning how an item of this category was labelled: a relic, an illustration of a certain verse of the Bible or, more generally, a token of Gods creative power in the Book of Nature.

One of the many collectors to be fascinated with these fluid boundaries was Bernardus Paludanus.[22] He was born in 1550 in Steenwijk, in the north of the Netherlands. Although Leiden, the first university of the revolting provinces of the Northern Netherlands started in 1575, the medical faculty did not function properly until the 1590s. Like so many of his fellow countrymen who wanted to study medicine, Paludanus set out for northern Italy. After arriving in Padua in 1578, he enrolled as a student. While still a student he travelled to the Middle East for several months in 1578, where he visited Bethlehem, Jerusalem, Alexandria, Lower Egypt and other places, as well as collecting relics, Egyptian objects, stones and seeds. Travel to the mysterious land of Egypt was unusual at this time. Back in Italy, Paludanus of course also visited the already world-famous Aldrovandi in

19 Martin Luther to Georg Spalatin, 1522, *Martin Luthers Werke* II, 630. See also: Ogilvie, *Science of Describing*; Dannenfelt, "University of Wittenberg"; Reeds, "Renaissance Humanism and Botany."

20 Gmelich-Nijboer, *Gessner's 'Historia Animalium'*; Ashworth, "Natural History and the Emblematic Worldview."

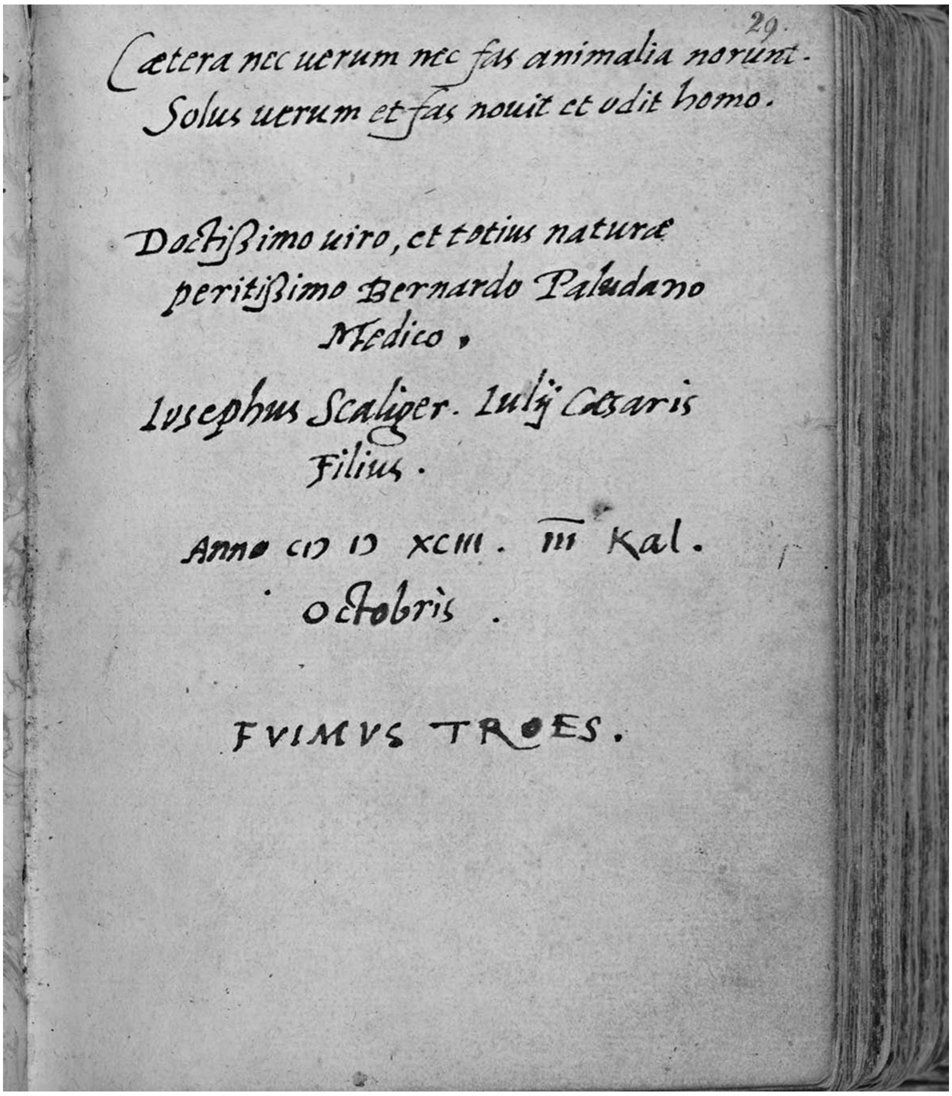
21 Franzius, *Historia animalium sacra*. See: Bäumer-Schleinkofer, "Biblische Zoölogie"; Roggen, "Biology and Theology."

22 There is much literature on this interesting figure, but mainly in Dutch: Hunger, "Bernardus Paludanus"; Van Wijk, "Bernardus Paludanus"; Van Gelder, "Paradijsvogels in Enkhuizen; Jorink, *Boeck der Natuere*, 276-87.

near-by Bologna. Aldrovandi's collection must have particularly impressed him. In later life he referred to Aldrovandi as his mentor (*praeceptor meus*). After graduating in 1580 and returning to the Netherlands, Paludanus became town physician in the bustling port of Enkhuizen, where he created his own botanical garden and continued to build up his collection of curiosities. He soon achieved a great reputation; in 1591 the curators of Leiden University tried to get Paludanus to lay out the botanical garden there and to include his complete collection of *naturalia*.[23] Paludanus declined the offer, but maintained cordial relations with the academic world of Leiden, including the famous scholars Carolus Clusius and Scaliger (see Figure 2).[24] Paludanus' fame extended further. He was, for instance, in close contact with the physician and collector Joachim Camerarius II and the cosmographer Abraham Ortelius. The friendship between Paludanus and his fellow townsman Jan Huygen van Linschoten was also of great importance. On his travels, the explorer collected all kinds of curiosities for Paludanus, while Paludanus added annotations to Linschoten's account of his years in Portuguese Goa, the *Itinerario ofte Reijsboek* (1596). Thanks to the immensely popular *Itinerario*, a wide public could make the acquaintance of numerous new peoples, animals, plants and stones. Paludanus kept almost all his treasures in cabinets, which were carefully arranged.[25] There was no fixed order according to which the items were organized. There was, for instance, a seamless transition from the works of art and utilities from the East and West Indies to writing materials, including Chinese sealing wax and ancient writing on papyrus, which moved by way of a weapons section – pipes made of bones 'which the American cannibals have gnawed' and the sword of a swordfish – to the large collection of marine objects. This category included not only the requisite parts of whales but also the teeth of "a creature that John called *Behemot.*" The identification of this creature was apparently not problematic for Paludanus.

Like Aldrovandi, Paludanus' collection was both intended to testify to the influx of new information from the East and the West and to illustrate the writings of the ancients. According to contemporaries, Paludanus could find and explain in his collection almost every object described in books.[26] The intention to illustrate the Bible is apparent not only from the presence of a part of the Behemoth but also

23 Egmond, "Een mislukte benoeming."
24 Berendts, "Clusius and Paludanus."
25 At least three inventories are known. The following is based on the most extensive description by Paludanus himself, evidently intended as a sales catalogue (1617), which is kept in the Royal Library in Copenhagen (KBK) Ms K.S. 3467,8. A much shorter inventory from 1624 is kept in the Bibliotheca Medicea-Laurenziana in Florence: (BLF) Ms. Ashb. 1828.10.
26 Ogilvie, *Science of Describing*, 40.



29.

Cætera nec uerum nec fas animalia norunt.
Solus uerum et fas nouit et odit homo.

Doctissimo uiro, et totius naturæ
peritissimo Bernardo Paludano
Medico.

Iosephus Scaliger. Iulij Cæsaris
Filius.

Anno CIↃ IↃ XCIII. III Kal.
octobris.

FVIMVS TROES.

Figure 2: Scaliger signed Paludanus' album amicorum on 3 October 1593, only a month after his arrival in the Dutch Republic. (Courtesy Royal Library, The Hague)

from many other items. For example, Paludanus had stones from the mountains of Sinai, Calvary, Cedron and Tabor, red earth from Damascus the colour of Adam's flesh, stones from the cave "where St John did penitence," "brimstone from Sodom and Gomorrah in which those cities were burnt," an unspecified part of Leviathan, locusts, cedar wood from Mount Lebanon, myrrh, a stone from the Temple of

Solomon, earth from the Jordan "where it is said that Christ was baptised by St John," and "a piece of the stone on which Christ sat when he lamented the city of Jerusalem."

The unproblematic boundary between text and object is illustrated by the following. One of the most wanted objects up to the 1660s was the so-called horn of a unicorn.[27] The horn that could be seen in many cabinets referred to the biblical stories of the unicorn. The original Hebrew text of the Old Testament refers to the animal ראם (*re'em*) in eight places. This was translated into the Greek of the Septuagint with the word μονοχέρωτος, 'one-horned'. The Dutch translation of the Reformed Church, the *Statenvertaling*, rendered this further as 'eenhoorn'. The biblical passages in question generated an enormous corpus of texts, images and ideas. European scholars speculated about the unicorn until late in the early modern period, and evidence that seemed to attest to the existence of this creature was welcomed in churches and cabinets alike. What were supposed to be unicorn horns at the time were shown to be narwhal tusks later in the seventeenth century. For Paludanus and his contemporaries, however, the unicorn was a genuine beast that was the source of emblematic representations. It is significant that, although Paludanus was not able to get his hands on a horn of this kind, he did manage to obtain the impression of such a horn in stone and "a white bolus [...] *mark* of a unicorn."[28] These were apparently good substitutes for the horn itself, just as the horn referred to the much sought after animal, which in turn seemed to refer to the textual tradition. This example, as so many others, illustrates the fluid ontological boundary between text, illustration and object around 1600. A part or print of a certain animal was considered as much as a representation of the creature mentioned in the text, as a picture of it (schematic or *ad vivum*), or as an entire specimen, dead or alive. In this respect, the humanist culture of collecting had much in common with the tradition of relics, were a tooth of a saint was as much as valid as a relic as a bone, a sealing ring or a breviary of the saint. For collectors like Paludanus – born as a Catholic, converting to Protestantism in the 1580s – the possessing of bone, jaw, bill, feather or any other part of a bird was equal to representing and possessing the creature as such.

Be it as it may, Paludanus' by far most impressive illustration to the biblical story were his three mummies. Mummies were appealing references to the arcane wisdom of the ancient Egyptians.[29] Egypt was the biblical land of the pharaohs,

27 Shepard, *Lore of the Unicorn*; Schnapper, *Le géant, la licorne, la tulipe*; Gerritsen and Jonker, *De eenhoorn*.

28 KBK Ms K.S. 3467,8., f 60v, my italics. See also: BLF Ms. Ashb. 1828.10 f 14r.

29 Dannenfelt, "Egyptian Mummy."

magicians and mysteries, the kingdom of the pyramids, the enigmatic obelisks and the fascinating hieroglyphs.[30] The Old Testament contained full descriptions of rituals and customs that Christians regarded with ambivalent feelings, such as the concluding verse of the book of *Genesis*: "So Joseph died, being a hundred and ten years old: and they embalmed him, and he was put in a coffin in Egypt." This is part of the background against which we should view Paludanus' mummies: as allusions to the *prisca theologia*. Strictly speaking, the objects were mute. Nevertheless, in a sense they were telling entities, illustrating the Biblical text and evoking ancient history. The mummies rendered the divine history of salvation imaginable, visible and even tangible. In the inventories of his collection, Paludanus explicitly referred to the biblical passages mentioning the techniques of embalming.[31]

Mummies were extremely rare at the time – Paludanus' had been shipped to Holland under the greatest difficulties – and attracted a good deal of attention. It was presumably the fame of the mummies that made the ever busy Scaliger decide to travel to Enkhuizen immediately upon arriving in Leiden in 1593. The great scholar recorded his astonishment at the largest of the three mummies:

> Paludanus displayed an intact mummy at Enkhuizen, an Egyptian body buried over 3000 years ago; it is a true antiquarian object. Someone convinced Gourgues [the companion of Scaliger] that it was one of the bodies of the Kings. He venerated it and wrote to his father, as if he had seen the relics of a Saint's body.[32]

For the authority that had calculated that the Creation had been completed on 25 October 3950 BCE, the sight of such an ancient relic must have been a real sensation. In terms of Scaliger's chronology, the mummy dated from the years of Abraham's sojourn in Egypt (*Genesis* 12:10)![33] It is no wonder that Hugo Grotius,

30 Dannenfelt, "Egypt and Egyptian Antiquities"; Iversen, *Myth of Egypt*; Assmann, *Moses the Egyptian*; Shalev, "Measurer of All Things."

31 "Von die manijre disser balsummunge kan man lesen das letste capittel ins eerste buch Moysi dar aldus steht: *Porro Joseph medicis suis servis mandavit ut aromatibus condirent patrem suum et aromatibus condierunt medici Israelem et exacti sunt et quadraginta dies, nam hic implentur dies eorum qui aromatibus condiuntur et luxerunt eum Aegyptii septuaginta dies*," KBK Ms f 63r. This remark is repeated in BLF Ms. Ashb. 1828.10, f 14v.

32 "Paludanus à Enchuse, ostendit Mumia, integram, corpus Aegyptiacum ante 3000 annos sepultum; est vera antiquitas. Quidam persuasit à Gourges, esse unum ex corporibus Regum; adoravit illud & scripsit ad patrem, tamquam si vidisset corporis Sancti reliquias," *Scaligerana, Thuana, Perroniana, Pihoeana et Colomesiana*, II, 484. See also: Grafton, "Rhetoric, Philology and Egyptomania"; Dijkstra, "Mysteries of the Nile?."

33 See: Scaliger, *De emendatione temporum*, 350-51, where the embalmment is dated 1407 BCE, in other words over 3000 years ago at the time of writing.

operating in the same intellectual framework as Scaliger and Paludanus, was also deeply impressed. There is no doubt that he considered the mummies in the light of the Bible, and was later to write to Paludanus that these "wonders of Egypt" had made a profound impression on him. In this light, Grotius' description of Paludanus' collection as the "Ark of the universe" is revealing.[34]

A similar tendency to render the earliest chapters of the Bible visual as well as tangible can be seen in the collections of Leiden University. After a somewhat hesitant start in 1575, the board of the university decided to invest seriously in the Faculty of Medicine in order to challenge the reputed Italian Universities. In accordance with the new empirical trends, it decided to establish both an *hortus botanicus* and a *theatrum anatomicum*, each with its own cabinet of curiosities. Both cabinets were the brainchildren of Petrus Pauw (1564-1617), who had studied in Leiden and Padua before receiving a special appointment as professor of medicine in Leiden in 1591. In the course of the seventeenth century both collections were to expand considerably under Pauw's successors and formed not only a three-dimensional teaching aid but also an important attraction for students and tourists.

After it had become clear that Paludanus wanted to stay in Enkhuizen, the governing body of the university in Leiden managed to engage the world-famous botanist Carolus Clusius (1526-1609) for the projected botanical garden in 1592.[35] Like Scaliger's, Clusius' reputation also reflected back on the university, and thanks to his far-flung international network, many exotic plants, bulbs, seeds and rarities found their way to Leiden. The garden was actually laid out by the apothecary Dirck Outgaertsz Cluyt (1546-1598). By September 1594 he was able to send the governing body a description of the layout of the botanical garden. Clusius, Cluyt and Pauw contributed rarities from their own collections. In addition, the instigators and crews manning the first Dutch expeditions to the East responded to Leiden's request to collect "seeds, fruits, bulbs, roots, spices, flowers, gums, resin, animals, marine products and similar objects" for the botanical garden.[36] As they arrived in Leiden, the *naturalia* were compared with the descriptions found in the works of the classics. The same critical scrutiny to which ancient writings were exposed was applied to the world of living nature and related to what was

34 Rogge, "De schriftelijke nalatenschap van B. Paludanus"; KBK Ms K.S. 3467,8 f 3v: "Thesaurus orbis totius compendium/Arca universi, sacra Naturae penus/Templumque Mundi panos hic sacrarum/Rerum theatrum et grande promptuarum est."

35 Fat and De Jong ed., *Authentic Garden*; Egmond, Hoftijzer and Visser eds., *Clusius*.

36 Hunger, *Charles L'Ecluse*, 241: "zaden, vruchten, bollen, wortelen, cruyden, bloemen, gommen, haersch, gedierte, opwerpselen van de see ende diergelijcke, als in die landen zouden moghen ghevonden worden ons alhier ongewoon ende onbekend."

already known. The inevitable, albeit unintentional result of this comparison was the gradual erosion of the authority of the textual tradition. The enormous quantities of *naturalia* that arrived from the East and West Indies, Africa and the polar region were often difficult to match up with descriptions found in the classical sources. To name just one obvious obstacle: in the very year of its opening, Leiden's *hortus* possessed 1,060 plants, whereas the known ancient sources spoke of no more than 600 – and this discrepancy existed even before the large flow of *naturalia* occasioned by the gifts of the voyagers to the East Indies set in (The Dutch East Indian Trading Company, the V.O.C., being established in 1602 only).[37] Clusius' famous *Exoticorum libri decem* (1605) already expresses a certain degree of scepticism with regard to the classics' presumed omniscience. Had they, for example, been acquainted with the bird of paradise? No, was Clusius' verdict. The same was true of the armadillo, the potato, the dodo, the penguin, and many other *exotica*.[38]

Even though considerably smaller, the collection of curiosities in the Leiden botanical garden bore thus the same character as the collection belonging to the man who had been invited to become its first superintendent, Paludanus. There existed, however, one important difference: objects referring to biblical events, which featured so prominently in Enkhuizen, were not to be found in the botanical garden.

This category was however represented elsewhere in Leiden, namely inside the anatomical theatre on the other side of the Rapenburg canal. The formation of the anatomical collection had been the initiative of the indefatigable Pauw.[39] He started to perform dissections in the recently completed anatomical theatre in November 1593. In the summer, when no dissections could be carried out, the professor displayed the skeletons of humans and animals on the benches of the anatomical theatre. After Pauw's death in 1617, his modest collection was energetically enlarged by his successor Otto Heurnius (1577-1652). Heurnius has gone down in history as the man who introduced clinical teaching in Leiden in 1636, an important innovation that has to be seen in the light of the growing emphasis on empiricism.[40] However, like many of his contemporaries, including Scaliger, Heurnius believed in the existence of a *prisca scientia*. Although the wisdom of the Chaldeans, Babylonians and Egyptians had for the most part perished, it was

37 Reeds, "Renaissance Botany," 40.
38 Clusius, *Exoticorum libri decem*, 358-63 and passim. See also: Mason, "*Americana* in the *Exoticorum libri decem*."
39 Lunsingh Scheurleer, "Un amphithéâtre d'anatomie moralisée"; Huisman, *Finger of God*.
40 Beukers, "Clinical Teaching in Leiden."

possible to obtain a glimpse of it by studying the philosophical writings of the barbarians, as he argued in his *Barbaricae philosophiae antiquitatum libri duo* (1600, reprinted in 1619). Heurnius' ideas about the *musaeum* were largely inspired by this conviction. He paid a large sum for engravings including the Tower of Babel and the Golden, Silver, Bronze and Iron Ages. The latter symbolised the Fall and the subsequent human misery and loss of *scientia*.

Besides citations from and illustrations based on the Holy Scripture, Heurnius assembled a wealth of artefacts that recounted the history of biblical Egypt. Heurnius was very proud of the biblical part of the collection, and invested much time and effort in acquiring *Aegyptiaca*, as is testified by a memorandum asking the University for permission as well as funds to acquire objects through a contact in Aleppo under the aegis of the Leiden medical faculty. This contact was a Leiden student of oriental languages and law, David le Leu de Wilhelm (1588-1658), who from 1617 to 1629 worked as a merchant in Syria and Egypt. Le Leu was a generous patron of the arts and sciences, who later in life would surprise the Leiden professor Jacob Golius (1596-1688) with a unique Arabic manuscript on conic sections, bought during his service in the Levant.[41] In 1619, Le Leu visited the burial site of Saqqara, near Cairo, were he bought many antiquities, including a mummified arm, a burial vase and two shabtis (funerary figurines). He donated these items a year later to Heurnius in the latter's capacity as curator of the anatomical theatre.[42] In 1621, he presented Heurnius with a truly extraordinary gift: a mummy in its sarcophagus. Heurnius' letter of thanks to Le Leu is a testimony to the Leiden professor's deep fascination with ancient Egypt. He described how overwhelmed by joy he has been upon receiving this gift, and the way he has put the mummy immediately at display in a glass cabinet in the *theatrum anatomicum*, placing an inscription above it in honour of Le Leu. In the subsequent years Heurnius continued to inundate Le Leu with additional requests for artefacts that could threw light on the customs of antiquity, sending for another couple of mummies, the head and penis of a hippopotamus, an ibis, an ichneumon, linen, cotton, Nile-reed, the bird trochilos which cleans the teeth of crocodiles, more shabtis, papyri, "a tower-shaped headdress of a native woman from antiquity," branches of cedar, olive, larch, fig and peach trees as well as, interestingly enough, for "four pounds of red lentils." Apparently not offended by Heurnius' frequent and rather immodest requests, Le Leu kept sending all kinds of items. According to the inventories of the collection, the cabinet eventually came to contain a stuffed crocodile, a canopic urn, "an Egyptian scarab carved from

41 See the chapter by Fokko Jan Dijksterhuis in this volume.

42 Stricker, "Correspondentie: Van Heurn – Le Leu de Wilhem."

cornelian," three stones with hieroglyphs, images of Isis "that are full of hieroglyphs," an adder, "idols that were found with the mummies in the cellars beneath the ground in the land of Egypt," and other funerary items (see Figures 3 and 4).[43] To Le Leu, Heurnius explained the motives behind his thirst for objects: Egypt was "the ancient tutor in every branch of science."

It is indicative in this context that, like so many of his contemporaries, Heurnius was fascinated by hieroglyphs. Since the rediscovery and publication of Horapollo's Greek treatise (1505), Neo-Platonic circles in particular engaged in intense speculation about the nature of these signs, which were thought to provide insight into the essence of things. Hieroglyphs "had nothing in common with ordinary graphic systems operating with words and letters," Erik Iversen notes, "and, although they appeared as ordinary pictures of material objects, the individual signs were in reality symbolic entities, revealing their true meaning only to initiated readers by means of a divinely inspired process of intellectual enlightenment."[44] The hieroglyphs, which had not yet been deciphered, offered a glimpse of the lost knowledge of nature from before the Fall and Babel. Before God gave mankind (Hebrew) writing via the Ten Commandments, things were identical with their name.[45] Heurnius considered that hieroglyphs predated Moses' ascent of Mount Sinai, and he regarded them not as a language but as a system of symbols that embodied the real nature of things. The objects and figurines inscribed with hieroglyphs in Heurnius' collection were thus the spectacular but indecipherable remains of the period when Adam gave their names to the cattle, the birds of the air and the beasts of the field. The Egyptian items could thus be regarded as tangible manifestations of the *prisca theologia*. They show clearly how inextricable the link was between words and things, between philology and the study of nature.

The Leiden collection of *Aegyptiaca* aroused much attention in learned Europe, and descriptions of some objects circulated in print. The famous Jesuit scholar Anathasius Kircher (1602-1680) managed to obtain an illustration and a description (by Heurnius himself) of the burial vase Le Leu had bought in Saqqara. Both were included in the *Oedipus Aegyptiacus*.[46] But Heurnius' prize-item was of course the mummy, also known as "de groote mummie," celebrated throughout Europe and still to be seen in the Rijksmuseum voor Oudheden in Leiden (Figure 5). Heurnius issued a broadsheet edition of a brief *Explicatie der mummie*,

43 Barge, *Oudste inventaris*; Witkam, *Catalogues of all the chiefest rarities*, 1-15.
44 Iversen, *Myth of Egypt*, 64.
45 Céard, "De Babel à la Pentecôte"; Bono, *The Word of God*; Grafton, "Kircher's Chronology."
46 Kircher, *Oedipus Aegyptiacus*, III, 514-17.

Figure 3

Figure 4

Figures 3 and 4: Two representations of the burial vase Le Leu sent to Heurnius in 1619. To the left, the vase in its present state in the Rijksmuseum voor Oudheden in Leiden. To the right, the vase as it was depicted in Kircher's Oedipus Aegyptiacus (1652-1654). (Courtesy Rijksmuseum voor Oudheden and University Library, Leiden)

Figure 5: The coffin of Heurnius' 'great mummie', which is still kept at Leiden's Rijksmuseum voor Oudheden. (Courtesy Rijksmuseum voor Oudheden, Leiden)

which was printed and hung above the coffin.[47] The public was asked to treat it with great care as its great antiquity rendered it very fragile. In his explanatory text, Heurnius described in detail how Le Leu himself had removed the mummy from a tomb of the "ancient heathen Egyptians near the pyramids [. . .] beside the River Nile, from which Moses was rescued by the daughter of the king pharaoh" and were "the children of Israel had lived in slavery under Pharao."[48] Interesting enough, Heurnius also revealed how the mummy had been sent to Le Leu's brother in Amsterdam. Since the 'Bassa', the Vice Roy of Egypt, on penalty of death, forbade the trade of mummies with Christians, the gift to Heurnius was wrapt up in a bale of cotton, spices and camelhair and shipped to the Netherlands, notwithstanding the ancient belief that especially ships carrying mummies tended to get wrecked by storms or plundered by pirates.

It is clear that Heurnius was not primarily interested in the alleged medicinal effect of mummy. For him, as for Paludanus, the mummies told the story of God's chosen people in the heathen land of wisdom, Egypt. One of Heurnius' aims, as he wrote unambiguously to Le Leu, was to obtain more insight into that kingdom, which had been described by Moses, Herodotus and Pliny. At the sight of the mummy, the scripturally minded viewers of the period would immediately have been reminded of such passages as the last verse of *Genesis* that describes the embalming of Joseph.

The same biblical perspective is characteristic for the Dutch culture of collecting in general up to the 1650's. Although, as we already noticed, the cabinets had no fixed meaning and the motives for collecting were divergent, the presence of objects illustrating or retelling the Bible is striking. In many Dutch collections we encounter items such as the tooth of Behemoth, parts of Leviathan, locusts, feathers of the basilisk, the fruit of the carob tree (also known as St John's bread) "that yields the honey that St John ate in the wilderness," Egyptian papyri, myrrh, lentils, stuffed crocodiles, and Nile-reed. Monstrously large teeth and bones were seen as conclusive of the truth of the existence of the giants mentioned in *Genesis* 6:4.[49] Collectors racked their brains to try to identify biblical flora and fauna. Lengthy philological and botanical disquisitions led to the conclusion that the

47 Breugelmans, "Een document." Cf. Barge, *Inventaris*, 51.

48 Breugelmans, "Een document": "Dese seldsame ende kostelicke Mumie heeft den hooghgheleerden, ende wijdt-versochte Heer, David de Willem Anno 1620 midden in Egyptenlandt gehaelt uyt kelders (welcke de Sepulturen, ofte Begravenissen, van de oude Heydens Egyptenaers waren) . . . ghelegen aen de Rivire den Nijl, uyt welcke Moses van de dochter des Conckx Pharao werde opgenomen . . . daer de kinderen van Israel onder Pharao in slavernie woonden."

49 De Mey, *Godgeleerde en natuurkundige wercken*, 342.

miraculous tree under which Jonah found shade (*Jonah* 4:7) was the prosaic castor oil tree described by the famous botanist Dodonaeus.[50] In 1663, the English botanist John Ray saw in a cabinet in Delft "a locust of the sort that St John Baptist ate in the wilderness."[51] The identification of the biblical Behemoth and Leviathan remained a popular quest.[52] Paludanus and, nearly a century later, the collector Nicolaes Witsen (1647-1717) claimed that Behemoth was a hippopotamus.[53] After much deliberation another collector, Johannes de Mey (1617-1678), arrived at the equally plausible conclusion that it was an elephant. As for Leviathan, he took it to be a whale.[54] The boundary between exegesis, natural history and the culture of collecting was a fluent one. Biblical terms and natural historical objects were used to explain each other.

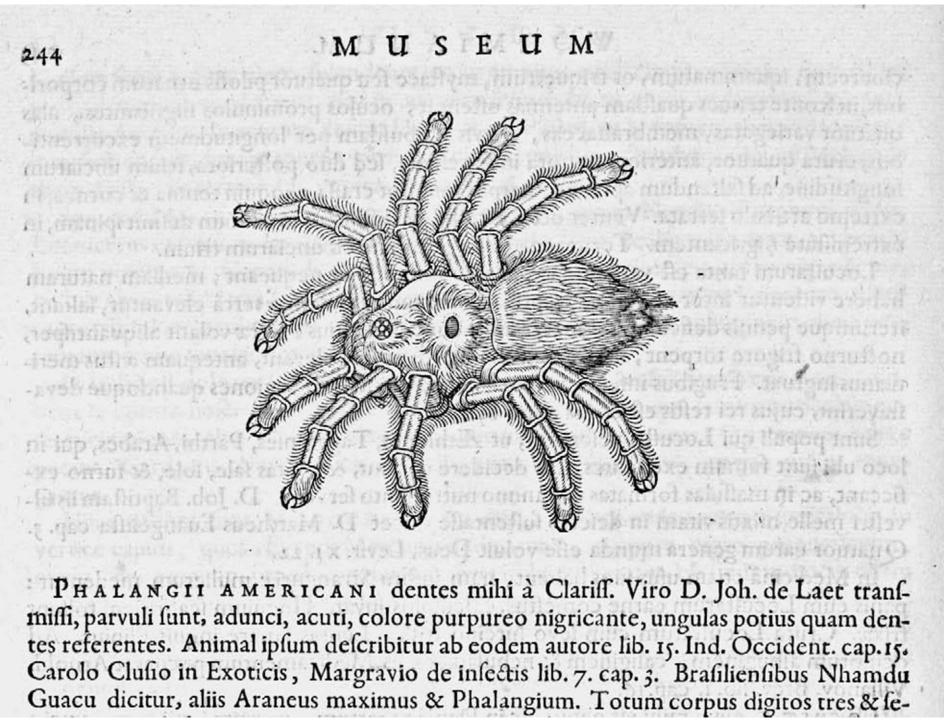
Trouble in Paradise: Johannes de Laet and the West Indies.

An important role in the unfolding of our story was played by Johannes de Laet (1581-1649), a Leiden student of Clusius' and Scaliger's.[55] He was to acquire fame as well as fortune as a merchant, historian of the Dutch West Indian Company (WIC) and owner of a collection of curiosities. De Laet studied classical languages, philosophy and theology from 1597 to 1602 and made a good impression on Scaliger and Clusius. The former dedicated a book to him, the latter described curiosities that he had received from de Laet in the *Exoticorum libri decem* (1605). Although he never crossed the Atlantic, de Laet built up an astonishing knowledge of the New World. He wrote the pioneering work *Nieuwe Wereldt ofte beschrijvinghe van West-Indien* ("New World or Description of the West Indies," first published in 1625, followed by many reprints and translations). In 1644 he started to publish the *Jaerlijcks Verhael der West-Indische Compagnie* ("Annual Report of the West Indian Company"). He also published an edition of Pliny's *Naturalis historia* (1635) and two extremely polemical works against Hugo Grotius on the origin of the Amerindians (1643-1644). The background and implications of this controversy will be dealt with later. It is important to note that de Laet, unlike Grotius, did not blindly follow the *sapientia veterum* and the traditional biblical chronology. In his capacity as a governor of the West Indian Company, and thanks to his excellent connections with Prince Johan Maurits van

50 *Ibid.*, 568-69.
51 Ray, *Observations,* 25.
52 Céard, "De Babel à la Pentecôte"; Bono, *Word of God*.
53 KBK Ms. K.S. 3467,8 f 30r; Witsen, *Noord en oost Tartarye,* 747.
54 De Mey, *Godgeleerde en natuurkundige wercken*, 533.
55 Bekkers ed., *Correspondence*; Jacobs, "Johannes de Laet"; *Johannes de Laet,* special issue *Lias*.

Nassau Siegen, the Dutch governor in Brazil, de Laet had direct access to an enormous flow of artefacts: Maya inscriptions, armadillos, colibris, anteaters, llamas, sloths, and so on.

De Laet generously shared the information and artefacts with his fellow scholars and collectors. His collection was the basis for his publications and speculations. Objects, drawings, descriptions and inscriptions were constantly related to the classical and contemporary literature. As de Laet wrote to the famous Danish collector Ole Worm (1588-1658), his collection was kept without a semblance of order and was not shown to strangers.[56] Yet de Laet's contact with Worm is a good indication of the importance of his collection. The latter's *Musaeum Wormianum* (1655) was the basis on which many collectors modelled their collections.[57] It was thanks to de Laet that Worm came into the possession of a large number of artefacts from the New World (see Figure 6).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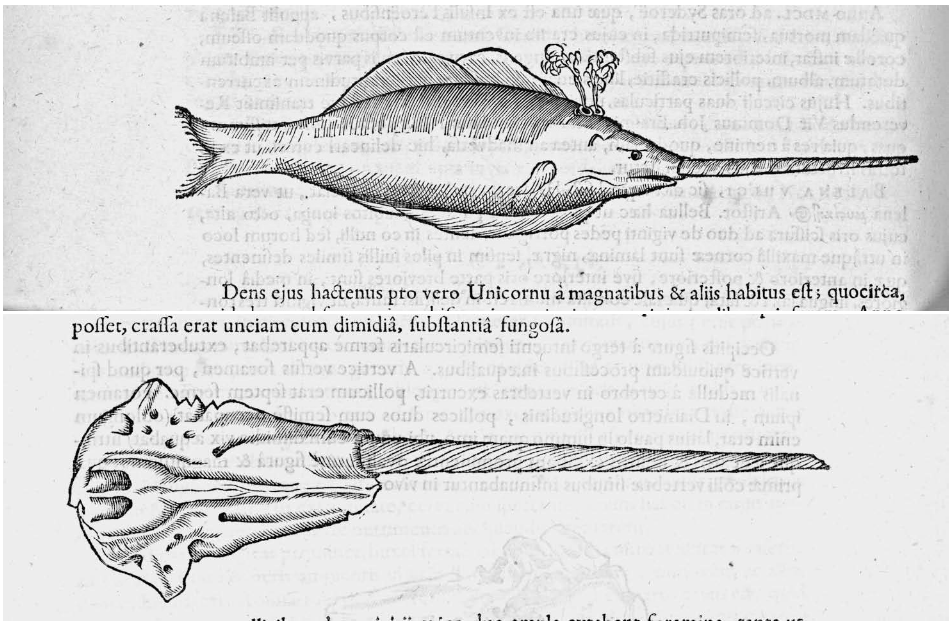
PHALANGII AMERICANI dentes mihi à Clariſſ. Viro D. Joh. de Laet tranſmiſſi, parvuli ſunt, adunci, acuti, colore purpureo nigricante, ungulas potius quam dentes referentes. Animal ipſum deſcribitur ab eodem autore lib. 15. Ind. Occident. cap. 15. Carolo Cluſio in Exoticis, Margravio de inſectis lib. 7. cap. 3. Braſilienſibus Nhamdu Guacu dicitur, aliis Araneus maximus & Phalangium. Totum corpus digitos tres & ſe-

Figure 6: One of the many naturalia De Laet sent to Worm was this 'great spider', as depicted here in Worm's Musaeum Wormianum (1655). (Courtesy Royal Library, The Hague)

[56] *Wormii epistolae* II, 815.

[57] Schepelern, *Musaeum Wormianum*; Hovesen, *Ole Worm*.



Figures 7 and 8: Basing himself on earlier work, Worm demonstrated in the Musaeum Wormianum that the so-called horn of the unicorn was actually the tusk of a narwhal. (Courtesy Royal Library, The Hague)

However, de Laet's work shows how problematic it was to incorporate new information and findings into the existing frameworks. A good example is the debate on the unicorn. Paludanus had believed that the horn that could be seen in churches and collections came from the biblical animal. The 1621 edition of Mercator's *Atlas minor* pointed out that this object was washed up in large numbers on the northern coasts, and that it was probably the tusk of a narwhal.[58] Worm had elaborated this idea further in a disputation of 1638 (see Figures 7 and 8). Worm's pupil Thomas Bartholinus (1616-1680) devoted his *De unicornu observationes novae* (1645) – a work that is regarded as the most exhaustive study of the unicorn ever written – to this theory. The horn was that of a marine animal, not a hoofed animal. Nevertheless, the existence of a unicorn was not ruled out. After all, sea unicorns existed, and Bartholinus also described a large number of birds and insects with a horn. His work was read with more than polite interest by de Laet and his close friend Claude Saumaise (1588-1653), who could be considered Scaliger's successor in Leiden.[59] The Leiden scholars promised the author to

58 Shepard, *Lore of the Unicorn*, 155.
59 *Wormii epistolae* II, 716.

devote themselves to a second, Amsterdam edition of *De unicornu*, and to send him additional classical references and descriptions of one-horned birds and insects from the New World. They kept their promise.[60] On the basis of reasoning by analogy, collectors sought the unicorn for a long time.

In the case of the unicorn, the collecting of objects somehow seemed to confirm the biblical accounts. There was, however, a rather disturbing tendency towards the opposite direction. Important aspects of the culture of collecting such as the proper names of things, the antiquity of mummies and the diffusion of peoples, languages and animals had routinely been interpreted on the basis of the letter of the Bible and biblical chronology. However, contact with the non-Western world in the influx of material objects at the beginning of the seventeenth century raised problems in this respect. First, there was the problem of quantity. Collectors became overwhelmed by the number of formerly unknown species, leading to what has been aptly described as an "information overload."[61] But there were problems of a more qualitative nature as well. Egyptian, Mexican and Chinese sources, in so far as they could be deciphered, prompted debate as their early histories seemed to antedate Adam and Eve. The flood of information about non-Western peoples shook the conviction that all peoples, languages and animals could be derived from the Garden of Eden. Had Moses and the heathen students of nature been familiar with armadillos, llamas, birds of paradise and colibris? Had there been a place for them in Noah's Ark? Were the Amerindians one of the lost tribes of Israel? Did all the languages in the world go back to Hebrew? As early as 1625, de Laet, wrote in his *Nieuvve Wereldt, ofte beschrijvinghe van VVest-Indien* ("New World or description of the West Indies") that America "was unknown to the ancients in so far as can be ascertained from their writings."[62] De Laet, member of the orthodox wing of the Dutch Reformed Church, left open the thorny question of whether Moses should be considered as one of the ancients too. The preacher, linguist and natural historian Abraham van der Mijle (1563-1637) went a step further: around 1630 he asked whether the peoples, animals and plants overseas had been known to the author of the Pentateuch, and if not, how they had ended up in America.[63] Although his cautiously formulated *De origine animalium et migratione populorum* was not published until 1667, the work was known to other scholars. Among the preacher's friends was Hugo Grotius, who knew the manuscript of *De origine*.

[60] Their remarks are included in: Bartholinus, *De unicornu observationes nova*.
[61] Ogilvie, "The Many Books of Nature."
[62] De Laet, *Nievve Wereldt,* **r.
[63] Hooykaas, "Abraham van der Mijle"; Meertens, "Abraham van der Mijle."

In 1642, Grotius published his *De origine gentium americanarum*, launching his theory concerning the origin of languages and the spread of flora, fauna and peoples around the earth. The background for the publication of this book were the studies carried out by the intriguing Isaac la Peyrère (1596-1676), who in 1655 was to publish his scandalous *Praeadamitae*.[64] In this work, printed in Amsterdam, La Peyrère argued, amongst other things, that there had been men living thousands of years before Adam, and that the Flood that occurred during Noah's life was not universal, but only restricted to the land of the Jews.

Isaac la Peyrère certainly was not a great scholar, but a fantastic visionary guided by intuition. Anthony Grafton has aptly described him as a man who, had he lived in the twentieth century, might have haunted public libraries, combing the plays of Shakespeare for evidence of Bacon's authorship.[65] According to the Frenchman's own testimony, the *Praeadamitae* was the result of a question he asked himself in his early childhood. Eve bore Cain and Abel. Cain rose up against Abel his brother, and slew him, after which deed he found himself a wife. But were did Cain's wife come from? This initial puzzlement led to the gradual elaboration of his theory. La Peyrère assumed that, if there had been men before Adam, not only exegetical questions could be answered, but also some other problems which increasingly puzzled early seventeenth-century scholars, such as the origin of the American peoples and animals. He stated that the Pentateuch was only an account of *Jewish* history. Moreover, he questioned the universality of the Flood, and asked disturbing questions about the origins of peoples and animals living in the New World. The result was commonly received as a monumentally heretical doctrine. "He was regarded as perhaps the greatest heretic of the age," Richard Popkin noted, "even worse than Spinoza, who took over some of his most challenging ideas."[66] What concerns us here, is the fact that La Peyrère had since 1640 been working on the manuscript of his *Praeadamitae*, basing himself also on information he obtained from two of his Dutch friends – de Laet and Saumaise.

Like so many of his contemporaries, La Peyrère was fascinated by reports and objects related to non-European peoples and chronologies. Although he had only a superficial knowledge of Scaliger's work, he became friendly with Saumaise, who was appointed at Leiden in 1631. In the 1640s, and with the assistance of a young and promising scholar named Isaac Vossius, Saumaise was working his way through all available Hebrew, Greek, Arabic, Persian and Latin sources concerning astronomy and chronology in order to write his vast attack against ancient

64 Popkin, *La Peyrère*; Jorink, "Horrible and blasphemous."
65 Grafton, "La Peyrère."
66 Popkin, *La Peyrère*, 1.

astrology and numerology, *De annis climactericis et antiqua astrologia diatribae* (published in 1648).[67] In the present context, it is interesting to note that Saumaise referred to Berosus, the Babylonian priest who supposedly transmitted Eastern wisdom to ancient Greece, and who claimed that the Chaldean astronomers had a tradition of no less then 470.000 years of observation. Saumaise discussed this stunning claim and other chronological matters with La Peyrère, in whose eyes this information offered the most convincing evidence that the pagan world had existed long before God created Adam.

This is how knowledge was circulated and adapted. But the arguments derived from ancient chronologies were not the only tools La Peyrère used to buttress his theory. Besides texts, he also used material evidence, namely al kinds of artifacts brought in from previously unknown countries. De Laet, being a director of the West Indian Company, had access to the overwhelming stream of information and artifacts returning from the Americas. As we have already learned, de Laet was an ardent collector of information, artifacts and curiosities from the New World, ranging from Maya-inscriptions to anteaters and from Eskimo-canoes to coral, sending many of his curiosities further to his good friend Ole Worm.[68] During a trip through Northern Europe undertaken in 1646, La Peyrère visited Saumaise and de Laet in Leiden, and then Worm in Copenhagen – were he discussed the status of the objects brought in from the America's. Without being aware of it, the orthodox pious de Laet had helped to foster the Praeadamites and to create a fertile ground for a polygenetic theory.

But the story is even more complex. Already in the early 1640s, an early draft of La Peyrère's manuscript was circulating in Paris and by way of Marin Mersenne ended up in the hands of Grotius, who was then living in the French capital.[69] Grotius, recognizing the disastrous consequences of the Preadamite theory to Christianity, immediately embarked upon a refutation, *De origine gentium Americanarum dissertation*, which he published in Paris and Amsterdam in 1642. In this book, the first work that was against La Peyrère's Praedamite theory and anticipating the latter's publication by thirteen years, Grotius gave an explanation of the origins of the Americans which did not disagree with the biblical account. Basing his argument on indirect information he had obtained concerning the language and objects of the Americans, Grotius unfolded an ingenious scheme, according to which the Americans originated from Scandinavia and Germany and hence from Noah and Adam. For example, did not the Mexican ending 'lan' (Cimat-

67 Salmasius, *De annis climactericis*.
68 Schepelern, *Musaeum Wormianum,* 170; Schnapp, "The Pre-Adamites."
69 Popkin, *La Peyrère*, 6; Nellen, *Hugo de Groot*, 553-54.

lan, Coatlan, Quazutatlan) show a striking similarity with the Germanic 'land' (Island, Greenland, Estotiland)? While La Peyrère took offence at Grotius, who attacked his unpublished manuscript in print, he received unexpected help from an intelligent and extremely well-informed refutation of *De origine*: de Laet's *Notae ad dissertationem Hugonis Grotii* of 1643, which virtually destroyed all of Grotius' arguments.[70] A bitter polemic resulted from this, which was fought out using numerous arguments with varying degrees of relevance.[71] The Leiden polyglot gave Grotius a long lesson in European and American philology. The Amerindian languages did not betray the slightest affinity with Hebrew, Greek, Latin or any contemporary European language. Instead, de Laet emphasised the enormous differences between the European and Amerindian languages and cultures, which matched their highly diverse flora and fauna. Admittedly, de Laet was less clear about where the people, animals and plants in the New World had come from. Contrary to Grotius, de Laet regarded ancient and Biblical texts as a different issue from the contemporary fauna and flora of America as two separate matters. For example, his edition of Pliny's *Naturalis historia* is characterised by a strict philological approach: De Laet treats it as a historical document and distinguishes between past and present.[72] Nowhere does he mention the immediate applicability of the Plinian text. This tendency is even clearer in his book on minerals, *De gemmis et lapidibus libri duo* (1647). De Laet justified this work in the preface by pointing to all the nonsensical claims concerning the powers of stones that had been made on the basis of a corrupt manuscript tradition of mineralogical texts. The book constantly draws a sharp distinction between the ancient world (*antiqui*) and the objects and knowledge of "our time" (*nos hodie*).[73] The continuity between *res* and *verba* as well as between time and space is deconstructed here.

This approach is also one of the most striking aspects of the *Historia naturalis Brasiliae* (1648), which de Laet edited (see Figure 9). This earliest natural history of South America was the result of Johan Maurits van Nassau's stay in Brazil. Willem Piso (1611-1678) and Georg Marcgraf (1610-1644) had meticulously charted the natural history of Brazil, and it was de Laet's task to arrange, supplement and publish their record, which included splendid illustrations of unknown creatures, skilfully drawn *ad vivum*.[74] The *Historia* has been characterised

70 De Laet, *Notae ad dissertationem Hugonis Grotii.*
71 Rubies, "Hugo Grotius' Dissertation"; "Space, Time, Travel."
72 *Historiae naturalis Libri XXXVII. Curante Joannes de Laet.*
73 De Laet, *De gemmis et lapidibus.*
74 Whitehead, "Georg Markgraf"; Parker Brienen, "Georg Markgraf."

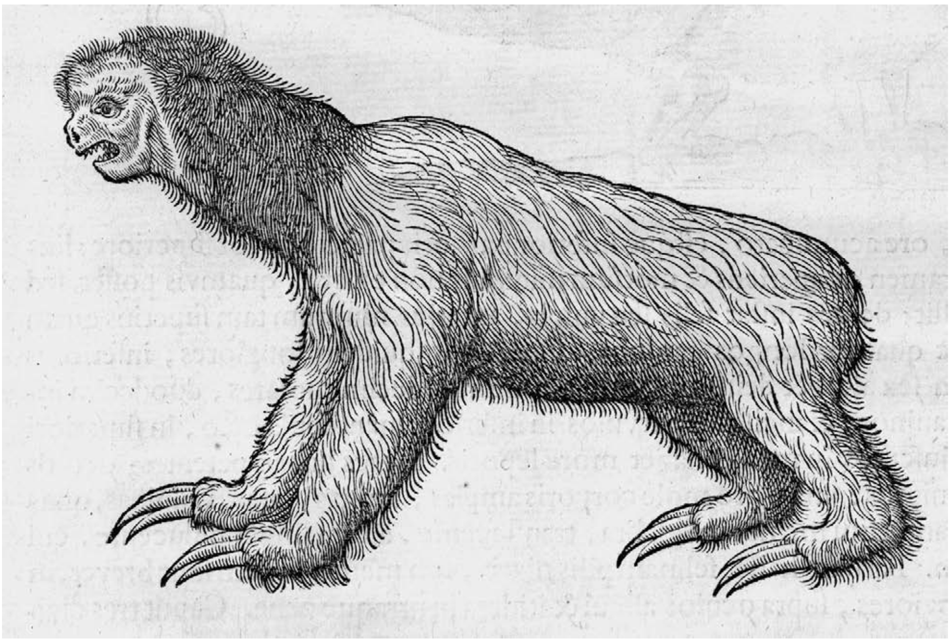


Figure 9: A sloth, as depicted (upside down) in the Historia naturalis Brasiliae (1648). This picture is based on the representation of the animal in Clusius' Exoticorum libri decem (1605). (Courtesy Royal Library, The Hague)

as one of the works that mark the watershed in the way that natural history was practised in the early modern period.[75] While Gessner, Aldrovandi and their followers had made textual references an integral part of the description, they were lacking in the *Historia*. Anteaters and sloths were not mentioned in the Bible, nor by Aristotle, Pliny or by the *Physiologus*. They were animals without history, creatures without a story, and so scholars could only record their present anatomy and behaviour. At least for them, the customary fitting of all information into a Biblical and etymological context was superseded.

In the following decades this separation was to become an immense intellectual problem, especially after the tumultuous publication of La Peyrère's *Prae-Adamitae* in Amsterdam in 1655.[76] In the printed editions – no less then four were issued by the publishing company of Elsevier before the book was banned – La Peyrère explicitly referred to de Laet's arguments against Grotius concerning the origin of the American peoples. In passing, La Peyrère argued that there were

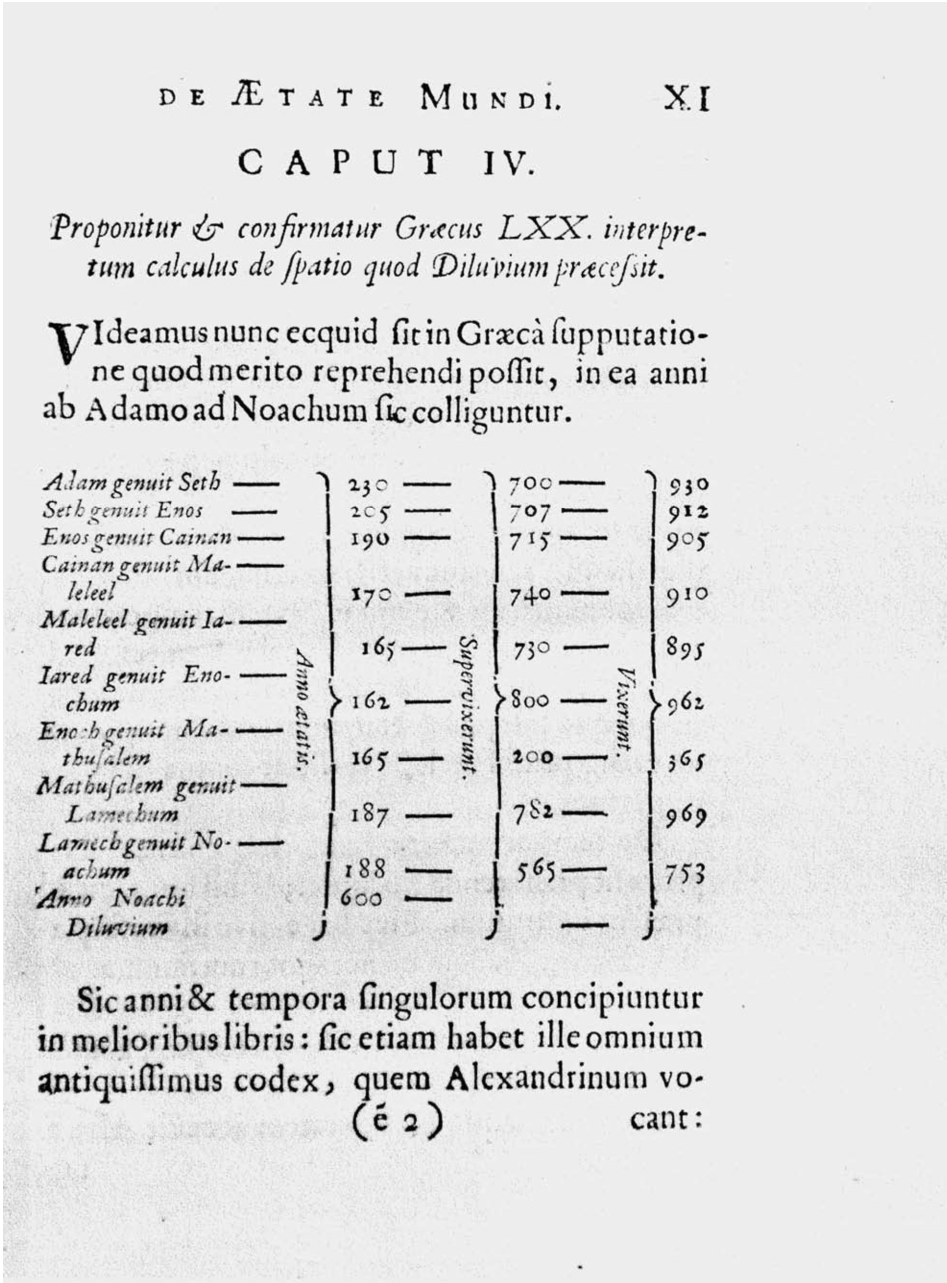
[75] Ashworth, "Natural History," 318.

[76] On this episode in more detail: Jorink, "Horrible and blasphemous."

no textual nor material sources to substantiate the claim that the Flood had been universal. Egypt, for one, was never inundated.

Needless to say that La Peyrère's book provoked furious reactions from orthodox theologians. However, the by far most remarkable response came from Grotius' former trainee Isaac Vossius, *De vera aetate mundi* (1659). This latter work can be regarded as one of the most important expressions of radical biblical criticism of the seventeenth century. Isaac Vossius (1616-1689) was the only surviving son of the great classical scholar, philologist and theologian Gerardus Johannes Vossius (1577-1649).[77] While his father had been a pious Christian, the militant young Vossius was to become notorious for his freethinking, which operated in the twilight zone between skepticism and atheism. As Anthony Grafton recently put it: "while Gerardus had built bridges, Isaac burned them."[78] From his early childhood on, Vossius junior was fascinated by eccentric classical texts, especially those dealing with geography, constantly checking ancient texts against the latest information by travels and merchants from abroad. While working as Grotius' secretary in Paris, Vossius had been close to the fray. He was fascinated, if not obsessed, by foreign countries. Like de Laet and Colvius, he kept a close watch on the flood of information, writings and artefacts from East and West, particularly from China, a country that he admired intensely.[79] The antiquity of China, emphasised in the extremely influential works of the Jesuit Martino Martini, the *Atlas sinensis* (1653) and the *Sinicae historiae* (1658), would play an important role in the ensuing debate. Martini's work, based on his stay in the Chinese Empire from 1642 until 1651, was immediately reprinted by the Amsterdam firm of Blaeu, and subsequently devoured by Vossius. The scholar argued at length that the Chinese are superior to the Christians in every respect, from their understanding of the pulse and the circulation of the blood, to their mastery of printing, the compass and gunpowder. According to Vossius, they were the most learned people in the world: "In their writings and chronologies they had a continuous history of 4,500 years. There are some among their writers who are older than Moses himself."[80] This was an unprecedented claim. On the basis of different versions of the Old Testament, sources from ancient Egypt and China and from the New World, Vossius argued that the earth must be considerably older than Scaliger and others had claimed, namely 1440 years to be precise (see Figure 10). He went on to conclude that the original text of the Pentateuch had been lost. In passing,

[77] On Vossius see: Katz, "Isaac Vossius"; Jorink and Van Miert eds., *Isaac Vossius*.
[78] Grafton, "Isaac Vossius, Chronologer."
[79] Pinot, *La Chine*; Weststeijn, "Spinoza sinicus."
[80] Vossius, *De vera aetate*, 39.



DE ÆTATE MUNDI. XI

CAPUT IV.

Proponitur & confirmatur Græcus LXX. interpretum calculus de ſpatio quod Diluvium præceſſit.

VIdeamus nunc ecquid ſit in Græcà ſupputatione quod merito reprehendi poſſit, in ea anni ab Adamo ad Noachum ſic colliguntur.

	Anno ætatis.	Supervixerunt.	Vixerunt.
Adam genuit Seth	230	700	930
Seth genuit Enos	205	707	912
Enos genuit Cainan	190	715	905
Cainan genuit Maleleel	170	740	910
Maleleel genuit Iared	165	730	895
Iared genuit Enochum	162	800	962
Enoch genuit Mathuſalem	165	200	365
Mathuſalem genuit Lamechum	187	782	969
Lamech genuit Noachum	188	565	753
Anno Noachi Diluvium	600		

Sic anni & tempora ſingulorum concipiuntur in melioribus libris: ſic etiam habet ille omnium antiquiſſimus codex, quem Alexandrinum vo-

(é 2) cant:

Figure 10: One of the sources of Isaac Vossius’ De vera aetate mundi were the differences in the lengths of the lives of the Patriarchs in the Septuagint and the Masoretic version of Genesis. (Courtesy Royal Library, The Hague)

this and subsequent treatises by Vossius also touched on other sacrosanct issues. Had the Flood been universal? Vossius considered that impossible. There were references to a similar event in the chronicles of both Christian and non-Christian cultures, but they were hard to reconcile chronologically. Furthermore, how did all those animals that were unknown to the ancient world reach the New World. Did they also disembark on Mount Ararat? Making fun of biblical literalists, Vossius argued that it was impossible that the abundance of previously unknown forms of life would have fitted on an Ark which according to *Genesis* 6:15 had a length of three hundred cubits, a breath of fifty cubits and a height of thirty cubits. The Ark was becoming overloaded. Scholastic disputations about the length of a biblical cubit, the number of known animals, the size of their stables and so forth could not conceal the fact that the Ark was in danger of being wrecked.[81]

In other words, partly as a result of the thirst for curiosities from East and West, philological expertise, internal and external biblical criticism, the status of the Bible was seriously called into question. Growing knowledge of ancient texts combined with a culture of collecting led, unexpectedly though maybe not paradoxically, to scepticism rather than certainty. The European hunger for curiosities, originally intended in part to illustrate classical and Christian history, began to undermine that very history. Humanist collectors had allowed the Trojan horse inside. The traditional scheme of Creation-Flood-Babel increasingly came under attack. As Grafton notes:

> 'Strong wits' across Europe gossiped enjoyably about the origins of Cain's wife and the authorship of the report of Moses' death in Deuteronomy. The most powerful of texts had tumbled down.[82]

The status of the letter of the Bible became increasingly undermined. This process went hand in hand with changes of the status of the objects collected in order to illustrate the Bible. Some silent messengers seemed to have become noisy disturbers.

Concluding Remarks

Dutch collections changed considerably in character in the course of the seventeenth century. The collection that Paludanus assembled between 1583 and 1630 was the product of a humanist heritage, the intellectual world of Aldrovandi, Cam-

[81] For a general outline of the seventeenth-century discussion see: Grafton, *New Worlds, Ancient Texts*; Brown, "The Flood"; Vermij, "The Flood"; Grafton, "Kircher's Chronology."

[82] Grafton, *New Worlds, Ancient Texts*, 242.

erarius and Scaliger, in which the striving for universal knowledge played a key role. Exegesis, natural history and collecting formed an indissoluble whole. We can find clear traces of different, interconnected ideas in the collections of Paludanus and of Leiden University. They were both intended to illustrate ancient texts, both the *sapientia veterum* and biblical history. Mummies, stones from holy mountains, myrrh and the remains of Behemoth were the silent witnesses from biblical times. Words and objects were intertwined: the collection had a narrative character that called for exegesis.

In the collections of a century later, a sharp distinction began to be drawn between past and present. Exegesis gave way to description, the search for symbolic meanings was replaced by an empirical attitude. The collections of *naturalia* no longer referred to the biblical text, increasingly pointed in two other directions: towards the kinds and genera to be found in nature, and to the almighty architect who had created them. Due to the influx of inscriptions and of objects that had been unknown to antiquity and of information about the history of non-Christian peoples, the traditional interpretation of the canon in general, and the biblical story of the Flood and Babel in particular, was increasingly called into question. Besides philological arguments, it was also the influx of the material from East and West provided by collectors like de Laet and Worm that gave La Peyrère and Isaac Vossius ammunition to attack traditional conceptions of the genesis and diffusion of peoples, languages, flora and fauna. Developments in textual criticism increased the distance between text and object, between past and present. Collections no longer unequivocally narrated and illustrated the story of Moses, Herodotus, Aristotle, Pliny and the *Physiologus*. The growth of empirical material (anteaters, sloths, the tusks of narwhals) brought on a crisis of the intertextual view of the world. The same is true of the influx of information about non-Christian languages and chronologies. The collection of curiosities, originally partly intended to bring the classical and Christian corpus to life, had – paradoxically – sown the seeds of scepticism and doubt.

This process went hand in hand with a change in the ontological status of the objects collected. Around 1600, a collector who wanted a representation of the biblical unicorn could be satisfied with the horn of the animal, but also with a picture or a hoofprint. With the increasingly problematic status of the Bible and the writings of the Ancients, the message told by objects became less univocal and open to more than one interpretation. Depending on the intentions of the observer, the 'horn' of the unicorn could be seen as the horn of an unicorn, as a proof of the existence of the biblical animal, as a tusk of a narwhal, as an indication that land-unicorn would probably exist, or as a proof that the existence of these creatures was rather unlikely. The Amsterdam collector, burgomaster and governor of the V.O.C. Nicolaes Witsen, for one, was perfectly aware that the horn of a unicorn was actually the tusk of a narwhal. "I have one," he wrote in 1710, "to which the cranium of the fish is still attached, as I have myself had them fished up in Greenland."[83] He spared no trouble or expense to obtain an exemplar of this marine unicorn and to have a drawing made of it, since he did not regard the illustrations in Worm and Bartholinus as sufficiently trustworthy. On the other hand, when reports arrived from Siam that unicorns had been seen there and a correspondent sent him a horn, Witsen concluded on the basis of this item that the unicorn did exist after all; it was "a terrestrial animal the size of a goat."[84] He proudly showed the horn to his friend Gisbertus Cuper, who concurred that this must be from the famous wild creature.

In other words, the status of the object became increasingly problematic with regard to epistemological questions. What did an object say, what did it prove? Did giant bones found in the earth illustrate the biblical lines of the book of *Genesis* 6:4 on giants (as any collector around 1600 would have believed), or did it mean something completely different (as nineteenth-century scientists would mostly tend to claim)? Were the remains of that elephant-like animal found in the Russian steppes the rest of an extinct species or rather what Witsen took it to be when he wrote to Cuper in 1713: "I own elephant tusks and the skull of an elephant that were found deep below the surface in Siberia, between 65 and 70 degrees in such a cold country that no elephants could live there; they must have been washed up there during the Flood."[85] The messengers were still silent, but from the second half of the seventeenth century on, could be interpreted in a range of often contradicting ways.

83 Gebhard, *Nicolaas Cornelisz. Witsen* II, 331: "Ik besit er eendaer het cranium van de vis nog aensit, so als ik die selve heb laeten vissen, in groenlant."

84 *Ibid*, 383: "dat de groote van een bok heeft, is een lant dier."

85 *Ibid*, 363-364: "UwelEd; weet hoe ik mede olifantstanden alsmede een cranium van een olifant besitte die in Siberien diep onder aerde syn gevonden, op 65 a 70 graden in so een koud land, daer immers geen olifanten konnen leven, hoe konnen die daer anders sijn gekomen, als bij aendrijving ter tijt der Suntvloet."

A Museum of Wonders or a Cemetery of Corpses? The Commercial Exchange of Anatomical Collections in Early Modern Netherlands

Dániel Margócsy

1713 was a sad year for Hendrickje Dircksz. Her husband, the Leiden anatomy professor Govard Bidloo died on April 20. A few months later, she put his library and anatomical museum on auction. Books were sold on October 23, 24 and 25 and brought in almost three thousand guilders. The museum was sold on the afternoon of the 25th. It contained 131 anatomical preparations, i.e. human organs preserved by the injection of wax, which were valued at just over 177 guilders, a small sum of money. Only four years later, the Amsterdam professor Frederik Ruysch cashed in over thirty thousand guilders when the Russian czar purchased his anatomical cabinet. For this money, Ruysch could have afforded five or six elegant houses on one of the more fashionable canals of Amsterdam, and the deal was almost equivalent to winning the lottery. When Ruysch's daughter won the jackpot in 1720, she received seventy-five thousand guilders for her ticket. Bidloo's family, on the other hand, would scarcely have managed to survive until the following summer on 177 guilders. While the contrast between these two sales appears quite shocking, it would not have surprised contemporaries. The two anatomists were known to despise each other, and spent the better half of the 1690s on a bitter pamphlet war over the role of preparations in anatomical research. Their respective positions foreshadowed the divergence of the sales prices. Ruysch claimed that his anatomical preparations offered a faithful representation of the body. Bidloo countered that the specimens offered deceptive evidence, and anatomical atlases were better equipped to visualize anatomical structures.

This chapter analyzes the role that preparations in anatomical research played in the debates and working practices of these Dutch professors. In their struggles to depict living organisms through the use of dead specimens, they hit on philosophically novel concepts of objectivity. Their debates thus echo historical controversies over methods of visualizing the body, e.g. the pre-Galenic arguments between the rationalists' reliance on (animal) cadavers and the empirical emphasis on wound observation, or recent debates on the comparative advantages of fMRI and PET scans. Yet the significance of Bidloo's and Ruysch's research went beyond the realm of philosophy, and also had direct relevance for the material value of anatomical specimens. Their pamphlet war played out in early modern, capitalist Netherlands, where visual representations were busily traded commodities. The Dutch Golden Age saw the production of over five million paintings, as well as the invention of the telescope, the microscope, mezzotints and color printing. Scientific entrepreneurs were eager to exploit and market these inventions to *liefhebbers,* i.e. curious gentlemen. It is thus no surprise that the age-old debate on the proper representation of human anatomy also had financial overtones. For anatomical preparations, price and epistemological status went hand in hand.[1]

Anatomical Preparations as Transparent Representation: Frederik Ruysch's Cabinet of Curiosities

For much of the early modern period, first-hand observation provided the best means to visualize the human body in Dutch medical research and education. Next to the perusal of classical texts and the lectures of professors, university students also attended dissections. From its foundation, for instance, Leiden University regularly requested suitable cadavers from state authorities to hold anatomy lessons. Within the guild system, apprentice surgeons and midwives also relied on practical anatomy to acquaint themselves with the human body's structures. The larger public could benefit from public dissections in the theaters of Amsterdam, Delft, Utrecht, The Hague, Rotterdam, Dordrecht and Middelburg. Forthcoming dissections were advertised in newspapers and commemorated in more than a dozen paintings. Despite their popularity, these lessons often had a limited role in education and research. Because the performance was frequently geared towards the entertainment of authorities and paying visitors, students could not discuss controversial issues at length. They were also seated at a considerable distance from the dissecting table, behind the rows of professors and municipal officials. Rowdiness only exacerbated the situation, and strict rules needed to be established to

1 For the Ancient debates on human anatomy, see Cosans, "Galen's Critique;" Hankinson, "Galen's Anatomical Procedures." For modern brain imaging, see Alac, "Working with Brain Scans"; Beaulieu, "Images"; Joyce, "Appealing Images."

regulate the audience's behavior. For these reasons, the finer details of the human body remained hidden from the public view.[2]

In the 1650s, anatomical preparations offered the promise of providing better and more widespread access to the human body's internal structures. In those years, the Flemish nobleman Lodewijk de Bils hit upon a novel method of preparing and preserving human organs. He developed a special, and expensive, liquor in which the organs could be bathed, and also injected the body's vessels with a wax-like material to visualize the circulatory systems. Unlike fresh cadavers, the preserved preparations could be examined repeatedly. Since they did not decay, one could hope that the number of specimens in circulation would steadily increase. The discovery raised the interest of medical professionals throughout the Netherlands. A group of anatomists at Leiden University, including Reinier de Graaf and Jan Swammerdam, began using oil of turpentine and wax for preparations. Their results were disseminated through the chemical and anatomical textbooks of Stephanus Blankaart and Carel Maets in the 1680s.[3]

Frederik Ruysch perfected his own technique in these Leiden circles. Born in 1638 into a family of civil servants in The Hague, he first trained there as an apothecary. A few years later he also obtained a medical degree from Leiden. He moved to Amsterdam as *praelector* of anatomy at the surgeons' guild in 1667 where he was subsequently appointed city obstetrician and professor of botany. He was elected to the Leopoldine Imperial Academy in 1705, became an F.R.S. in 1720 and was chosen to replace the deceased Isaac Newton as an *associé étranger* to the Académie des Sciences in 1727. He died in 1732 at the age of 93. Although he was a pharmacy-trained artisan, a scholarly physician and an internationally renowned natural philosopher at various points in his life, he did not clearly commit to any of these socio-professional roles.[4]

Back in his day, Ruysch was mostly known for the museum of anatomical preparations that were created according to his own version of the wax-injection method. Thousands of specimens were preserved in bottles, and they filled the shelves of elaborately decorated cabinets (Figure 1). They provided a comprehensive overview of anatomy including even the minutest organs. For Ruysch, the

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2 On Leiden University, see Otterspeer, *Groepsportret*. On anatomical theatres, see Ferrari, "Public Anatomy"; Rupp, "The New Science"; Rupp, "Theatra anatomica"; and Slenders, *Het theatrum anatomicum*. On anatomical portraits, see Hansen, *Galleries*.

3 On De Bils, see Jansma, *Louis de Bils*; Fokker, "Louis de Bils"; Cook, "Time's Bodies." On the history of preparations, see also Cole, "The History of Anatomical Injections"; Kooijmans, *De doodskunstenaar.*

4 On Ruysch, see Kooijmans, *De doodskunstenaar*; Scheltema, *Het leven van Frederik Ruysch*; Berardi, *Science into Art*; Luyendijk-Elshout, "An der Klaue"; Hansen, "Resurrecting Death."

Figure 1. An allegorical representation of Ruysch's museum. Ruysch, Alle de werken, frontispiece. ©The Wellcome Collection. Note the presence of anatomical preparations at the front.

epistemological role of his specimens could hardly be overestimated. He believed that the body was composed exclusively of the vessels of the various circulatory systems. By injecting wax, one could preserve the shape and position of these vessels in their natural state. In the absence of other building blocks, wax could faithfully capture the structure of the whole body.

For Ruysch, wax injection was clearly superior to engraved illustrations on paper because it was an auto-inscription technology that worked according to the notions of mechanical objectivity. Guided by the imagination, the hand of the engraver could always introduce fictitious elements into paper representations. Scientific illustrations, on their own, had no guarantee that they were truthful. Led by the body's own vessels, on the other hand, wax-injected preparations were unable to lie. Consequently, Ruysch's publications mostly discussed discoveries made with the help of wax injection. The scientific arguments were always supported by the evidence of a prepared specimen. If critics disagreed with Ruysch's claims, they were invited to visit his museum where the specimen was exhibited. Available for public viewing, the preparations served as the ultimate arbiter for bringing a controversy to closure.[5]

In addition, wax-injected specimens were beautiful curiosities that evoked wonder. As wax replaced blood in the circulatory system, the cadaver's collapsed organs were restored to their natural state of life. Ruyschian preparations appeared to vanquish the power of death. When the Russian czar was shown the body of a young girl, he thought that she was only asleep and kissed her. Apart from entertaining royalty, the cabinet also served as an excellent educational tool. Instead of poring through textbooks, students of medicine could subscribe to Ruysch's course on anatomy where the secrets of the human body, fish and birds were discussed with the help of the exhibits. Anatomical preparations thus trumped other forms of representation in every imaginable scenario, and Ruysch never ceased to praise their marvelous qualities in his publications. A malicious contemporary, possibly Govard Bidloo, took the pains to count how often Ruysch used the word *mirum* and its cognates in his relatively brief *Epistolae* and *Observationum centuriae.* The list ran to 96 occurrences.[6]

[5] "Ik hebbe kleene Kinderkens, die ik over twintigh jaaren heb gebalsemt, en tot nu toe soo netjes bewaard, datse eer schynen te slapen; als ontzielt te zyn." Ruysch, *Alle de werken*, 487. On the concept of auto-inscription, see Brain and Wise, "Muscles"; Chadarevian, "Graphical Method"; Douard, "E.-J. Marey's Visual Rhetoric." For mechanical objectivity, see Daston and Galison, "The Image"; Daston and Galison, *Objectivity*.

[6] The anecdote of the baby is recounted by several authors, incl. Dúzs, "Hogyan." For the satire, see *Mirabilitas mirabilitatum*. A copy survives at the British Library, cat. no. 548 F 16. (12.), which bears a note of identification on the title page: "Q. an a Godofredo Bidloo conscripta?"

Problems with Wax-Injection: *Johannes Rau* and *Hermann Boerhaave*

Bidloo's death in 1713 may have caused sorrow for his widow. It also provided a career opportunity for the lithotomist Johannes Rau, who was appointed to the vacated anatomy chair in Leiden and delivered his inaugural lecture soon afterwards. In this lecture, Rau discussed the best methods for learning anatomy. It was essential that students frequently read the texts of the ancients and the moderns, attend the lectures of the professors and participate in private dissections. Anatomical preparations were supposed to play only a secondary role. They could offer some guidance in research. The method of wax-injection, however, also distorted the structures of the human body. As it filled the veins and the arteries, it distended the walls of the blood vessels and made them appear bigger than in reality. No longer transparent, preparations only offered an approximate representation of the human body.[7]

Rau's criticism of Ruyschian preparations was shared by his colleagues. In a letter published in the early 1720s, Hermann Boerhaave repeated the claim that preparations enlarged the circulatory system. When wax was injected into the liver's portal artery, the vessel expanded to the extent that the neighboring anatomical structures were suppressed. This shortcoming was decisive for Boerhaave. Based on theoretical arguments, he had already surmised the existence of glands in the human body. In these glands, bodily fluids were mixed and separated like chemical substances in a retort. It was necessary that such structures should exist. Otherwise, the blood would circulate in the body without undergoing any modification in its composition. Since wax injection potentially suppressed these glands and only visualized the circulatory system, its anatomical use was heavily limited.[8]

While recent studies have emphasized the theoretical underpinnings of Boerhaave's criticism, it is important to note that the concept of visual evidence was also under debate. The existence of glands simply could not be detected with the Ruyschian preparation technique. The Leiden professor instead suggested an al-

7 Rau, *Oratio*, 9 and 29.

8 "Maar wy begrypen ook, dat door de aangedronge stoffe die vaten uytgespannen en opgevult worden, dewelke gelyk takken uyt een bloetvoerende slagader, als haar stam, voortkomen, maar welkers oorsprong echter naauwer is in zyn natuurlyke opening, als dat die het rode deel van 't bloet tot zich kan nemen, schoon zy fynder deeltjes als dit dikste deel gemakkelyk ontfangt: en waarom ook deze vaatjes, tot een tegennatuurlyke grootte vergroot zynde, *Valschelyk voor bloetvoerende pypies gehouden worden*; dewyl deze in gezontheit alleen Wyvoerende, als ik zo spreken mag, geweest zyn." Ruysch, *Alle de werken*, 1183-1184; where Boerhaave's letter is reprinted in its entirety.

ternative technology, recently dubbed by Domenico Bertoloni Meli as the *microscope of disease.* Originally invented by Marcello Malpighi, this method relied on the observation that certain illnesses caused the glands to grow into an abnormally large tumor. These tumors magnified the shape and structure of healthy glands so that they became visible to the human eye. Unlike preparations, the *microscope of disease* confirmed Boerhaave's claims. Ruysch was understandably upset by these criticisms and called Boerhaave a *redenkonstenaar,* i.e. a sophist. Instead of trusting the auto-inscription of preparations, Boerhaave mistakenly used reason to theorize and tumors to visualize the glands.[9]

Paper Epistemologies: The Debate Between *Govard Bidloo* and *Frederik Ruysch*

Throughout his career, the most vociferous opponent of Ruysch's preparations was the anatomist and playwright Govard Bidloo, born in 1649. As a surgeon apprentice in Amsterdam in the 1670s, he was already acquainted with the higher echelons of society. He was briefly associated with *Nil volentibus arduum,* a literary society that aimed at modernizing Dutch culture with the precepts of French classicism, and became a medical doctor in 1682. While Ruysch established his career with a museum of anatomical specimens, Bidloo put his stakes on the flourishing print culture of the Netherlands. He published a Dutch translation of Pierre Corneille's *Pompée* in 1684, ridiculed the *Nil* in 1685 in a satirical pamphlet and wrote the libretto for *Ceres, Venus and Bacchus,* the first Dutch opera in 1686. His monumental *Anatomia humani corporis* came out in 1685, cementing his fame as a medical professional (Figure 2). This atlas contained over a hundred folio engravings on human anatomy, which were designed by Gerard de Lairesse, the most-praised classicist painter of the period. Thanks to these publications, Bidloo became a client of Prince William of Orange, soon to become William III of England. After various posts, he was appointed professor at Leiden University at the instigation of the King in 1694. William later also called him to London where

9 "Wat my aanbelangt, ik zal in tegendeel myne zake alleen door proeven beweren, en zodanig bybrengen, welke met de Ogen des lichaams konnen gezien worden, want dit is ondervinding; maar die alleen een beschouwing door de Ogen des verstants vereisschen, zal ik aan anderen overlaten, die vermeynen, dat de redeneringen boven de waarnemingen te schatten zyn." Ruysch, *Alle de werken,* 1196. On the Boerhaave-Ruysch debate, see Knoeff, "Chemistry." On the microscopy of disease, see Bertoloni Meli, "Blood." For Boerhaave's work on glands, see Ruysch, *Alle de werken,* 1165-66. Some major works on early modern visual culture include Freedberg, *The Eye of the Lynx*; Ogilvie, *The Science of Describing*; Elkins, "Two Conceptions"; Alpers, *The Art of Describing.*

he had the dubious honor of assisting to the King's fatal illness. Left without a patron, Bidloo returned to Leiden where he taught until his death in 1713.[10]

Like Boerhaave and Rau, Bidloo thought that anatomical preparations lacked the transparency required to depict the body. He instead proposed paper as the ideal for anatomical representation. His claim was supported by three distinct arguments. While preparations were frozen in time, sequential images could represent on paper the changing shape of an active, living organ. Paper also offered the possibility to juxtapose and compare representations produced with various observation techniques, e.g. microscopy or even wax-injection. Third, engraved images had a higher resolution than anatomical specimens. They could magnify minute details that not even microscopes could detect.

We are in a privileged position to scrutinize Bidloo's complex paper epistemology and contrast it with Ruysch's preference for preparations. The two anatomists spent the better part of the 1690s dissecting each other's discoveries. In the early 1690s, Ruysch printed a part of his extensive correspondence with other anatomists. These essays on the internal structure of the spleen, on the branching of the aorta or on the *arachneal mater* often criticized the plates in the *Anatomia humani corporis*. Bidloo did not take these charges lightly and responded in a pamphlet titled *Vindiciae quarundam delineationum anatomicarum contra ineptas animadversiones Fred: Ruyschii.* The counter-response came almost immediately. The *Responsio ad Godefridi Bidloi libellum* argued that the *Vindiciae* had misrepresented Ruysch's original criticism of the *Anatomia humani corporis*.[11]

Some of Bidloo's arguments actually foreshadowed the ideas of Rau and Boerhaave. For instance, Bidloo found it problematic that Ruyschian preparations looked alive. Cadavers were dead and no art could bring them back to life. Although colored wax could make the cheeks of humans rosy again, the underlying structures were corrupted beyond repair. The reason for this should by now be familiar: injected cinnabar, scarlet and ceruse made blood vessels appear larger than

[10] On Bidloo's atlas, see Dumaitre, *La curieuse destinée*; Fournier, "De microscopische anatomie"; Herrlinger, "Bidloo's 'Anatomia'"; Vasbinder, *Govard Bidloo*. For biographical information, see Kooijmans, *De doodskunstenaar*, 95-97, 107-23 and 217-36; Krul, "Govard Bidloo." Bidloo's association with the Nil is documented in Dongelmans, *Nil*, 139-40. A source on Bidloo's early career is a letter about assisting the Six family in planning the purchase of a house for 13,000 guilders. Govard Bidloo to Joachim Oudaen, Amsterdam, May 9, 1676, Amsterdam University Library.

[11] Cf. Knoeff, "Over 'het kunstige'." For the pamphlets, see Ruysch, *Alle de werken;* Bidloo, *Vindiciae.*

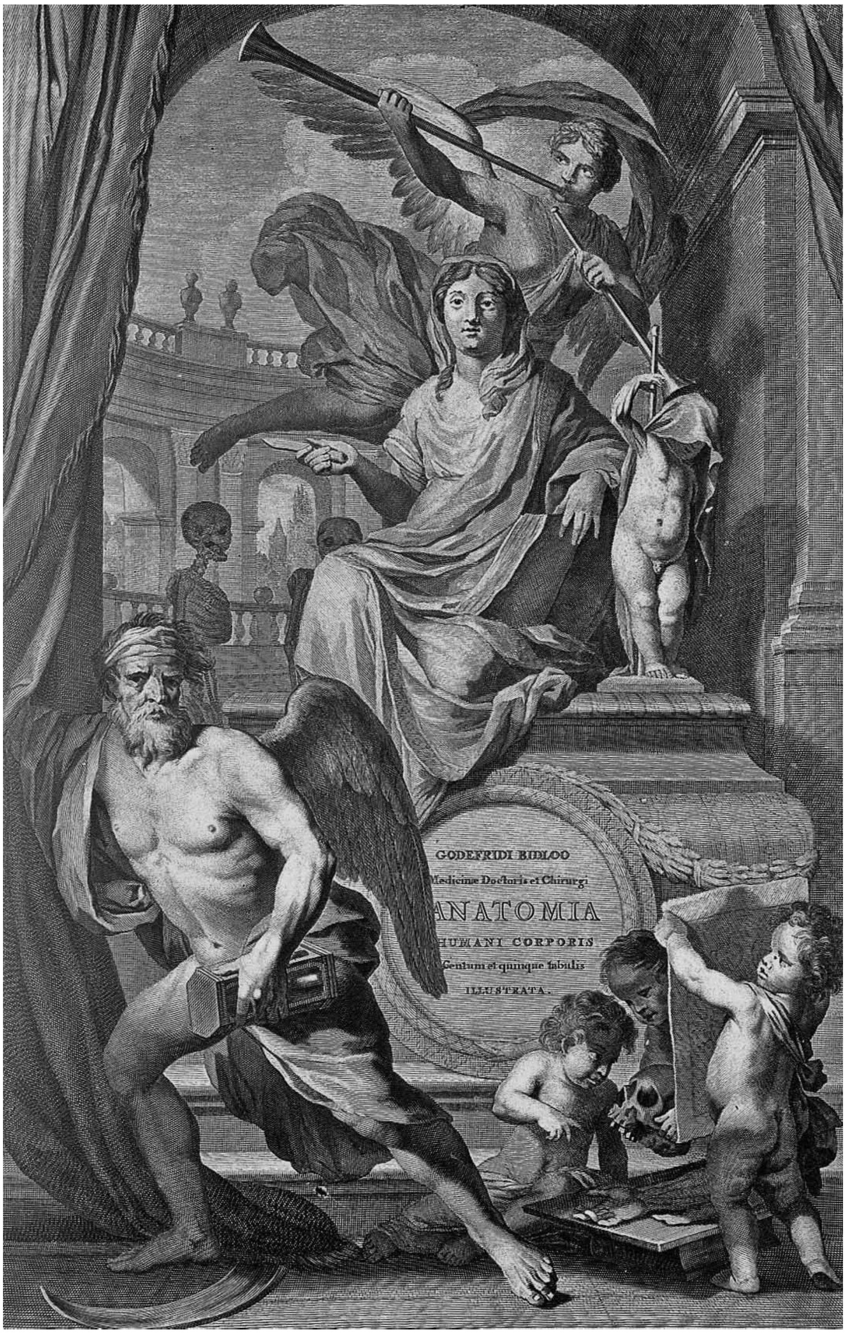

Figure 2. Bidloo, Anatomia, frontispiece. ©The Wellcome Collection. Note how the putto on the right holds up a print, presumably an anatomical representation.

life. The *mimesis* of preparations was no scientific proof but only a "meretricious art" to entertain the masses.[12]

Yet the criticism of the *Vindiciae* went beyond standard quibbles over distending the vascular system. At stake was the tangled representational relationship between cadavers and animate organisms. For Bidloo, no simple correspondence could be established between the two because the organs of the living body were in motion. External and internal pressure constantly changed the shape of the heart, the lungs and the skin. Since anatomical preparations, in contrast, were static and rigid, they could not represent temporal change. The preservation of the heart was especially problematic in this respect. In life, the four chambers regularly contract in a well-determined rhythm. Wax injections, on the other hand, filled, distended and froze the chambers in the state of diastole. The function of the heart was rendered incomprehensible through the art of preparations. Observers would not be able to understand the principles of the circulation system.

The rigidity of anatomical preparations was both a philosophical and a physiological problem for Bidloo who considered variety and change key constituents of human nature. In 1685, the same year the *Anatomia humani corporis* appeared, he ridiculed the *Nil volentibus arduum* because of its adherence to the artificial and rigid rules of Francophile playwrights. His satire pleaded for a more relaxed interpretation of classicist poetics. Similarly, if a preparation was preserved and kept in the same shape for centuries, it could not properly mirror the changing world of life.

The *Vindiciae* consequently charged Ruysch of too rigid an understanding of the shape of *papillary glands* in the human skin. Bidloo claimed that these glands had "the shape of a pyramid with a round base," i.e. a cone, which Ruysch heavily disagreed with. Bidloo mistakenly thought that the debate hinged on the definition of *pyramidal.* According to him, Ruysch understood *pyramidal* in a strictly mathematical sense and expected the glands to conform exactly to this well-defined shape. Ruyschian representations of their *foramina,* i.e. the openings at the cone's base, created the impression that these glands were similar to marble, i.e. rigid, inflexible and immobile.

[12] "Affectata tamen et nova, scilicet, haec condiendi cadavera methodus vulgo atque huic et illi idiotae medicastro placuit: sed, Catone judice, *quidquid vulgo placet, vel solum ideo omni suspicione dignum, etiamsi quoddam virtutis specimen prae se ferre videatur.* Sed ineptus sim, et arti Anatomes dirus, si dissimilem atque praelectorem Ruyschium non agnoscam *laboriosum, indefessum, die ac nocte rebus intentum anatomicus maxime,* intellige, fucandis, adulterandis minio, cocco, cerussa et quavis *arte meretricia* exornandis: hisce, fateor, se supra *communem anatomicorum* famam et sortem extulis altissime." Bidloo, *Vindiciae*, 14-15.

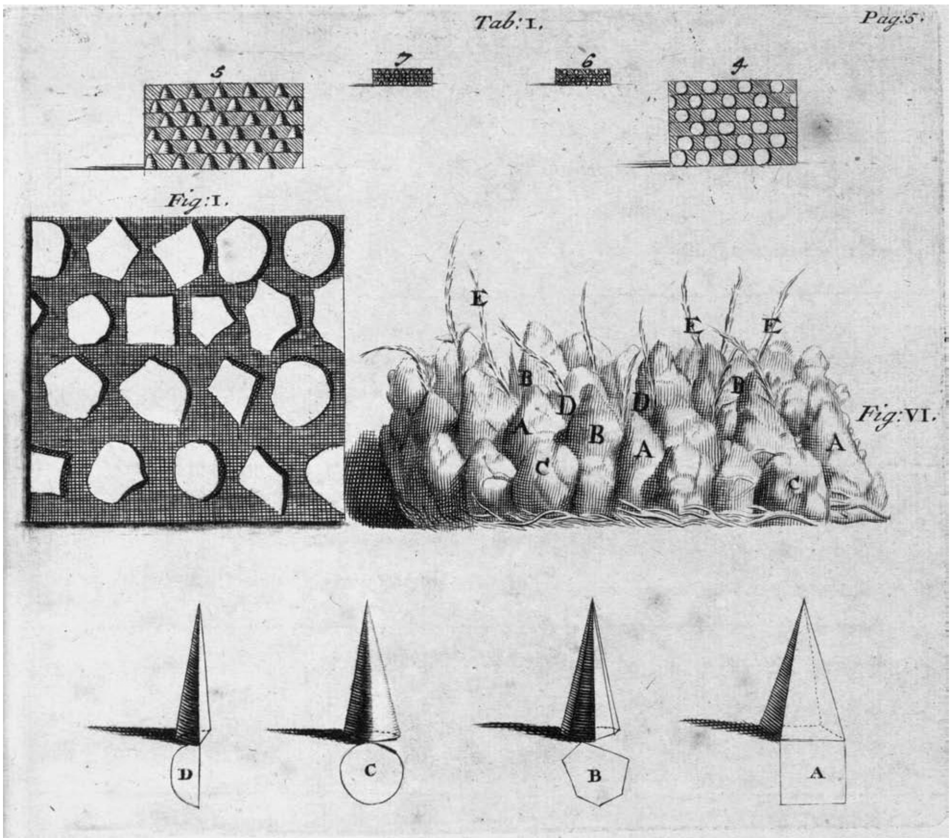

Figure 3. The papillary glands. Bidloo, Vindiciae, 5. ©Francis A. Countway Library of Medicine.

As for himself, Bidloo wrote that "it was never my opinion that these nervous-glandlike organs were mathematically pyramidal, but only comparatively." The varied shapes of the *papillae* more or less approximated the shape of a cone. Nonetheless, each *papilla* and its opening had a slightly different form that could also change in time as a result of motion, disposition, external pressure and flaccidity. Consequently, Bidloo preferred to depict a large number of *papillae* next to each other in a highly particularistic manner so as to show variability (Figure 3, Fig. I and VI, contrast to Ruysch's depiction on Fig. IV]. Figure VI could be interpreted as a particularistic representation of neighboring *papillae* whose shapes were subtly different. Figure I offered a diagrammatic cross-section of the openings at the bottom that again accentuated the variability of their forms. Yet I argue that this figure could also be read in another way. It could be interpreted as a cinematic representation of how one opening changed its shape with the passage of time. As the human skin was pressed and twisted, the opening grew, shrank and shifted in succession. Bidloo offered a rational explanation why these organs were so fickle. If the *papillae* could not change their form, the sense of touch would not have been able to differentiate between the perception of various materials that brushed against the skin.[13]

As it happens, Bidloo misunderstood the debate. Ruysch's main problem was not with the definition of *pyramidal*, but with the definition of papillary glands. He considered *papillae* and glands two separate organs. For him, *papillae* were pyramidal but glands had a globular shape. Definitions were of little importance when two separate organs were conflated into one. Yet Bidloo's misunderstanding is productive in that it highlights his opinion on the visualizing power of preparations and paper. He surmised that Ruysch's preparations and epistemology were connected. Since the preparations could not change their shapes, their maker also had to imagine the body's organs to be rigid. The surface of paper, in contrast, allowed Bidloo to set things in motion. He could represent changes to the shape of a *papilla* in a chronological order. Atlas images reflected the variability of nature better than three-dimensional specimens.

Paper had another advantage. It could accommodate different methods of visualization on the same page and provide the reader with the composite result. In table XXII of his *Anatomia humani corporis*, Bidloo provided a large number of competing representations of the heart, each of which visualized and emphasized different aspects of the same organ (Figures 4 and 5). While Fig. 1 attempted to represent the heart as *it appeared to the eye,* this image could not show its building blocks and structure. In order to visualize the structure of the muscles, tendons

[13] "Ego hasce papillas pyramidales et subrotundas (vide Fig: 6.) delineavi, non quod vel clariss: Malpighi, vel mea unquam fuerit sententia (egregium vero Ruyschianae inscitiae exemplum) nerveo-glandosa haec corpora mathematice, sed comparative esse pyramidalia et subrotunda: quam crasse porro erraverit, rete subcuticulare foraminulis pertusum vere rotundis, ope microscopii (vide fig. IV) adauctaque duplo, eorum magnitudine (vide fig. VI) exhibens, patet, cum pro papillarum motu et dispositione, compressione, intumescentia, flacciditate et similibus corporis reticularis foraminum figura mutari debeat: ut proponitur, fig. nova. I. corneum autem corpus hoc, nec papillas demonstrabit hasce, ut credo, marmoreas; rigidae enim si extrarent, inflexiles et immobiles, eadem esset omnium allidentium contractandarumque materiarum sensibus perceptio; posse eas extendi, deprimi, vi externa; intumescere, flaccescere liquorum spirituumque copia, aut penuria atque ab vicinarum partium compressione, vel et inter sese, mutata quarundam figura, aliarum itidem ut et superficiem partis in qua sunt, nec non, consequenter, foramina, sive aperturas corporis reticularis cui inhaerent, figura quoque juxta papillarum circumscriptiones, debere mutari, nemo (Ruyschio excepto praelectore) inficias ibit." Bidloo, *Vindiciae*, 6-7. On early modern and modern cinematography, see Biagioli, *Galileo's Instruments*, 135-218; Cartwright, *Screening the Body.*

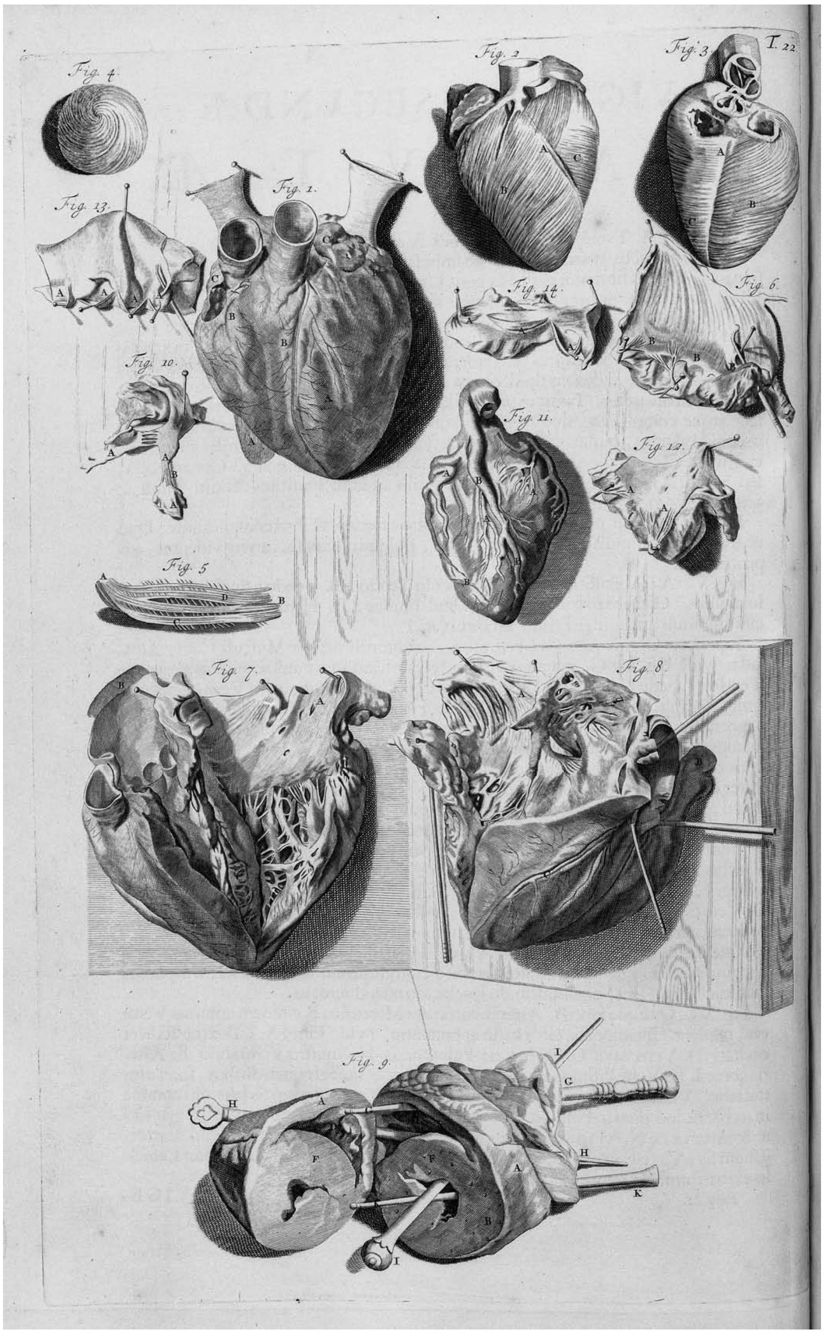

Figure 4. The heart according to Bidloo. Bidloo, Anatomia, Table XXII. ©The Wellcome Collection.

and their fibers, the heart needed to be boiled first. Figs. 2 and 3 thus showed the front and back of a boiled heart. Yet boiling was not the best method for the investigation of the ventricles. These chambers could be best seen with the help of desiccated specimens. Figs. 7 and 8 consequently depicted a dried heart from different perspectives to show the cavities. Fig. 9 then aimed to show the connections between the chambers of the heart. Bidloo inserted several quills into a desiccated heart that pierced through the barely visible valves. Thanks to these quills, the connections between the atria and the ventricles were adequately shown. Finally, Fig. 11 visualized the coronary arteries and veins on the surface of the heart with the injection of mercury and wax. While Fig. 11 offered a good picture of the elaborate structure of these vessels, it also emphasized the distortions of wax-injections when compared to Fig. 1 on its left.

Table XXII on the heart thus offered a functional theory of representation. There was no single method that could transparently depict all building blocks of the heart. The muscles, chambers, valves and blood vessels each required a specific mode of visualization. Table XXIII Fig. 15 on the infant circulatory system employed the same approach and emphasized that the art of wax injection was only one, imperfect method of representing the body. The blood vessels were shown in the state when they were filled with wax. Yet this representation was only approximate, as Bidloo admitted explicitly, because wax could not reach some blood vessels that were hidden in the muscles and around the bones. In order to highlight potential distortions, he even offered a detailed explanation how his method of wax-injection worked. This way, readers could judge for themselves how this method could produce artifacts.[14]

Bidloo's visualization of the heart and the blood vessels was therefore a direct attack on Ruysch. The response did not wait long. In his *Third Letter to Gaubius*, Ruysch argued that Bidloo did not correctly display the circulatory system on table XXIII. The heart's coronary arteries were especially problematic. Having read Bidloo's wax-injection method, Ruysch could only repeat that he and his son were the only anatomists who knew the true secret of preparation. Bidloo's arguments for the imperfections of preparations held true for his own specimens, which were truly awful, but not for Ruysch's specimens. It was no surprise that

[14] "Fig. XV. Referente Arteriae aortae, cera repletae, in corpore sex post partum mensium infantis (quam separatam reservo), praecipuas e trunco distributiones; Minores enim sub involucris, ossibus atque musculis reconditae, cultello persequi saepius non potui. Ex hac videre est quam diversimode interdum ejus propagines ducantur atque sint situatae. Lubet huic divaricationis descriptioni, modum, quo vasa haec impleantur, ut et quorundam curiositati satisfiat, praefigere." Bidloo, *Anatomia*, Tab XXIII Fig. 15.

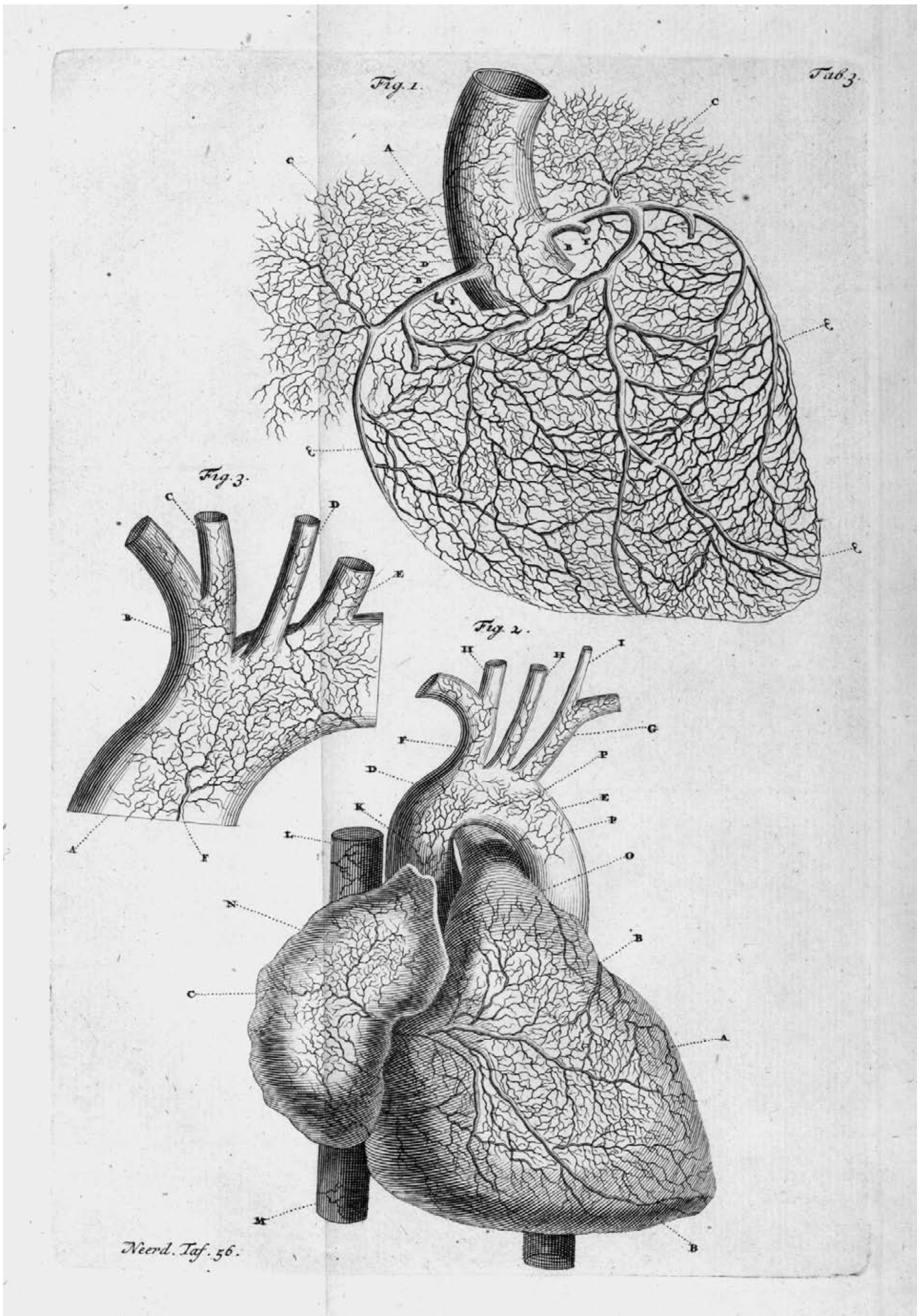

Figure 5. The heart according to Ruysch. Ruysch, Alle de werken. ©Francis A. Countway Library of Medicine.

Bidloo's anatomical museum was not open to the public. He must have been afraid that visitors would see how useless they were. In fact, some specimens in Bidloo's museum "were not [even] prepared by himself but acquired elsewhere." The doors of Ruysch's cabinet, in contrast, were always open to everybody.[15]

Bidloo's counter-response is especially interesting because his argument introduced a third reason for the superiority of paper over preparation. Wax-injection was an auto-inscription technique that blindly followed the arteries. Paper, in contrast, allowed for the intervention of reason in making a faithful representation. And only the dictates of reason could help correctly depict the coronary arteries. At first sight, Bidloo's claim might appear to conform to recent work on "paper epistemologies." Since Bruno Latour's classic article, many authors have claimed that paper is the best medium to simplify and standardize the chaos inherent in the outside world. The intervention of reason allows paper to control and represent nature in the form of abstracted diagrams. From a historical perspective, Lorraine Daston and Peter Galison have argued that enlightened anatomical atlases, in particular, retouched images of the body so that they could better accord with the idealism of mathematics and the Classics. Many of these analyses thus ally the use of paper and reason with an abstracted or idealized representation of nature. Bidloo's argument subverts this correlation. According to him, paper images' reliance on reason did not lead to abstraction. It served only to correctly depict chaotic nature in all its whimsical particularities.[16]

Bidloo's depiction of the coronary arteries on table XXIII might help disentangle his rather complex theoretical position (Figure 6, letter B). He claimed that the smaller branches of these arteries could be seen properly neither with a microscope nor with the help of a preparation. Yet reason postulated the existence of these branches because, together with the capillaries, they were needed to connect the arteries to the veins. How could one then visualize these barely visible structures? One option would have been to present an abstract diagram that showed a rough sketch of the coronary arteries' branchings without any claim to naturalism. Bidloo's solution was radically different. He offered a particularistic representation of the blood vessels with a plethora of idiosyncratic detail. For instance, the artery below the engraved letter B meandered downwards and then branched into

[15] "Indien zyn Cabinet voorzien, en verciert is met diergelyke doode lichamen van Jongelingen, over de twee Jaaren bewaart, waarom legt hy ze dan niet ten toon, gelyk ik gedaan hebbe in de voorlede honds-dagen?" Ruysch, *Alle de werken*, 252. "abunde enim scio, pleraque, quae in *Musaeo ejus pauperculo* inveniuntur non esse ab ipso praeparata, sed aliunde accersita." Ruysch, *Alle de werken*, 33.

[16] Latour, "Drawing Things Together"; Daston and Galison, "The Image"; Daston and Galison, *Objectivity*; Heesen, "News"; Klein, *Experiments*; Johnston, *Making Mathematical Practice.*

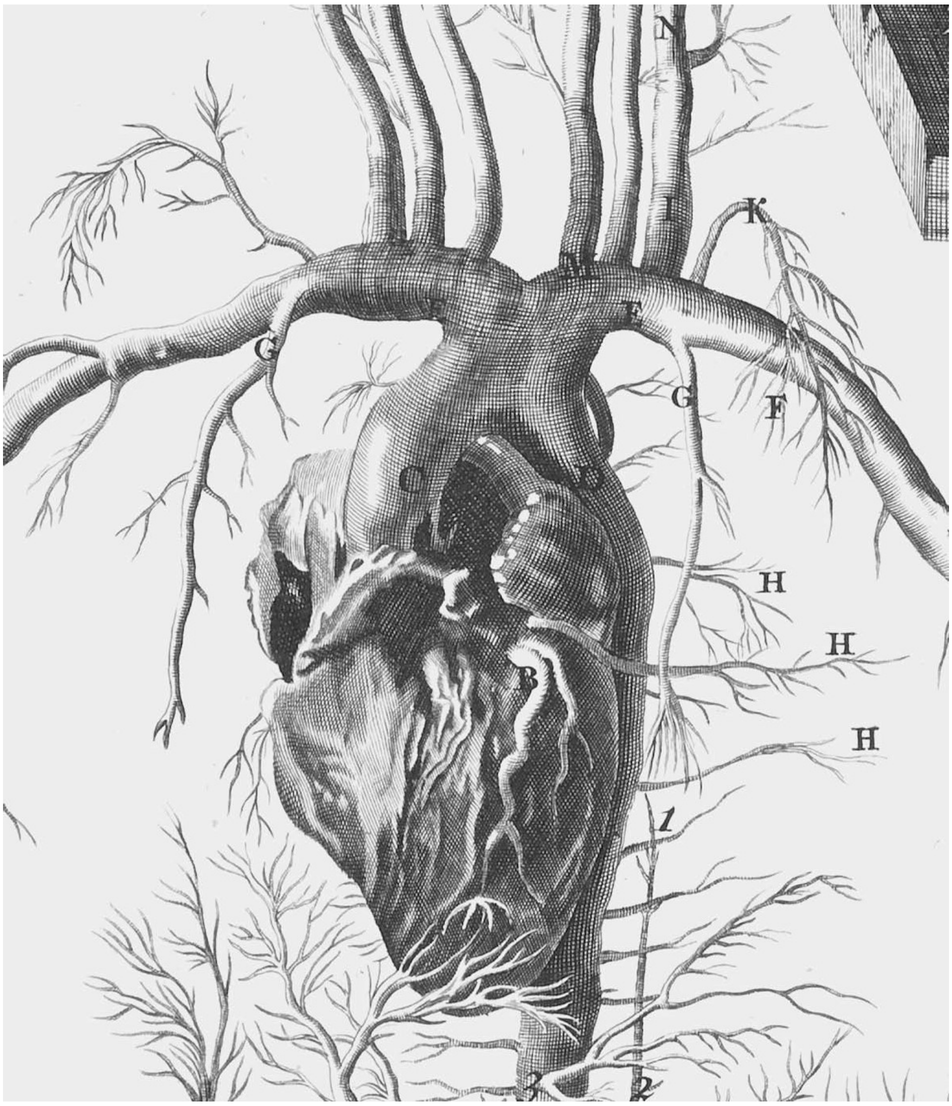

Figure 6. The aorta and the coronary arteries according to Bidloo. Bidloo, Anatomia, Table XXIII. Fig. 15. Fragment. ©The Wellcome Collection.

two. Of the two branched vessels, the right one disappeared inside the heart. The left one, in contrast, again branched into four smaller arteries. Reason on its own could not have vouchsafed for these details' necessary truth. Why did Bidloo depict four of these small, practically invisible arteries, and not three or five?

I would suggest that Bidloo's decision was based on the chaotic nature of the human body. At and beneath the microscopic level, the structure of the circulatory system continuously varied from person to person. Some coronary arteries meandered to the right, others to the left. In some people, certain arteries branched into four capillaries. In others, the same arteries branched into two, three or five. Because of this limitless variability, Bidloo's particularistic depiction of the arteries simply could not go wrong. Whether he depicted three or four smaller arteries, some people in a sufficiently large population must have featured a configuration that matched the representation. The law of large numbers ensured that at least a few people in the world had a coronary artery that meandered to the right, branched into two and then again into four. Unlike other Enlightenment atlases, Bidloo's *Anatomia humani corporis* did not represent an ideal or average human body. But, by all probability, it corresponded to at least one specimen among the millions of people. Bidloo dubbed this mode of naturalist depiction the "mind's eye" and exclaimed happily: "Is there anyone of sane mind, who does not gladly agree that it is possible to see the coronary arteries with *the mind's eyes* and to understand in what way they should spread out in the heart?"[17]

Bidloo expounded his theory of rationally naturalist representation when he discussed his illustration of the aorta's branchings on the very same table XXIII. Ruysch was very critical of this image and claimed that the positions of the branchings were incorrect. Bidloo's defense was eloquent. He first affirmed that variability was essential to these structures, and wrote that "nature often plays with the origins of the bronchial artery." The aorta of many humans might have branched in accordance with Ruysch's observations. Yet the continuous variability of nature also ensured that other people's circulatory systems conformed to Bidloo's illustrations. Bidloo's representation might not have been typical but it referred to an extant configuration nonetheless. His image of the aorta's branching actually relied on the dissection of a cadaver. Yet the same laws of fickleness could represent the coronary arteries without recourse to visual evidence. Variability ensured that naturalism could be objective even in the absence of firsthand observation. Refuting Ruysch's qualms about the potential fictional quality of printed images, Bidloo argued that the illustrator's hand could never lie because imaginative nature would always produce at least one corresponding original.[18]

[17] "Posse *mentis oculis videri,* concipi, quomodo arteriae coronales divaricari debeant in corde, quis mente non carens, lubens non annuit?" Bidloo, *Vindiciae*, 19.

[18] "Ipsi Epist 2 pag 10 *arteriae mammariae interiores bis inordinata ramificatione, inordinato,* credo ipsum velle insolito, irregulari, *cursu distribuuntur.* Quo jure negat, in aorta ejusque divaricatione, ab me observatum? *placet,* enim, ut ipse ait, *naturae aliquando varietate frui.* Epist. sexta. pag. 11. *ludit,* ipsi, *natura saepius circa arteriae bronchialis exortum*, sed vasis, mihi delineandis, ludere non licet, hisce more solito, modeste, incedendum est: sed monente Seneca,

Bidloo's argument of the mind's eye offers an alternative to the representational regimes that Daston and Galison have posited for scientific atlases. Daston and Galison differentiate between truth-to-nature and mechanical objectivity, both of which impose a regime of regularity on the observer. Mechanical objectivity relies on an automated, trustworthy representational technique that works by eliminating human intervention. Enlightened, truth-to-nature objectivity, in turn, can function only because the scientist's desire for rational order creates an archetypal, characteristic or abstracted image of nature. In contrast, Bidloo accepted that fickle nature obeyed no rules, within certain limits. As a result, he suggested that the draughtsman should have a relatively free choice in representing the aorta's branchings or the coronary arteries. The artist's hand only imitated nature's own whim. Judgment was supplemented by creativity.

To sum up, Bidloo's visual epistemology and stance towards preparations were therefore based on three fundamental points. First, anatomical preparations could not capture the temporal, sequential changes that the organs of the human body underwent. Secondly, anatomical preparations offered only one, and moreover distorted, image of the human body, and not a transparent representation. Thirdly, anatomical preparations had a low power of resolution whereas the technique of the *mind's eye* could offer particular representations of microscopic organs inferred with the help of reason. Anatomical preparations were therefore only of limited use for Bidloo's anatomical research. Ruysch's museum turned into a "Ruyschian cemetery" where distastefully decorated dead bodies were paraded as true representations.[19]

The debate between Bidloo and Ruysch is thus an important step towards understanding how an anatomist could turn towards a functionalist interpretation of images. Bidloo did not simply break with the tradition of Ruyschian preparations, but also disposed of the idea of transparent representation. For him, no single image could present a faithful image of an organ in the human body. Anatomists first had to decide what they wanted to learn about a particular organ and only then could they choose a proper way of imaging the body. Paper's great advantage was to allow for the juxtaposition of various modes of representation within the borders of a single page. Instead of establishing a world-class museum, Bidloo therefore decided to publish a luxurious atlas.

ignorat naturae potentiam, qui illi non putat aliquando licere, nisi quod saepius facit." Bidloo, *Vindiciae*, 16. For the concept of typical, see Daston and Galison, "The Image," 87-88.

19 Bidloo never criticized Ruysch's museum catalogues because "catalogum enim Rariorum, observationibus annexum, non tango, ne Ruyschiana *coemeteria*, violare profanus dicar." Bidloo, *Vindiciae*, 60.

The Material Value of Anatomical Preparations

Both Ruysch and Bidloo used their anatomical research to further their own careers. Ruysch received aristocratic guests in his anatomical museum, used his specimens in private lessons and, at a later stage in his life, decided to sell the collection *in toto*. Bidloo, on the other hand, used his anatomical atlas to gain the patronage of William III, who later secured him a professorship in Leiden. Consequently, the two anatomists' debates on the use of preparations also played out on a material level. Their epistemological standpoints corresponded well with the size, value and circulation patterns of their collections of their specimens. Ruysch's anatomical museum was the most important repository of anatomical curiosities in the Netherlands, whereas Bidloo's collection was insignificant even when compared with lesser-known cabinets of the period.

The Ruyschian museum was a major financial enterprise, and its sale elevated Ruysch into the highest echelons of Amsterdam society. His first anatomical collection, which also included some animal and plant specimens, was sold to czar Peter the Great in 1717. Ruysch received 30,000 guilders for roughly two thousand specimens, and an additional 5,000 guilders for divulging his secret method of wax injection. Soon thereafter, he started a new cabinet. Ruysch's ultimate aim was to sell this second collection as well. In December 1730 he authorized his grandson Juriaan Pool to begin inquiries about potential customers. Ruysch specified that the museum could not be sold for less than 22,000 guilders. Unfortunately, he died the following year and left behind 1,300 specimens that were auctioned off soon afterwards. This data suggests that Ruysch's preparations were rather expensive. In 1717, a single specimen cost 15 guilders on average. Based on Ruysch's estimation from 1730, his preparations were worth roughly 16 guilders a piece, the equivalent of an expensive, illustrated folio encyclopedia.[20]

While these two data sets only offer bulk estimates of the value of the collections, some information is also available on the financial value of individual preparations. The collection of pharmacist Albertus Seba, a friend of Ruysch, was put on auction in 1752. Seba owned 73 Ruyschian preparations, which included animal and plant specimens and went for more than 560 guilders (Table 1). Two decades after the maker's death, the price of anatomical curiosities went down slightly. Wet preparations fetched roughly 10 guilders on average, whereas dry specimens were worth slightly over 4 guilders per lot. Despite the drop, these

[20] On the first sale, see Driessen, *De kunstkamera*. On the authorization of Pool, see GA Amsterdam 5075, Notarial Archives, Inv. 7648 Abraham Tzeewen, Act 981, December 28, 1730. For the second catalogue, see Ruysch, *Catalogus*.

prices were still quite high. At the same auction, Seba's *exotica* were less valuable than even the dry preparations. Pickled snakes and birds cost almost 1.5 guilders on average. Preparations of fish were sold for just below 2 guilders, while exotic insects could be purchased for 5 guilders per lot. Other animals were priced at roughly 4 guilders.[21]

Table 1. Sales Prices from the Auction of Albertus Seba's Collection in 1752. Source: Seba, Catalogus.

Type of Object	Total Price (Guilders)	Number of Lots	Average Price / Lot
Shells	12772.25	253	50.48
Corals	1682.5	72	23.37
Petrified specimens	418.5	39	10.73
Minerals	2236	484	4.62
Agates	1723	312	5.52
Fossils	71.5	20	3.58
Diverse Rarities	166	20	8.3
Animals	579.5	150	3.86
Ruyschian preparations	127.75	30	4.26
Ruyschian wet preparations	436.5	43	10.15
Exquisite cabinets	643.5	10	64.35
Insects	2433	487	5
Snakes	573	422	1.36
Wet bird specimens	75.75	51	1.49
Wet fish specimens	402	214	1.88
Sum Total	24340.75	2607	9.34

Compared to Ruysch's specimens, the financial value of Bidloo's collection was negligible. It is possible that he initially attempted to shape his anatomical museum according to the Ruyschian model. In the 1670s, Bidloo's preparations were much praised by the pharmacist and poet Johannes Antonides van der Goes, a member of the *Nil volentibus arduum*. Van der Goes' poem described these specimens in the terms of the culture of curiosities, not unlike the way Ruysch praised his own preparations. The poem claimed that Bidloo's museum contained

21 Seba, *Catalogus*. The prices are noted in the copy at the University of Amsterdam Library.

"anatomical wonders, where art and nature competed" and this charming art "gave life to the dead themselves." Yet it also pointed towards the practical, research-oriented aspects of the museum. According to Van der Goes, Bidloo's cabinet contained dry, wax-injected preparations of the blood vessels, livers, lungs and reproductive organs. Wet specimens, embryos and complex body parts were not mentioned. Unlike Ruysch's universal collection, Bidloo's preparations probably served to visualize only the circulatory and the respiratory systems.[22]

While Van der Goes was quite adulatory of Bidloo's collection, other accounts offer a more qualified assessment. When Leiden University was about to purchase Bidloo's herbarium, the curators appointed a certain Dr. Cosson and the pharmacist Taurinus to evaluate the collection on offer. Cosson and Taurinus reported that both Bidloo's plants and the university's own herbaria were of mixed quality, and some specimens were in a deplorable condition. The integration of the two herbaria, however, would have resulted in a good collection. The university curators therefore decided to purchase Bidloo's plants to complement their own for the moderate amount of 250 guilders. Bidloo also possessed some exotic animals and presented the English collector and pharmacist James Petiver with a snake. Characteristically, he was the source of only one specimen. Petiver received more than a dozen *exotica* from Ruysch.[23]

Bidloo's anatomical museum also lacked a stable environment and visitors had limited access to it. In the 1700s, Bidloo did not even keep his cabinets at home, but deposited them at the anatomical theater of the university. The traveler John Farrington saw some of them during his visit to Leiden in 1710, and mistakenly claimed that the theater was "now made much more considerable by the large addition of Professor Bidloo's curiosities." Bidloo in fact did not donate his collection to the university but simply used the anatomical theater for the purposes of

22 "Hier streeft de konst natuur voorby / [. . .] / Maar Bidloo van een edel vier / Ontsteken, nen door lust gedreven, / Weerstaet dien trotschen vyant fier, / En schenkt den dooden zelfs het leven." Van der Goes, "Op de anatomische wonderheden."

23 "Den Professor Hotten refereert [. . .] dat hy [. . .] met de heer Doctor Cosson ende den apothecaris Taurinus nader onsersoek hadde gedaan van den toestant van het Cabinet van de heer Professor Bidloo, alsmede van 't Cabinet van de Universiteyt, staande in de gallerye van de Academischen tuyn, ende bevonden dat in 't een ende 't ander alle vegetable mettertijs was komen te vergaan, sijnde niets goed gebleven als de mineralen, gesteenten ende verruwstoffen; ende dat derhalven waeren te raiden geworden de H. C. ende B. te exhorteren tot 't combineren van de voors. Cabinetten, wanneer men met kleyne kosten een seer completen collectie soude kennen maeken." Molhuysen, *Bronnen*, IV, 135. For Bidloo's gift to Petiver, see Petiver, *Decades,* Table VI Fig. 5. For specimens from Ruysch, see Petiver, *Decades*, Table X Fig. 9, Table XII Fig. 9, Table XXIV Fig. 1; and Petiver, *Centuriae*, #118, 395, 396, 519, 604, 627, 651, 692.

storage. Gerard Blanken, the *custos anatomiae,* complained much about the fact that Bidloo did not keep an order among the preparations. Whenever he needed a particular specimen for the purposes of research or education, Bidloo took it out from the cabinet and did not necessarily return it to the same place afterwards. As a result, the servant could no longer ascertain which preparation belonged to Bidloo, and which one to the university. The professor was therefore ordered by the curators of the university to make a list of his own preparations and then move them back to his own house. He did not immediately comply with the request, and the curators had to remind him a year later. The collection functioned more as a research tool than a showcase of the art of preparation.[24]

The practical, hands-on approach to anatomical preparations was reflected in the financial value of Bidloo's collection. Since they were not privileged representations, these specimens did not need to be prepared with the same amount of care and attention that Ruysch devoted to them. They were not intended to last for centuries and could in principle be thrown away after use. As a result, Bidloo's anatomical collection consisted of only 131 preparations and, as mentioned before, was sold for 177 guilders and 8 stuivers. He also owned 149 wet specimens of animals worth 276 guilders 14 stuivers, 24 kidney stones at 18 guilders 15 stuivers, and 62 bones, skulls and skeletons at 117 guilders 9 stuivers. Altogether, these specimens were worth just over 590 guilders, still much less than Ruysch's collection.[25]

On average, Bidloo's anatomical preparations cost 1.35 guilders, significantly less than Ruyschian specimens. Apart from the size of the collection, the price difference was the result of two different factors. First, most of Bidloo's specimens were dry, which were (and still are) significantly less expensive to make than wet preparations. Expensive alcohol was a necessary ingredient for the preservative liquid. Ruysch's dry preparations were also worth only 40% of the price of wet

[24] On Farrington's visit, see Farrington, *An Account*, 11-12. On Blanken's complaint, see "Den Custos Anatomiae aen de heeren Curat: en Burgermeesteren hebbende bekent gemackt, dat den Professor Bidloo van intentie was om eenige kassen met rariteijten, dewelke hij voor heen opt Theatrum Anatomicum had doen brengen, wederom van daar te laten transporteren, versoekende hij Custos te mogen weeten hoe hijs sigh daar omtrent soude hebben te gedragen. Waar op gedelibereert sijnde en goedgevonden en verstaen, dat den gemelten heer Bidloo sal worden aengesegt, dat hij een Lyste sal overleveren van 't geene hij oordeelt aen hem toe te behooren, om 't selve gesien sijnde, nader te resolveren soo als men na redelijckheijt sal oordeelen te behoren." Leiden University Library AC1 29, Resolutien van de Curatoren en Burgermeesteren 1696-1711, March 24, 1710, f. 539. For the reminder, see Leiden University Library AC1 30, Res. Cur. 1711-1725, f. 65.

[25] For Bidloo's sales catalogue, see Bidloo, *Bibliotheca*. The prices are noted in a copy in St Petersburg, but not in the British Library. One guilder equals twenty stuivers.

specimens. Second, comparisons of similar items in the two collections suggest that the quality of Bidloo's preparations was inferior to Ruysch's.

For instance, a customer at Seba's sale purchased a lot that contained a "piece of a penis, artfully prepared" by Ruysch, a preparation of intestines, a book, and a mole skeleton for the sum of 23 guilders. In 1713, Bidloo's "most charming mole skeleton" was sold for 4 guilders 10 stuivers. Human intestines "decorated with wax and mercury and a corium humanum" were also available for 1 guilder 10 stuivers. A "penis siccatus" fetched 1 guilder and 2 stuivers together with "two testicles injected with mercury." As part of a separate lot, several "penes viriles et canini" were purchased for 14 stuivers, even though a dog's *baculum* was also added. Adding together Bidloo's mole skeleton, intestines and penis, the total amount is 7 guilders 2 stuivers, and it also includes an extra *corium humanum* and the two testicles. Discounting the additional book on Seba's sale, Ruysch's specimens were still worth three times as much as Bidloo's.

Preparations of foetuses offer another opportunity for a comparison. At Seba's auction, four Ruyschian foetuses were on sale. Three were worth roughly 12-13 guilders. A fourth one, probably in worse condition, sold for only 7 guilders. In comparison, Bidloo's best foetus was worth 8 guilders. Another one sold for 6 guilders, and three specimens fetched only 2 guilders. These numbers suggest again that Bidloo's preparations were worth ⅓ of the price of comparable Ruyschian specimens. In sum, Bidloo's museum contained only a few specimens, most of which were dry and of low quality.

The Collections of Lambert Ten Kate, Abraham van Limburg and Johannes Rau

Looking at a few other sales, it appears that Ruysch's creations were more expensive than average anatomical preparations (Table 2). His name functioned as a valuable brand. As we have seen, Seba's auctioneers deemed it important to specify Ruysch as the maker of the preparations. At the post-mortem auction of wheat merchant and educational pioneer Lambert ten Kate, the makers of most specimens were not mentioned. The only exceptions were the ivory models of the auditory organs "from the Cabinet of Professor Ruysch" and a "book of Professor Ruysch" that contained prepared specimens of plants. Ruysch's preparations were therefore branded like Fahrenheit thermometers or Hartsoeker microscopes. Ruysch's art was also imitated by other anatomists. The collection of the Amsterdam physician Abraham van Limburg was sold in 1720. The sales catalogue claimed that Limburg's specimens were done according to Ruysch's method. Nonetheless, Limburg's preparations were much cheaper than the originals. Out of the forty specimens on offer, 33 were sold in the end. They fetched 2.77 guilders on average, still twice as much as the 1.35 guilders for Bidloo.[26]

Table 2. Summary Financial Data on Select Anatomical Collections in the Netherlands.

Anatomist	Total Price (Guilders)	Number of Lots	Average Price / Lot
Ruysch (1717 est'd)	30000	2000	15
Ruysch (1732 est'd)	22000	1300	16.92
Ruysch Wet Specimens in Seba's Collection	436.1	43	10.15
Ruysch Dry Specimens in Seba's Collection	127.73	30	4.26
Bidloo (anatomical preparations)	177.4	131	1.35
Bidloo (wet animal specimens)	276.7	149	1.86
Bidloo (kidney stones)	18.75	24	0.78
Bidloo (bones, skeletons)	117.45	62	1.89
Limburg	91.4	33	2.77
Rau	Donation	471	N/A

My last example shows that the anatomical collections of Ruysch's other critics were also considerably smaller and less valuable than the Ruyschian museum. Johannes Rau's museum contained 476 specimens at his death, which were stored in one small and two large cabinets. Like Bidloo's, this collection was not designed for the entertainment of visitors, either. When the German traveler Baron Zacharias Conrad von Uffenbach visited, he wrote in his diary that Rau's collection was "not for decoration, but for use." Uffenbach also complained that several bottles of wet specimens were only partially filled with alcohol, conjecturing that the anatomist wanted to save on the expensive liquid.[27]

[26] For Ruysch's specimens, see "'t Gestel van 't oor en de gehoor-deelen van yvoir, uit het Cabinet van den Heer Professor Ruysch" and "Een Boekje van den Heer Professor Ruysch; waerin 17 Sceletons van Bladen etc." Ten Kate, *Catalogus*, 88 and 96. On Limburg's collection, see Limburg, *Musaeum*.

[27] "Er haette seine Sachen nicht zum Zierrath, sondern zum Gebrauch." Uffenbach, *Merkwürdige Reise*, III, 622.

Although larger than Bidloo's cabinet, Rau's collection still lagged behind the Ruyschian enterprise. Upon his death, Rau donated it to Leiden University without specifying its financial worth. Leiden's reaction suggests that the preparations had limited value. When the university curators appointed Bernhard Siegfried Albinus to make a catalogue of the collection, he was ordered to throw away worthless duplicates and triplicates. According to the catalogue, most specimens directly related to Rau's anatomical work on the bones, the eyes and the testicles. More than 20% of the collection consisted of skulls: 52 skulls of adults, children and foetuses, 42 skulls of aborted foetuses, and 9 fragments. Another 10% of the collection, or 52 bottles, contained parts of a complete set of the auditory bones. 16 bottles of adult teeth, 38 eyes or eye parts and 33 preserved testicles were also listed. In contrast, the catalogue did not mention any wet preparations of embryos, or larger parts of the human body. Instead of offering a transparent representation of the body, Rau's specimens served his particular research interests.[28]

Some of Rau's preparations are still extant today at the Leiden University Medical Center's Anatomical Museum. Most of the specimens are exquisitely preserved bones, but their arrangement does not facilitate careful observation. Several bottles hold so many bones that they occlude each other. The largest and most impressive specimen is a wax-injected placenta. In comparison with Ruysch's specimens, this exhibit certainly appears less impressive. Unfortunately, the wax has escaped from the blood vessels at several points and has flooded and dyed large parts of the placenta, making its fine qualities indistinct.

Bidloo's Books

The epistemological debate between Ruysch and Bidloo was related to the monetary value of their anatomical collections. Similarly, Bidloo's preference for books over preparations was also expressed in financial terms. He was both an avid book collector and a prolific author whose output ranged from occasional pamphlets to luxury atlases. His library contained over 1800 items that were worth almost 2900 guilders (Table 3). Although cheaper than Ruysch's cabinets, the library was nonetheless ten times as expensive as Bidloo's preparations. The folio volumes on medicine, or on natural history, on their own brought in more money than all the anatomical specimens. An average folio volume was worth more than a preparation. Compare the prices of 5.07 guilders for works of anatomy, 4.38 for natural history, and 5.4 guilders for the Classics to 1.35 guilders for an average specimen.

[28] Albinus, *Index*.

Table 3. Summary Financial Data on Bidloo's Library. Bidloo, Bibliotheca.

Book Type	Total Price (Guilders)	Number of Lots	Average Price / Lot
Anatomy Folio (F)	218.05	43	5.07
Medicine F	208.1	67	3.1
Natural History F	249.8	57	4.38
Philosophy and Maths F	72.15	24	3.01
Greek and Latin F	232	43	5.4
Misc F	613.85	86	7.14
Folio Subtotal	1593.95	320	5.14
Anatomy Quarto (Q)	111.8	74	1.51
Medicine Q	221.5	174	1.27
Natural History Q	70.95	28	2.53
Philosophy and Maths Q	86.45	66	1.31
Greek and Latin Q	69.95	30	2.33
Misc Q	129.45	135	0.96
Quarto Subtotal	690.1	507	1.36
Anatomy Octavo (8)	86.7	104	0.83
Medicine 8	93.8	225	0.42
Natural History 8	64.55	55	1.17
Philosophy and Maths 8	21	50	0.42
Greek and Latin 8	77	67	1.15
Misc 8	207.6	212	0.98
Octavo Subtotal	550.65	71	3 0.77
Duodecimo Subtotal	46.7	257	0.18
Prohibited Subtotal	4.7	7	0.67
Total	2886.1	1804	1.6

Bidloo's commitment to the culture of print is shown even more clearly in his career as an author. He aimed to corner with his publications the same high-end market that Ruysch dominated in the field of preparations. His *Anatomia humani corporis* was arguably the first major anatomical atlas published since Andreas Vesalius. Bidloo claimed to have dissected almost 200 bodies during the preparations for the atlas. The images were drawn by Lairesse and then cut by Abraham Blooteling, one of the leading engravers of Amsterdam. An anecdote about Bidloo's intended readers might enlighten the social stakes involved in the printing of the *Anatomia*. King William III dislocated his shoulder during a fall from a horse in 1702, an accident that contributed to his death a few weeks later. Upon hearing about this event, Bidloo rushed to the King, holding the *Anatomia humani corporis* in one hand and a skeleton in the other, in order to explain what exactly happened during the fall.[29]

The price of the volume was considerable. It cost roughly 30 guilders and was one of the most expensive one-volume, illustrated encyclopedias in contemporary Europe. At the auction of Bidloo's library, the English translation of the *Anatomia* sold for 27 guilders, higher than any other book. It was also among the most expensive works sent to English bookseller Samuel Smith by his European correspondents.[30]

The atlas' publication process was a serious financial enterprise, financed by four different publishers including Hendrick Boom. Although it is not known whether it brought in a large profit, the appearance of translations in several languages hints that printers in other countries also considered it a potentially good investment. The original publishers came out with a Dutch translation in 1689. London booksellers Samuel Smith and Benjamin Walford contracted with Boom in 1695 to publish an English version of the atlas. They ordered three hundred copies of the illustrations from Boom and hired English surgeon William Cowper for the translation. For the English translation, this number was an impressive print run, given that it was supposed to circulate almost exclusively on the British Isles. Importantly, Boom had to print new impressions off the original plates, which suggests that the transaction did not simply serve to dispose of remainders from the Latin and Dutch editions. Cowper added nine extra plates, emended the text and published it as his own work, literally scraping off the name of Bidloo from the title page.[31]

Bidloo and his publisher were understandably enraged. Significantly, Boom was more concerned about the loss of potential profit than about the omission of the author's name. He was worried that Cowper's corrected edition with its extra illustrations would dominate the European market. A simple English translation would not have sold well on the Continent, but a second edition could easily lower the value of the original version. A pamphlet war erupted and Bidloo asked the Royal Society to condemn Cowper. The Royal Society refused to do so and it is

29 Ronjat, *Lettre*, 23.
30 Hoftijzer, *Engelse boekverkopers*.
31 For details of the publication contract, see Van Eeghen, *De Amsterdamse boekhandel*, IV, 129-131.

not known how the sales of the original version were affected. A few years later, a Russian edition was also planned and a manuscript translation was executed for Peter the Great. Finally, a new Latin edition was published in 1735.[32]

Bidloo's *Anatomia* was clearly successful among the contemporary public. Its illustrations were copied in the second edition of Stephanus Blankaart's *Anatomia reformata*, an affordable textbook that discussed anatomical topics in 700 pages and sold for around 14 stuivers. The *Anatomia reformata* was well-known enough even in the farthest corners of Europe that the Transylvanian physician Ferenc Pápai Páriz decided to order it in the 1690s. Importantly, Bidloo did not start a copyright debate with Blankaart. The octavo edition was not a financial competitor for the original folio, but helped spread the author's fame among medical students. Two of the images were also included in the Italian physician Bernardino Genga's *Anatomia* in 1691.[33]

Bidloo's paper representations thus circulated widely in contemporary Europe in various authorized and unauthorized formats. Expensive atlases could travel, be pirated, and serve as the source of *gesunkenes Kulturgut*. Bidloo's cheap and disposable preparations were used instead locally. Looking at the scientific half-life of Bidloo's works, the same pattern can be observed. While none of the preparations survive today, a simple web search reveals more than 100 copies of the *Anatomia humani corporis* in libraries all around the world.

Conclusion

The debate between Bidloo and Ruysch has served to illuminate how epistemological concerns can determine what scientific objects turn into consumer goods that circulate commercially. Although the two anatomists differed on almost any topic, they both agreed that one needed to produce expensive curiosities to become a successful anatomist with a respected social status. They also concurred that not all products of anatomical research would have a significant financial value. Yet

32 Boom said that "Ik meene ook dat u E. wel kunt afneemen dat het ons omtrent het verkoopen van onze Anatomie niet min schaadelijk zijn zal. Wy hebben een tijd lang niet kunnen bevatten, wat'er van geweest zy, als ons nu 't elkens voorquam, dat'er in Engeland een nieuwe, en beeter werd gedrukt, als de onze is: maar nu werden wy daar in verlicht: indien wy dit hadden gedacht, dat u. E. op deze wijze daar mede zoude gehandeld hebben, wy kunnen u. E. wel verzeekeren, dat u E. noit figuren van ons zoude gehad hebben": Bidloo, *Gulielmus Cowper*, 8. On the Royal Society's response, see Robert Southwell to Govard Bidloo, n.d., Wellcome MS 7671/5.

33 Blankaart, *Anatomia*; Pápai Páriz, *Pax*; Genga, *Anatomia*. For the price of Blankaart's book, see Bidloo, *Bibliotheca*, 50.

they vehemently disagreed on what objects had a potential to become lucrative commodities in the booming markets of contemporary Europe.[34]

Studies on the transmission of knowledge and material objects have already explored how information and objects need to be made durable to enter global systems of exchange. Marc Ratcliff, for instance, has argued that Abraham Trembley's strategy of generosity hinged on his ability to keep microscopic specimens alive when sent from The Hague to Paris. Harold Cook has argued, in turn, that techniques of preparation were originally designed to ensure that commodities would withhold the ravages of time. In similar ways, durable preparations allowed Ruysch to become a successful scientific entrepreneur in the long-distance markets of *naturalia*.[35]

Yet, as Bidloo argued, the art of preservation might also be interpreted as the objectification of human life. Anatomical preparations could not capture the variability of nature. They were rigid and static and could not simulate temporal change. Paper, in contrast, was flexible. It also allowed for the juxtaposition of multiple representational techniques. Wax-injected, desiccated and boiled hearts could be displayed on the same page. Moreover, the variability of nature allowed paper to visualize the particular details of the circulatory system, whose existence was only inferred by reason. Therefore, Bidloo did not subscribe to the abstracting and idealizing tendencies of other enlightened atlases and opposed the mechanical objectivity of anatomical preparations. Instead of relying on learned judgment, he embraced the naturalism of the *mental eye.* When nature itself was fickle, the creative imagination of the draughtsmen was unable to lie.

Consequently, Bidloo's preparations failed to become luxurious goods that would circulate commercially. They functioned well only within the walls of the laboratory, where they served as disposable tools in the production of more trustworthy paper atlases. Outside the private research of the anatomist, Bidloo's preparations had little epistemological and financial value. The larger public could not trust them as faithful representations of the body, and would not consider them as worthy investments. Bidloo's museum was not visited by aristocrats and did not elevate his social status. He instead invested in the publishing business to produce valuable and curious scientific atlases.[36]

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34 On commodification, and the circulation of scientific objects in various systems of exchange, see Anderson, "Kuru"; Biagioli, *Galileo, Courtier*; Appadurai, *The Social Life*.

35 Cook, "Time's Bodies"; Ratcliff, "Abraham Trembley's"; Margócsy, "Advertising Cadavers."

36 On the history of cabinets of curiosities, see Findlen, *Possessing Nature*; Daston and Park, *Wonders*; Bergvelt and Kistemaker, *De wereld*; Impey and Macgregor, *The Origins*; Cook, *Matters*; Pomian, *Collectors*; Schnapper, *Collections*.

One can thus observe a dialectical relationship between paper and preparation. For Ruysch, anatomical preparations had both an epistemological and financial primacy. They were prized curiosities for collectors in England, in the Netherlands, in Germany and in Russia. They promised transparent representation for centuries and around a thousand of these preparations indeed survive to this day in St Petersburg. Ruysch's publications served primarily to advertise his preparations and had no epistemic function on their own. For Bidloo, in contrast, preparations were cheap, disposable tools used locally in the process of making expensive atlases. It was the publication of *Anatomia humani corporis* that spread his fame in the Netherlands, in England, in Russia, and the rest of Europe. While none of his preparations survive, the illustrations of the *Anatomia* are still popular.[*]

[*] Research for this chapter has been funded by the New York Academy of Sciences Klemperer fellowship, the Harvard Committee on Graduate Studies Sheldon Traveling Fellowship, the Minda de Gunzburg Center for European Studies Traveling Fellowship, the Social Science Research Council International Dissertation Research Fellowship and the NSF (SES-0621009). The author would like to thank Mario Biagioli, Ann Blair, Katharine Park, Benjamin Schmidt, Harm Beukers, Stephen Johnston, Mihály Köllő, Márk Somos, Matthew Underwood and Hugo van der Velden.

Conflicting Pictures: Illustrating Descartes' *Traité de l'homme*

Claus Zittel

Introduction

The circulation and, consequently, the historical impact of scientific ideas do not derive solely from linguistic sources. Frequently the generation and communication of knowledge takes place by means of instruments, samples, and collectables. A central role in the dissemination and reception of a scientific work is played by images. However, images are also capable of both contradicting the texts in which they occur and of obtaining a great degree of independence from them, to the extent that a text may be primarily received through its images. Vesalius' *De fabrica humanis corporis* is a prominent example of such an independent reception, as its plates were often republished separately without the accompanying text. This implies, however, that even in cases where images circulate together with a text, the histories of their respective reception can split up and follow different tracks. Descartes' *Traité de l'homme* presents us with a revealing example of one such dual reception history.

In what follows, I shall attempt to show that the reductionist notion of man as a machine, which is always attributed to this treatise, is primarily an iconographic idea invented by post-Cartesians, who simplified and reinterpreted Descartes' text, and that this idea is developed and established far less by the actual words of the treatise than by the images, which were added later.

The *Traité de l'homme* was by far Descartes' most influential work until well into the eighteenth century. Its impact can be attributed primarily to two posthumous editions, which were both undertaken by physicians belonging to Descartes' circle of friends, both contained plentiful images and for several decades both vied for dominance until one finally triumphed. These two editions were: *Renatus Des Cartes de homine, figuris et latinitate donatus a Florentio Schuyl*, edited by Florentius Schuyl (Leiden: Franciscus Moyardus & Petrus Leffen, 1662); and

L'Homme de René Descartes et un Traité de la Formation du fœtus du mesme autheur, avec les remarques de Louys de La Forge, docteur en medecine, demeurant à La Fleche sur le Traité de l'homme de René Descartes et sur les figures par luy inventées, edited by Claude Clerselier (Paris: Charles Angot, 1664).[1]

Schuyl's – earlier – edition of *De L'homme* appeared thus in the Netherlands. But although the rivalling edition was first published in Paris, Clerselier, too, soon made a special effort to conquer the Dutch market. The third printing of his French edition as well as its Latin translation were both published in Amsterdam.[2] Apart from France, it was above all in the Netherlands, then, that the struggle for interpretive dominance of rival editions of a central early-modern scientific text took place. Commentaries on, and images accompanying, the text played a decisive role in this struggle: in fact, the titles of both editions specifically mentioned the images. Schuyl called attention to them at the beginning of this title, while La Forge's intentionally ambiguous wording left it open whether the images were his own or Descartes'. This clearly indicates the central role attributed to the images in disseminating knowledge not only by Descartes himself (through their description in the text), but by the Cartesians as well. Both Schuyl and Clerselier included exhaustive introductions and commentaries in their editions, whereby Clerselier – in contrast to later editors – also presented a detailed history of the origin and function of the images.[3]

These two editions represent an exciting opportunity for a systematic-historical examination of the text-image relationship in scientific works: two nearly contemporaneous projects offering pictorial supplementation to a classical text in the history of philosophy and science. A comparative analysis of these texts reveals in which respects they differ, what different perceptual and cognitive ideals they postulate, and how each of them relates to Descartes' text. In addition,

1 Further publications of Schuyl's edition are: *ibid.*, 1662; *ibid.* 1664 (Hack); Leiden/Amsterdam, 1672 (Gaesbaeck); Amsterdam, 1677 (Elzevier); Amsterdam, 1686 (Blaeu); Frankfurt, 1692, 1697 (Knoch). For general information on the reception of this work, see Dibon, "Der Cartesianismus," 349-74, 460-62; Verbeek, "Dutch Cartesian Philosophy," 167-82.

2 René Descartes, *Les Traitez de l'homme, et de la formation du foetus* (Amsterdam 1680). Clerselier subsequently translated his edition into Latin in order to correct Schuyl's edition and to render it completely superfluous: Renatus Descartes, *Tractatus de Homine, et de Formatione Foetus. Quorum prior Notis perpetuis Ludovici de La Forge* (Amsterdam, 1677). Further editions followed this one (ibid., 1686), and, among others, the text in the third volume of *Renati Des Cartes Opera philosophica omnia. In tres tomos distributa omnia haec recensita à Viro clarissimo denuo sunt revisa, & ab innumeris mendis, quibus priores editiones scatebant, repurgata, una cum notis quibusdam & animadversionibus tumultuariis in inuversum opus, huic edition recens adjectis* (Frankfurt, 1697).

3 Cf. Clerselier's "Preface," an excerpt of which is reprinted in Descartes, AT XI, XI-XXIV.

if, historically speaking, there existed a choice between alternative editions, why did one edition triumph over the other?

With respect to both editions, it must be stressed that, apart from two surviving rough sketches by Descartes, all images in the *Traité de l'homme* were fabricated posthumously and had therefore not been authorized by Descartes, in contrast to those accompanying the *Essays* (that is, the *Dioptrique, Météores, Géometrie*) or the *Principia*. Following Descartes' death, the original sketches for the *Traité* could no longer be located. And yet, the manuscript of the *Traité* referred continously to images that were supposed to make the written material plausible or clear, but which no longer existed. It thus became necessary to produce the intended images anew. For this reason, the so-called illustrations of Descartes' *Traité* must be approached with sceptical caution, and should certainly not be treated as if they had been supplied by Descartes, constituting an authentic visual representations of his scientific concepts.[4]

Such a nonchalant attribution has grave implications for the interpretation of Descartes' thought. For example, Descartes is persistently accused of having described humans as machines in his medical treatises, in so doing of having laid the highly influential groundwork for a purely mechanistic view of the human body.[5] He is said to have conceived the notion of a body-machine as an alternative model to the living organism, and thus to have paved the way for the view that nature can be completely dominated. Referring to this type of machine metaphor, the historiography of philosophy and science has come to embrace the notion of a "mechanical philosophy" so as to describe a specific seventeenth-century type of reductionist and mathematically-oriented style of scientific thinking.[6] However, since Descartes' idea of viewing organisms as machines conflicts with the evident fact that in contrast to machines, organic bodies develop and grow, reproduce and regenerate, it has always been easy to reproach Descartes for disregarding the limitations of this machine model.[7] Why, then, should he have come to draw this apparently absurd comparison between living creatures and machines in the first place?

In the following, I would like to show that our current notion of the Cartesian human machine is the result of a specific text-image interaction that was made

4 Such an attribution constitutes the rule; see e.g., Gaukroger, *Descartes' System,* 188, and unfortunately also Zittel, "Abbilden und Überzeugen," 535-601.

5 Baruzzi, *Mensch und Maschine*, 61; Sutter, *Göttliche Maschinen*, 68; Stollberg-Rilinger, *Der Staat als Maschine*, 32.

6 Dijksterhuis, *Die Mechanisierung*, 553-57.

7 Rodis-Lewis, "Limitations," 152-70.

possible only by the pictorial agenda of the Clerselier edition. Interestingly, it is not primarily the printed word but the images that have shaped the reception of this central early-modern scientific text – even in those instances where the images contradict the text! Indeed, as I shall try to show, in the editions of *De l'homme*, the respective rhetoric of text and image travel along different discursive trajectories, the images often functioning as autonomous bearers of information and disseminators of knowledge.

Habent Sua Fata Libelli

In 1662, working from two manuscripts, Florentius Schuyl (1619-1669), then professor of philosophy in Leiden, produced the first Latin edition of Descartes' *De homine*, for which he provided numerous images.[8] Schuyl played a key role in the diffusion of Cartesianism in the Netherlands, and his own career at the University of Leiden was connected with his support of Descartes.[9]

In turn, ever since Descartes' death in 1650, Claude Clerselier had devoted considerable time to producing a French edition. Clerselier shared Descartes' view that reason could better comprehend physical objects when aided by the imagination than on its own. New images thus had to be created for the text, since only two rough sketches by Descartes himself had survived. This task proved to be extremely difficult, and Clerselier long searched in vain for suitable illustrators. Finally, after a 'call for illustrations' in 1659[10], two people responded: Gérard van Gutschoven, professor of anatomy in Leuven, and the French physician Louis de la Forge.[11] Clerselier had both of them work on the images independently. When, around the same time, he learned of Schuyl's planned edition, he contacted the latter and managed to obtain from him also the Dutch set of images. As a result, Clerselier had access to potential images from three different scientists – for all three illustrators were professional doctors, not artists.

8 For the history of the first editions of the *Traité de l'homme*, see Clerselier's preface to the above-mentioned edition; see also van Otegem, "The Relationship," 614ff; Wilkin, "Figuring," 38-66.

9 On Schuyl, see Lindeboom, "Florentius Schuyl," 25-37. Schuyl obtained the title of Doctor of Medicine only in 1664, from the University of Leiden, where he had taught philosophy for 24 years. Through the patronage of Sylvius, he became professor of medicine the same year. Although Schuyl had already been considered a doctor before, it was his publication of Descartes' *De homine* that led to the rapid academic career in this subject, too.

10 AT V, 764.

11 On La Forge, see Isolle, "Un disciple," 99-131; Claire, "Le matérialisme," 529-30; Rodis-Lewis, "Louis de La Forge," 409-13.

One of Clerselier's main problems in assessing the images sent to him was that what Descartes described could neither be observed with the unaided eye nor with a microscope, because many of the physiological processes he sketched were located at the level of the smallest material particles, which not even optical instruments could access and which could only be imagined. The criterion of 'faithfulness to the object' – a confirmation of the image's truthfulness through personal observations – therefore had to be ruled out. Admittedly, the text to which Clerselier and the illustrators referred was filled with descriptions and made reference to images – never produced or lost – that were supposed to clarify Descartes' argument. But precisely that text of Descartes, which was written entirely around the pictures, is often incomprehensible without them. As a consequence, the illustrators found themselves confronted with a truly paradoxical situation: they were to develop images for a text that remained to them largely opaque and, at the same time, to bring about the intended transparent unity of perception and explanation in whatever way they could. In other words, the illustrators were required to interpret the text and create images that rendered its meaning understandable. Since in this case the illustrators were also trained medical doctors, they employed their artistic imagination not only in the service of visualizing Descartes' descriptions, but brought their own medical experiences and conceptions to bear in the name of scientific progress, in an effort to bring Descartes' book up to date with the latest scientific knowledge.[12] As a consequence, their main objective in drawing the images was often not the exact reconstruction of what Descartes might have intended, but the reflection of current scientific knowledge. There was a reason, after all, for La Forge's decision to provide an additional, detailed commentary upon Descartes' text – and 213 pages of explanations for a contemporary text is certainly unusual.

Clerselier dismissed Schuyl's images as inadequate and later chose from those provided by the other two illustrators whose images he considered to be of equal quality. In his edition, he marked van Gutschoven's pictures with a "G," those by La Forge with an "F," and the two images apparently stemming from Descartes with a "D" (see Figures 1 to 3).[13]

In the foreword to his edition, Clerselier explained his decision not to make use of Schuyl's pictures with a back-handed compliment: Clerselier writes that he would indeed have gladly adopted the images from the Latin edition, because

12 Clerselier even explicitly praises van Gutschoven for not being slavishly submissive to Descartes' interpretations and for occasionally supplanting them with his own knowledge. Cf. AT XI, XIX.

13 *Ibid.*

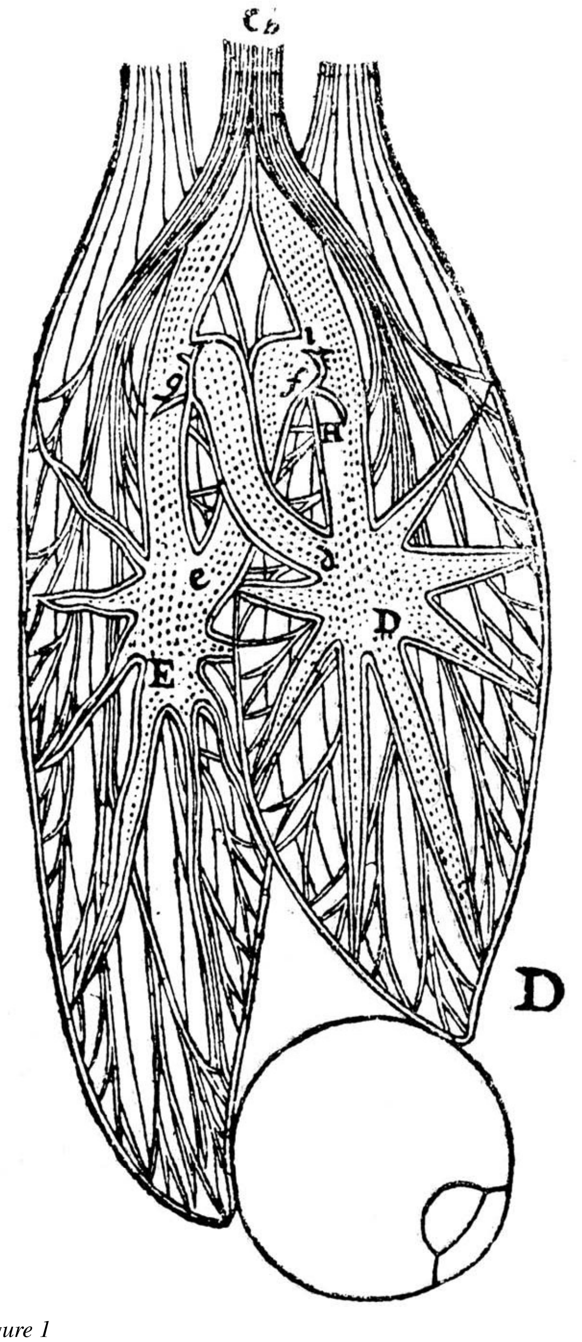

Figure 1

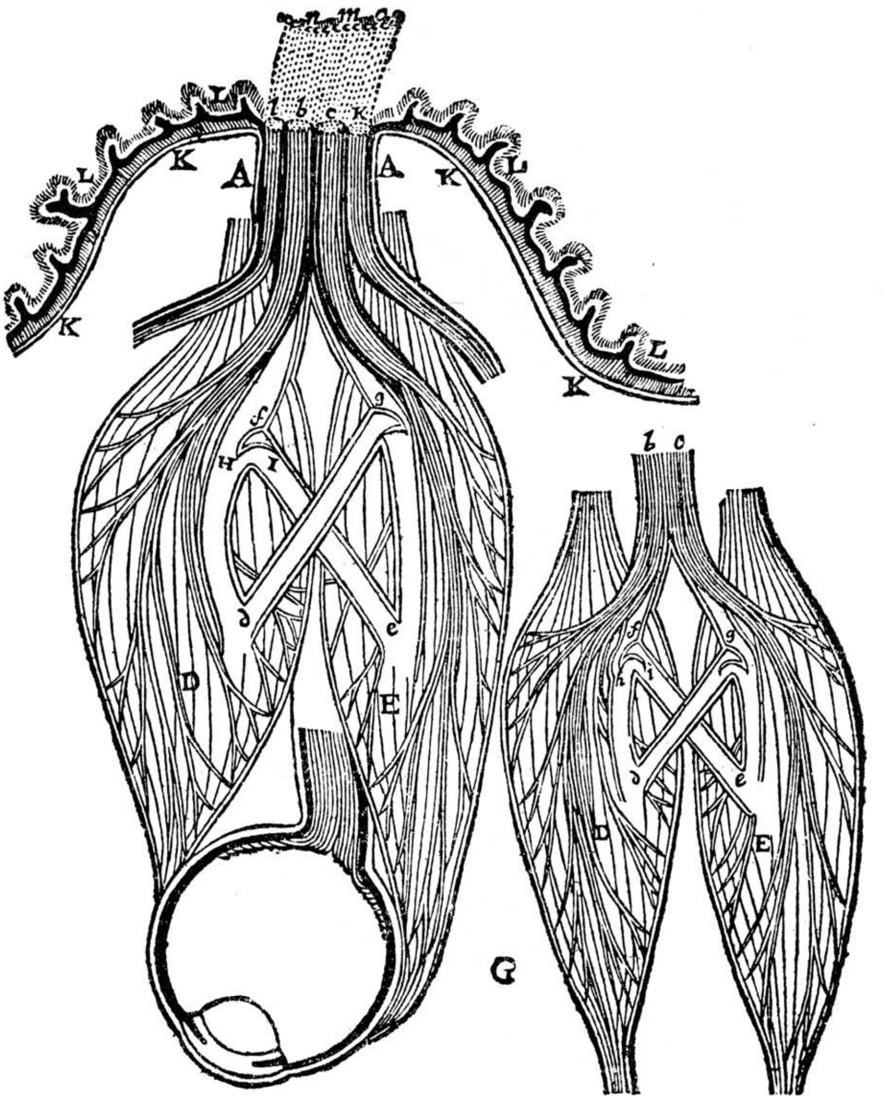

Figure 2

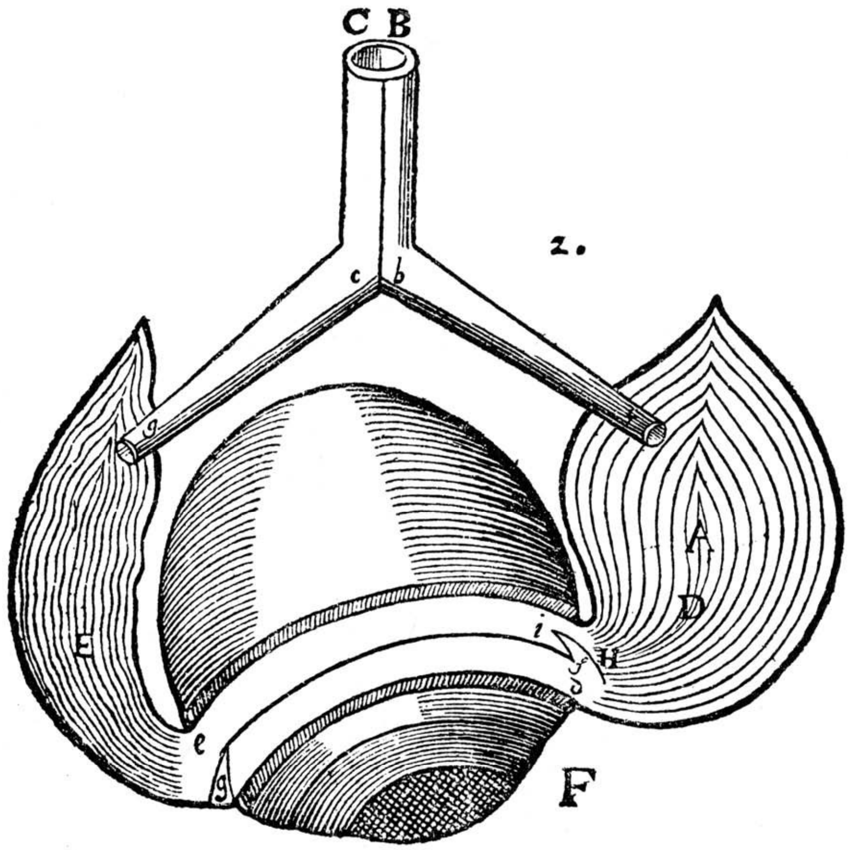

Figure 3

Figures 1-3: The respective depictions of eye muscles by Descartes, van Gutschoven and La Forge.

they are "si ample et si belle." But even though they are better than the images by van Gutschoven and La Forge, with respect to engraving and printing, they are for the most part deficient in the depiction of the brain and the muscles and are, on the whole, less understandable (*moins intelligibles*) and not adequate to the "intelligence" of the text:

> If he had matched [the quality of the other engravings] equally well in the figures of the muscles and of the brain, [. . .], I would have wished to do nothing else than to provide this treatise in its original language and would have used his [*sc.* Schuyl's] figures, which are doubtlessly much better than the ones I have had placed in my edition, if one considers only the quality of engraving and printing; but I believe that they are for the most part less intelligible than those here, and less appropriate to the understanding of the text.[14]

Clerselier alleges (and not only here) among other things that, firstly, Descartes' text is comprehensible and, secondly, that the images must correspond to the clear Cartesian argumentation. After Descartes' death, Clerselier was generally recognized as the legitimate trustee of the Cartesian inheritance. His editions of Descartes' letters and previously unknown works from among Descartes' papers made him the decisive figure in the establishment and transmission of an official Cartesian school.[15] In the same vein, his explicit preference for a 'rationalist' style of imagery was as successful as his criticism of Schuyl was devastating, for all its politeness. Ever since, Schuyl's images, to the extent that they were known at all, have been considered to be non-Cartesian by the self-appointed keepers of Descartes' memory. All editions of *De l'homme* that are in use today, including those by Adam and Tannery, André Bridoux, Ferdinand Alquié, Karl Rothschuh, Gianni Micheli, Thomas Steele Hall, Stephen Gaukroger and Annie Bitbol-Hespériès, reprint the images from the Clerselier edition, and all interpretations refer to that collection of images, as if it were a matter of course, whereas Schuyl's images have fallen into near total oblivion.[16]

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[14] AT XI, XI: "S'il avoit aussi bien rencontré dans les figures des muscles et du cerveau qu'il a inventées, [. . .] je n'aurois rien voulu faire autre chose, que de remettre ce Traité en sa langue Naturelle, & me serois servy des ses propres figures, qui l'emportent sans doute de beaucoup sur celles que j' ay fait mettre icy, si l'on a simplement égard à la graveure & à l'impression, mais que je croy pour la pluspart estre moins intelligibles que celles-là, & moins propres à l'intelligence du texte."

[15] Cf. on this Wilkin, "Figuring," 42-43.

[16] See, e.g., Descartes, *The World*, ed. Gaukroger. Gaukroger obscures the fact that he does not know where the pictures in *Le Monde* come from; concerning the *Traité de l'homme*, he writes that the pictures can be traced back to Schuyl's first edition which Clerselier modified, and that his edition prints the pictures in a form "slightly different" from the first edition. Given the falseness of this statement, it would appear that Gaukroger can only be famil-

From the immense flood of Descartes interpretations, I only managed to fish out three that deal with Schuyl's images; and of the three, two interpreters, van Otegem and Rebecca M. Wilkin, do not question Clerselier's criticism. Wilkin, for one, argues:

> Clerselier rightly points out that Schuyl misunderstood the epistemological function that Descartes assigned to figures, and he accuses him of neglecting Descartes' comparison of the human body to a machine. Underlying Clerselier's criticism of the Cartesian character of Schuyl's figures, however, is the question of the philosopher's posthumous fate. Schuyl's figures underscore the body's mortality and, consequently, evoke the circumstances that engendered them: the author's death. In contrast, Clerselier's illustrators incorporate Descartes' machine analogy into their figures.[17]

Although Jean-Pierre Cavaillé had taken some first steps towards a comparison of the images in Schuyl's and Clerselier's editions, Rebecca M. Wilkin has the merit of being the first to explicitly compare their images. Arguing not from a philosophical, but a cultural-historical perspective, she places Schuyl's images in the *vanitas* tradition, arguing that their manner of presenting the body as mortal could be traced back to the anatomical representations of the Renaissance and to Dutch painting.[18] Descartes' comparably early death had come as a shock to many of his

iar with Clerselier's pictures. Cf. ibid. XXXVI. See also Descartes, *Le monde; L'homme*, ed. Bitbol-Hespériès; Descartes, *Treatise of Man*, ed. Steele Hall; Descartes, *Oeuvres et Lettres*, ed. Bridoux; Descartes, *Opere scientifiche*, vol. 1, ed. Micheli; Descartes, *Oeuvres philosophiques*, ed. Alquié; Descartes, *Über den Menschen*, ed. Rothschuh.

17 Wilkin, "Figuring," 45. Cf. also *ibid.,* 58. Van Otegem, "The Relationship," 620, calls Clerselier's images "more modern." Cavaillé, *Descartes*, 147-53, devotes six full pages to the question of the images in *De l'homme.* While judging Clerselier's pictures to be "en effet fidèles à l'esprit du texte," he yet mistrusts this "esprit Cartesien" and in no way takes it for granted that Descartes would have chosen Clerselier's pictures (p. 150). Baigrie, "Descartes," 93, includes one of Schuyl's pictures but attributes it to Clerselier and does not discuss it further. Des Chene, *Spirits*, 74, simply adopts Clerselier's assessment.

18 Wilkin, "Figuring," 49: "Rembrandt's *Anatomy Lesson of Dr. Tulp* typifies the triumph of description in Dutch painting of the period, the kind of representation that Descartes explicitly sought to avoid in his figures, but Schuyl [. . .] adopts in *Renatus Des Cartes de homine.* He ignores Descartes' dismissal of anatomy . . . ." Wilkin here attributes Clerselier's understanding of representation to Descartes himself. In addition, it must be stressed that Descartes did not dismiss anatomy at all; in fact he devoted a great deal of attention to it his whole life. The intention of her reference to Dutch painting thereby contrasts with this and forces us to examine the advantages of Schuyl's form of representing anatomical findings, typical of the period. For Descartes' impact on Dutch medical culture, see Cook, *Matters,* 226-66. On Descartes' and Rembrandt's mutual participation in Amsterdam's anatomical culture, see Sawday, "Rembrandt." On the possible presence of Descartes at Dr. Tulp's legendary anatomy lesson, see Heckscher, *Rembrandt's Anatomy*.

supporters, as he had suggested that he would live a very long life because of his medical knowledge; and this reputation had played no small part in the dissemination of his ideas. Descartes' death, therefore, threatened to shake the credibility of his theory.[19] According to Wilkin, it was out of concern for Descartes' posthumous reputation that Clerselier rejected Schuyl's images, in an effort to dissociate Descartes' doctrines from the signs of transience, preferring to them the functional, automatic machine images that bore no association with death. Schuyl, in contrast, misunderstood the epistemological task Descartes – still according to Wilkin's thesis – had intended for the images, which was that of rendering functional explanations plausible. But then, the question arises, of course, whether Wilkin does not succumb here to Clerselier's very suggestions. For, her conviction that Descartes required that the images serve as a heuristic tool to communicate a functionalistic understanding of the body may possibly be the direct result of Clerselier's policy regarding the selection of images. With the schematic images of Clerselier's edition in mind, we unwittingly tend to impute to Descartes' text an analogous machine-like conception of the human body.[20] But is there any textual

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[19] Cf. on this Shapin, "Descartes the Doctor," 131-54.

[20] This policy for selecting images is supported by Clerselier's foreword and La Forge's commentary, which, however, are often missing in modern editions and thus cannot be given primary responsibility for the success of the machine image. La Forge, for example, explains the machine term in a strictly functional way and introduces the notorious analogies between clocks, automats, the universe, and humans. For him there is no longer a qualitative difference between natural and artificial machines; all passages in which Descartes examines the creation and development of human beings are ignored in La Forge's definition. The separation of body and soul is carried out in even more extreme fashion. La Forge therefore develops an occasionalist position; see his *Traité de l'homme,* ed. Clerselier, 156: "*Machine,* art. 2. Cette supposition est fort vraye; Car le mot de Machine, on ne peut rien entendre autre chose, sinon un Corps compose de plusieurs parties organiques, qui estant unies, s'accordant à produire quelques mouvemens, dont elles ne seroient pas capables, si elles estoient separées. J'appelle parties organiques, toutes sortes de Corps simples ou composez, qui estant unis ensemble, peuvent aider par leur conformation, figure, movement, repos, et situation, à la production des mouvemens, et fonctions de la Machine dont ils sont parties. Cela estant, non seulement les horloges, et autres Automates, sont des Machines; mais encore le Corps de l'Homme, celuy de tous les Animaux, et l'Univers mesme tour entire passer une Machine. Aussi la difference des Machines Artificielles & des Naturelles ne vient pas de ce que les principes prochains de leurs mouvemens sont de divers genres, mais seulement de ce que les organes de celles sont plus petites, en plus grand nombre, et capable de plus de chose, que non pas ceux des autres." Characteristically, Leinkauf, "Der Natur-Begriff", 405 and 415, note 47, explains the rationalist *res extensa*- model in his lucid and instructive study only with a reference to the Latin variation of this passage from La Forge. The machine comparison is clearly more pronouncedly employed here than by Descartes himself. On the discussions by La Forge's contemporaries, cf. especially Géraud de Cordemoy's occasionalistic position in his *Dissertations physiques*.

evidence at all for such a reading? Does Clerselier's adequacy criterion for images and text withstand closer examination? What would we think today of Descartes' mechanical understanding of the human body if we only had his text with Schuyl's images?

As has been mentioned in my Introduction, above, the bulk of the current interpretation of Descartes' *Traité de l'homme* as well as of Descartes' conception of humans in general is one-sidedly influenced by Clerselier's posthumous selection of images. These, together with the posthumous foreword, decisively re-interpret Descartes' text. The suggestive harmony of the mechanistic creed and the images were, for the centuries to come, to assure the resounding success of this re-interpretation.

Facta and *Ficta*

I would like to begin with some general observations concerning the special features of the two editions as well as some of their differences, which will later be made more concrete through a comparison of the images. As for Clerselier, he consistently modified and supplemented Descartes' text where he thought it necessary to facilitate comprehension.[21] As a result, the *Traité de l'homme* constitutes from the outset a corrupted and unauthorized posthumous text and print version that, unbeknownst to the reader, has been expanded in places according to the editor's ideas in order to create an "intelligible" text. Thus, there is no solid foundation for the criterion, invoked by everyone from Clerselier to Wilkin, that images must be faithful to the text. Yet even if the postulate of faithfulness to the text were upheld *with this reservation*, there still is no justification for giving preference to the images contained in the Clerselier edition, for the following reason.

First, van Gutschoven's and La Forge's images are woodcuts, while Schuyl's are copperplate engravings. Woodcutting is a comparatively less sophisticated medium, which undoubtedly requires exceptionally gifted people like Albrecht Dürer in order to cut printing blocks capable of reproducing an engraving's subtle details. Woodcuts, therefore, work particularly well for diagrammatic representations. With copper, by contrast, it is easier to engrave details – which suggests that Schuyl's technique gave him a clear advantage. Moreover, Schuyl's artistic abilities were far superior to those of van Gutschoven and La Forge, for instance with respect to the accuracy of representation, the composition of the image and the treatment of perspective. Clerselier was fully aware of the aesthetic inferiority of

21 Cf. Baillet, *La Vie* II, 402; Wilkin, "Figuring," 41.

his own set of images, but made a virtue of necessity by introducing a distinction between artistic images, which were more beautiful and aesthetically pleasing, but potentially ambiguous, and the scientific intelligibility of simple images – a distinction that is echoed today by those who oppose the interpretational openness of artistic images to the instrumental purpose and therefore unequivocal nature of scientific images. But Clerselier's stipulated separation of art and cognition has no conceptual basis in Descartes' writing. In fact, Descartes made no distinction between aesthetic and scientific images. He moreover preferred copper plate engravings for their ability to render many details visible and recognizable, particularly in cases where the image did not follow mimetic postulates. In fact, he praised the sharper gaze and well-trained eyes of the engravers.[22] In *Les Météores*, he deliberately relied on minute copper representations of the subvisible microworld so as to render his meticulous description of tiny material particles phenomenally plausible and to assist the comprehension of his theory of matter by means of the mind's imagination.[23] In fact, for Descartes, the aesthetic and detailed image often facilitates – or in fact enables – the comprehension of his theory, and this above all in those cases where the image is detached from the postulate of mimetic realism.[24]

Second, Schuyl based himself for the crafting of his images very closely on two copies of the manuscript text, whereas La Forge's and van Gutschoven's images also reflect medical developments that took place after Descartes' death. Yet, since according to his own testimony, Descartes could decipher his manuscript years later only with difficulty, there is no ultimate certainty about the reliability of the copies (of which Descartes was aware, while not correcting them)[25] or the textual versions assembled from them.

Third, Schuyl took as his model Frans van Schooten's images for the essays that were published with the *Discours de la méthode*. These images often combine mimetic and abstract diagrammatic elements. Schuyl, who copied that

22 Descartes, *Dioptrique,* AT VI, 112-113, 164.

23 Descartes, *Les Météores*.

24 For a more thorough discussion of this argument, see Zittel, *Theatrum Philosophicum.*

25 In a letter to Mersenne dated 23 November 1646 (*Philosophical Writings*, 3: 301; AT IV 566), Descartes wrote that "it is now twelve or thirteen years since I described all the functions of the human or animal body; but the manuscript is in such a mess that I would be hard put to it to read it myself. Nevertheless, four or five years ago I could not avoid lending it to a close friend, who made a copy which was then recopied by two more people, with my permission but without rereading or correcting the transcripts." Lindeboom suspects that Alphonse Pollot was this trusted friend. In any case, ten years later Pollot gave Schuyl a copy; he received another copy from the knight van Bergen van Sturck. As Lindeboom, "Florentius Schuyl," 32, points out, the copying and circulation of manuscripts outside university circles provides remarkable evidence of the great general interest in Cartesian philosophy.

style, sometimes also attempted to describe processes, and in so doing, follow the graphic technique of Descartes' *Dioptrique* and *Météores* much more closely than the primarily static and schematic representations of the Clerselier edition. Like Descartes himself, Schuyl repeats individual pictures several times and in so doing adopts the Cartesian strategy of imprinting images on the memory by repeating them – once again a feature that is not found in the Clerselier edition. It is thus evident that Schuyl tried to adapt Descartes' visual language from the essays of the *Discours*, probably with the intention of using its cognitive functions to explain anatomical phenomena. To what extent this transfer from one field of study to another was successful, however, remains to be seen. Since Descartes, in collaboration with van Schooten, closely monitored the production of images for the essays, their representational strategy can at least be considered authorized. Note that Schuyl's decision to repeat this typology constituted more than a mere argument from authority, as the images in the essays of the *Discours* were closely interwoven with the text and since Descartes obviously attributed a clarifying function to this interplay between texts and images, which neither medium could have achieved on its own. While, for this very reason, Schuyl's decision to orient his images on the typology favoured by Descartes himself makes sense, the demonstratively lucid type of functionalism that characterizes precisely those images by La Forge and van Gutschoven that would later become famous, are strikingly different from Descartes' authorized earlier editions. It would therefore appear that our own tendency to view Schuyl's images as incompatible with Descartes' objectives is a direct result of Clerselier's successful campaign to establish a functionalist reading of Descartes's work, which in fact is neither compatible with the "morphological alphabet"[26] of microscopic particles of the *Météores* nor with Descartes' explanation of human development in *De formatione foeti* (a text that was published together with the *Traité de l'homme* in posthumous editions).

Finally, as we shall see in a moment, the images contained in the Clerselier edition are themselves far less homogeneous and consistent than their editor would like readers to believe. Their alleged functionalism is often more rhetorically pretended than practically exemplified.

In sum, then, if one wished to argue from the point of view of Descartes' supposed intentions, which ought to be rendered intelligible by some new set of images, then the arguments in favour of Schuyl's visual language would definitely be stronger.

[26] Cf. Lüthy, "Where Logical Necessity," 97-133.

Fig. 33.

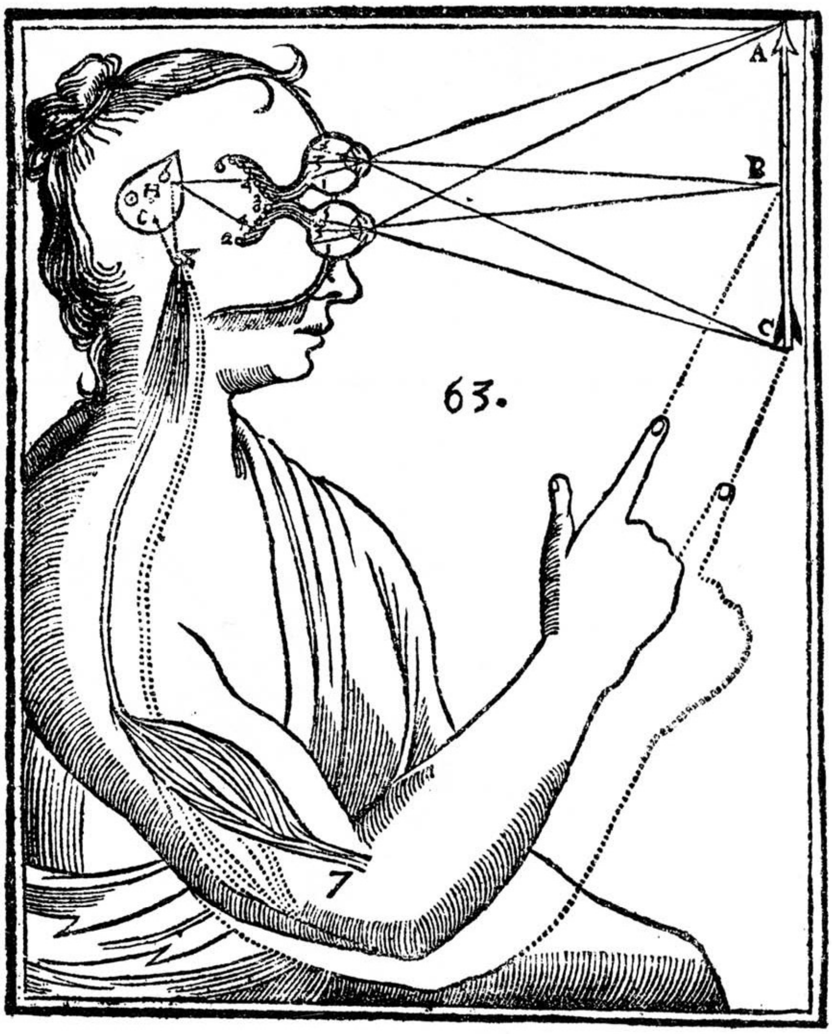


Figure 4: Depiction of a mechanistic functional relationship in Descartes' Traité de l'homme, ed. Clerselier.

Intelligible Mechanisms?

Figure 4, which is as famous as it is allegedly simple, depicts a mechanistic functional relationship in Clerselier's edition of Descartes' *Traité de l'homme*.

Light rays, represented by geometrical lines, radiate from an object (in this case, an arrow); they then reach the eyes, depicted one above the other, penetrate the lenses to the retina and to the optical nerves, and from there travel to the pineal gland in the centre of the brain. There they are converted into impulses, which produce a muscular contraction in the arm that triggers the pointing motion of the finger. Figure 4 shows no real observation; instead, it is a depiction of something invisible. It does not mimetically refer to external objects, but leaves the plane of observable phenomena and seeks to render higher-level structural or functional relations plausible. The image appears to be an unproblematic depiction of Descartes' mechanistic explanation of the process of seeing. Brian Baigrie therefore interprets the function of this kind of image as an attempt to train and "sharpen *our mechanistic intuitions*."[27] However, as in other places, Descartes considers his explanations in *De l'homme* to be hypothetical. Therefore, such an image, even if it referred to the level of causal explanation, could not function as evidence. Neither did it empirically confirm an observation; rather, it would assume an explanatory function to the extent that, starting from observed effects, hypothetically possible causes are understood as functional explanations and depicted diagrammatically to be made plausible.

Figure 4 is well known, not least because it has so often been reproduced outside its proper context; it not only adorns the book jackets of general accounts of the history of early modern science, but belongs to the permanent stock icons of the mythography of the so-called "Scientific Revolution."[28] Not only were our conceptions of Descartes' mechanistic explanations of the human body, based on the automaton model, decisively influenced by this image; in more recent cultural history it has generally served as a visual symbol of the seventeenth century's new way of thinking, which began to restrict itself to describing human beings in a 'scientific' reductionist manner fashion in terms of its functional mechanisms alone. We may therefore take this image as our starting point and trace, as well as question, the emergence and development of this central guiding image in historiography.

A first skeptical qualification concerning the apparently self-explanatory functional suitability of this image arises from the fact that in his natural philosophical

27 Cf. Baigrie, "Descartes," 116.

28 E.g., Henry, *The Scientific Revolution.*

texts, Descartes repeatedly shifts from static to genetic explanations.[29] A large part of Descartes' studies of humans consists of research on embryology, at the centre of which stands precisely the attempt to comprehend unpredictable yet mechanically conceived developmental processes. Descartes had explained already in his *Discours de la méthode*, that "nature is much easier to understand when one sees her developing gradually than when one contemplates her fully formed."[30] In *De formatione foeti*, he even went as far as to say that if "the precise seminal mass of humans were known," the entire, fully developed structure could be "deduced" from it with mathematical certainty.[31] An image such as Figure 4, consequently, runs the risk of transforming a cognitive *aspect* into an independent image claiming universal validity.

Upon closer observation, it furthermore appears that this seemingly straightforward image is not as clear-cut as it seems; in it, editorial decisions and cognitive-theoretical inquiries are in fact indissolubly intertwined. Georges Canguilhem long ago recognized that in contrast to Clerselier's famous depiction, Descartes' text does not identify in the light rays emanating from the arrow the cause that brings the spirits in the brain to arrange themselves in such a way as to command the raising of the arms through the nerve cords.[32] For Descartes, the starting point of the mechanism, which triggers the movement toward an external object, is not found in the object, but in the brain. The corresponding passage in the *Traité* reads:

> Now the chief effect [. . .] is that the spirits, departing from certain regions on the surface of this gland and not from others, have force enough [to do two things]. [1] They can turn the tubules into which they flow, in the inner brain surface, toward the places where these spirits emanate from the gland (unless the tubules in question are already pointed in that direction). And [2] they can make the members to which these tubules correspond turn toward places corresponding to the indicated regions on the surface of gland H. And note that if we have an idea about moving a member, that idea – consisting of nothing but the way in which spirits flow from the gland – is the cause of the movement itself. [In Figure 4] for example one can suppose that what makes tube 8 turn toward point b rather than toward some other point is merely that the spirits leaving point b tend with greater force

[29] E.g., Descartes, *Principia* III §45. Cf. also *De formatione foeti* and *De generatione animalium*.

[30] Descartes, *Discourse,* 33; AT VI, 46. In the *Conversation with Burman*, the cognitive perspectival change is established on the basis of Descartes' treatise *The Description of the Human Body*: "cum enim solum animalis functiones explicare vellet, vidit se id facere vix posse sine eo quod animalis conformationem ab ovo explicare," Descartes, *Gespräch,* 88.

[31] Descartes, *Descriptio,* AT XI, 277.

[32] Fifty years ago, Georges Canguilhem pointed out that something was not right about figure 4: "Descartes, pour lequel cette figure est faite par un dessinateur autre que Descartes, impose manifestement l'interpretation contraire." Canguilhem, *La formation,* 46.

toward 8 than do any other [spirits]. The same thing will cause the soul to sense that the arm is turned toward object B provided the soul is already in this machine.[33]

The following figure (Figure 5) is also supposed to show that such movements are triggered "by the force of the spirits alone, without the aid of the rational soul or the external senses."[34] In fact, for Descartes it is this independence from external objects that makes it possible to explain how and why, even without an external influence in the brain, ideas can form in the memory through preceding impressions:

For if at the region of the brain toward which the gland is inclined, the shape of one particular object is imprinted more distinctly than that of any other, the spirits tending to that region cannot fail to receive an impression thereof. And it is this that past things sometimes return to thought as if by chance and without the memory of them being excited by any object impinging on the senses.[35]

Descartes' seminal concept of a *mémoire involontaire* is not captured by Clerselier's image, which simply shows an external stimulus and the way it is processed in the brain. Descartes' conception of involuntary memory is connected with two further problematic questions of visualization: the first has to do with the representation of those physical interactions with external objects that are generally described as reflexes; and the second with the problem of how to adequately represent graphically the impact of the spirits in the brain, particularly when the task involves visualizing involuntary brain states, like dreaming or sleep.

1. Reflections upon 'Reflexes'

The images that have already been discussed belong to a series of other images, in Clerselier's edition, all of which are supposed to shed light on allegedly reflexive reactions to other objects (see Figures 6 and 7). Descartes' description of the process depicted in the images is as follows:

Thus [in Figure 6], if fire **A** is near foot **B**, the particles of this fire (which move very quickly, as you know) have force enough to displace the area of skin that they touch; and thus pulling the little thread *cc*, which you see to be attached there, they simultaneously open the entrance to the pore [or conduit] *de* where this thread terminates [in the brain]:

[33] Descartes, *Of Man,* 92; *De l'homme*; AT XI, 183.
[34] Descartes, *Of Man,* 96; *De l'homme*; AT XI, 184.
[35] Descartes, *Of Man*, 96; *De l'homme,* AT XI, 184.

Fig. 34.

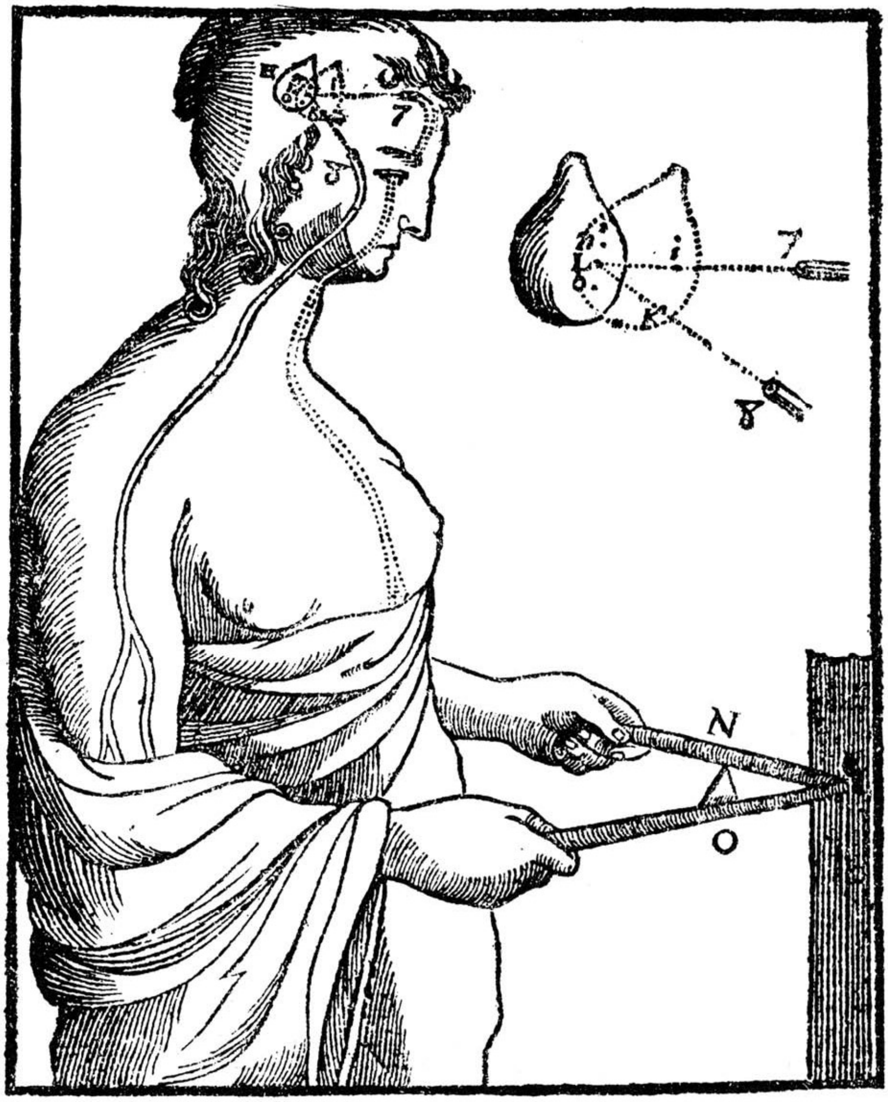


Figure 5: From Descartes' Traité de l'homme, ed. Clerselier (1664).

Fig. 7.

Figure 6

Fig. 37.

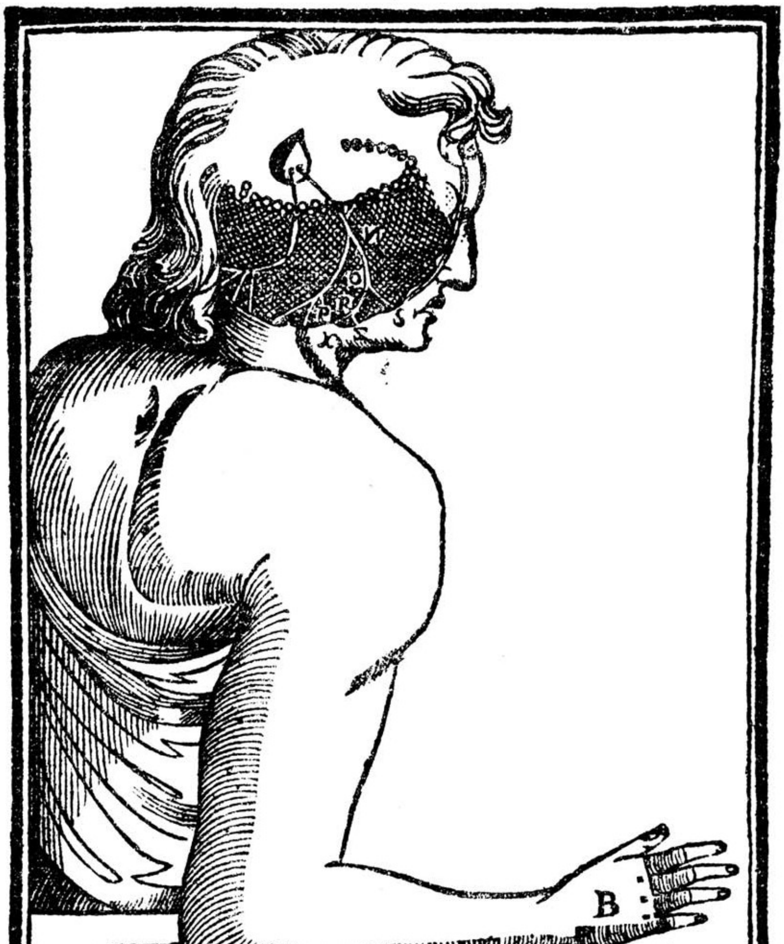


Figure 7

Figures 6 and 7: Images from Descartes' Traité de l'homme, ed. Clerselier (1664).

just as, pulling on one end of a cord, one simultaneously rings a bell which hangs at the opposite end.[36]

Just as in the analogy between the light ray and the blind man's cane of the *Dioptrique*, the present analogy between a nerve trigger and a bell pull also presumes an instantaneous transmission of particles. Yet, in a paraphrase of this passage, Stephen Gaukroger claims: "In the account of reflex response in *L' homme,* [Descartes] gives an example of a 'man machine' [Figure 6]. [. . .] Such automatic motion is completely mechanical."[37] Indeed, Descartes is frequently credited as having been the first to describe bodily reflexes or, in any case, as having anticipated the concept of reflexes. Gaukroger shares this belief, even though he recognizes (in contrast to most other descriptions of this process in the secondary literature) the critical difference between an adverse-effects reflex and Descartes' conception. Adverse-effects reflexes are proprioceptive reflexes, which occur without the transmission of neurons. But Descartes clearly indicates an involvement of the brain. Indeed – and this is one of Canguilhem's central theses – Descartes was not acquainted with the term "reflex." The ascription of a reflex theory to Descartes is, according to Canguilhem, merely an enduring legend, which came about because most historians of philosophy are insufficiently versed in physiology – and medical historians often lacking in critical *ésprit*.[38] Against the objection that Descartes might have developed the concept of a reflex even without having a term for it, Canguilhem convincingly argues against such "illusions de retrospectives", which are nourished precisely by Clerselier's images, by pointing out that Descartes is rather concerned with a general concept of involuntary movement, which include digestion or heart beat, all of which require a particular disposition of the spirits in the brain (just as in Figure 6). Descartes, he concludes, may have had a mechanistic theory of neuromuscular processes, but he certainly had no theory of reflexes.[39] Clerselier's image, in other words, is supposed to depict the concept of an involuntary movement and not that of a simple reflex. It suggests, however, the simultaneity and the homogeneity of two different processes, namely an irritation of the skin and a muscle contraction.

Canguilhem's lucid explanation of the reflex problem has unfortunately remained without an echo in the secondary literature outside France. Canguilhem's

36 Descartes, *Of Man*, 34; AT XI, 141.

37 Gaukroger, *Descartes' System,* 188-89. In a commentary to Article 13 of *Passions de l'Ame*, Hammacher even imputes to Descartes a "Doctrine of reflexes," although reflexes are not the subject of the article. See Descartes, *Die Leidenschaften*, 331 and 325.

38 Canguilhem, *La formation,* 36-42.

39 Cf. *ibid.,* 41.

explanation underlines that Clerselier's image did not really make Descartes' text comprehensible, but instead successfully promoted an alternative concept. As mentioned above, all later editions follow Clerselier. The reception of the *Traité de l'homme* demonstrates that it was not the wording of the text but the conception suggested by the image that have prevailed to such an extent that even the text has since been read selectively and reinterpreted accordingly.

But how does Schuyl depict the same process? In Schuyl's images (see Figures 8 and 9), a young boy holds his right hand motionless over a fire, like the classical Mutius Scaevola. There is no indication here that the hand will be pulled back and therefore also no suggestion of an adverse-effects reflex, for in the second picture, the child still has his hand over the fire, so that the observer's attention is drawn primarily to what happens in the brain.[40] There are connecting threads that run from the brain to the musculature; thus the brain is the starting point for the imminent motion, which is shown in clear independence from the – prior – irritation triggered by the fire. In addition, the child is not depicted in a machine-like fashion. However, the irritation of the skin particles of the hand by the flickering, tiny fire particles remains invisible, which means, in turn, that the process, in principle subvisual, has to be imagined by the viewer of Schuyl's image (whereas the externally visible muscle contraction is graphically indicated).

It is instructive to compare these figures with Figure 10, which depicts the brain's control of the muscles in the case of an arm movement. These images are also unsatisfying, because they fail to develop an imaginitive concept for the non-visible. Nonetheless, they are without question closer to the text than Clerselier's images.

2. Dream Theater

If it already proves difficult to represent processes involving simple motions, then it is near impossible to pictorially explain processes involving complex interactions that depend upon the accidental dispositions of the spirits and the regions in the brain that surround them. Whenever Descartes cites dispositional causes, he is not referring to causal mechanisms or formal, deductive chains of cause and effect, but results arising from chance groupings and collisions of particles. In the *Traité de l'homme*, too, which is often purported as being concerned exclu-

[40] Clerselier, too, correctly shows no reflex; however, possibly the fact that he shows here a foot and there a hand close to the fire made it easier for later observers to imagine this as a moment in which the reflex appears.

Figures 8 and 9: Images from Descartes' De homine, ed. Schuyl (1662).

Figure 10: Depicting the brain's control of the muscles through the movement of an arm, from Descartes' De homine, ed. Schuyl (1662).

sively with mechanistic functions, explanations in fact repeatedly rely on specific dispositions.

The reader is supposed to "conceive" the brain as a "rather dense and compact net or mesh, all of whose links are so many little conduits which the spirits can enter."[41] These little conduits, however, cannot be compared to water pipes in hydraulic grotto figures (and the mechanism underlying their movements).[42] For, according to Descartes, the transport organs of the brain do not consist of fixed pipes that might serve for the flow of a constant stream of spirits. Instead, the brain is said to be composed of tiny fibres or "filaments," which undergo permanent alteration, becoming variously permeable at different places depending on how they are deformed by the equally inconstant, sometimes more or less numerous, slower or faster spirits. After all, one of the basic characteristics of these filaments is "that they can retain, as if made of lead or wax, the flexure last received until something exerts a contrary pressure upon them."[43] The spirits, hence, take unpredictable paths and "detours," as "they tend where the disposition of the brain at the time impels them."[44] Depending on their current distribution, they trigger different states in the brain and generate different notions. Descartes invites us to engage in the following idea:

> Imagine, for example, that the differences between the two diagrams (*figures*) M und N [see Figures 11, 12, 13, and 14] is the same as that between the brains [a] of a man who is awake and [b] of a man who is sleeping and dreaming.[45]

Clerselier was unable to use La Forge's depictions of the flow of spirits and the states of the brain, because they were so rough. He chose the alternative set by van Gutschoven, who in the face of this task realized the need to move away from the naked schematism that characterizes his other images.[46] With respect to this subject, Descartes repeatedly calls upon his readers to observe with their own eyes the course of the spirits and the way in which they interact and communicate with one another.[47] In other words, the readers are expected to see, not mere structures, but complex states of tension and transformations. Descartes is

41 Descartes, *Of Man*, 77 passim; AT XI 170.
42 According to Lazardzig, "Die Maschine," 167-93.
43 Descartes, *Of Man,* 79; AT X 171.
44 Descartes, *Of Man*, 81 (translation slightly modified); AT XI, 173.
45 Descartes, *Of Man*, 82. AT XI, 173.
46 This also constitutes an objection to Wilkin's interpretation ("Figuring," 53), which generally endorses Clerselier's images: "Their mechanistic figures reproduce Descartes' theory of life, for Descartes likened the human body to a machine." Here Wilkin is following Des Chene, *Spirits*.
47 Cf. Descartes, *De l'homme*; AT XI, 174.

Fig. 27.

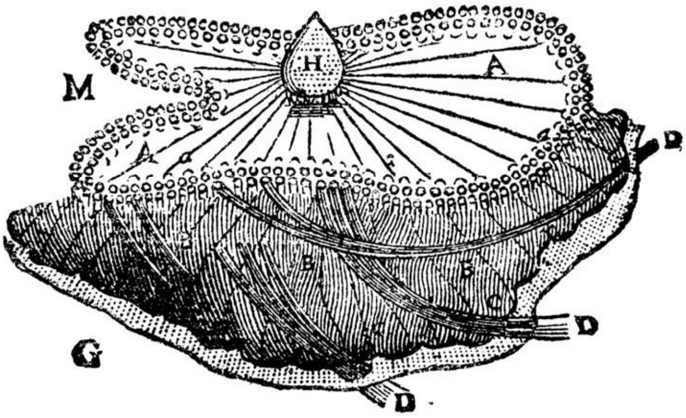
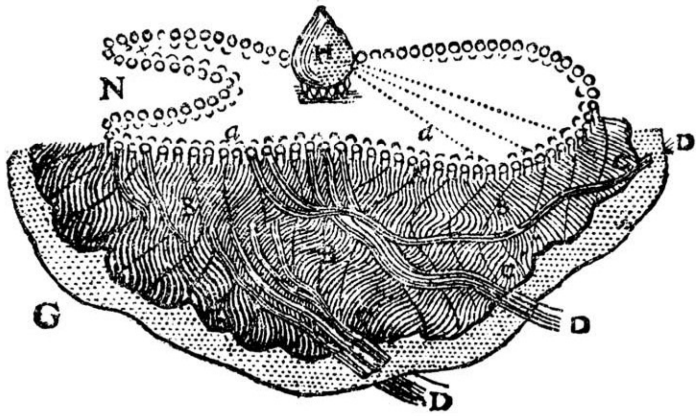
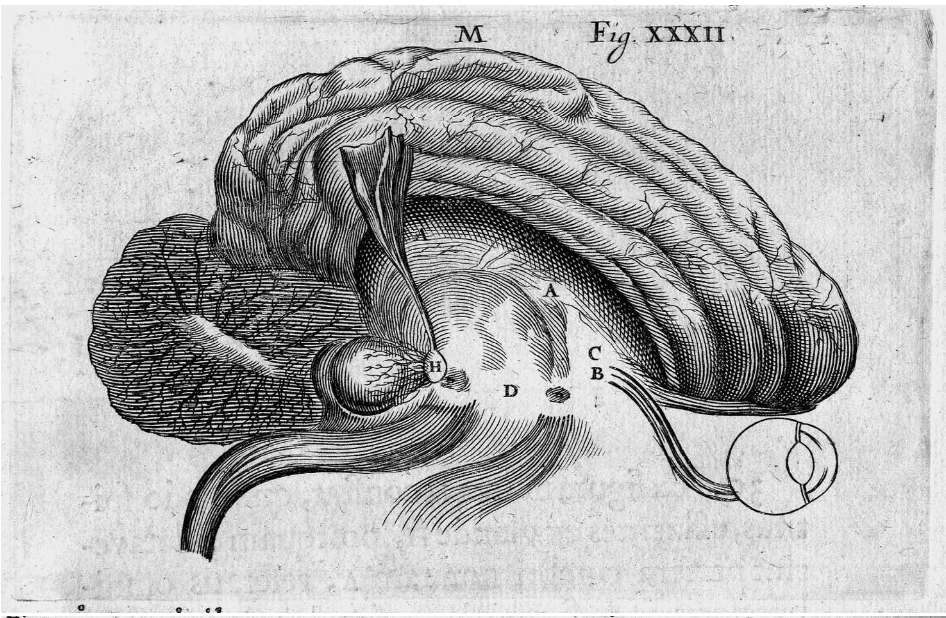


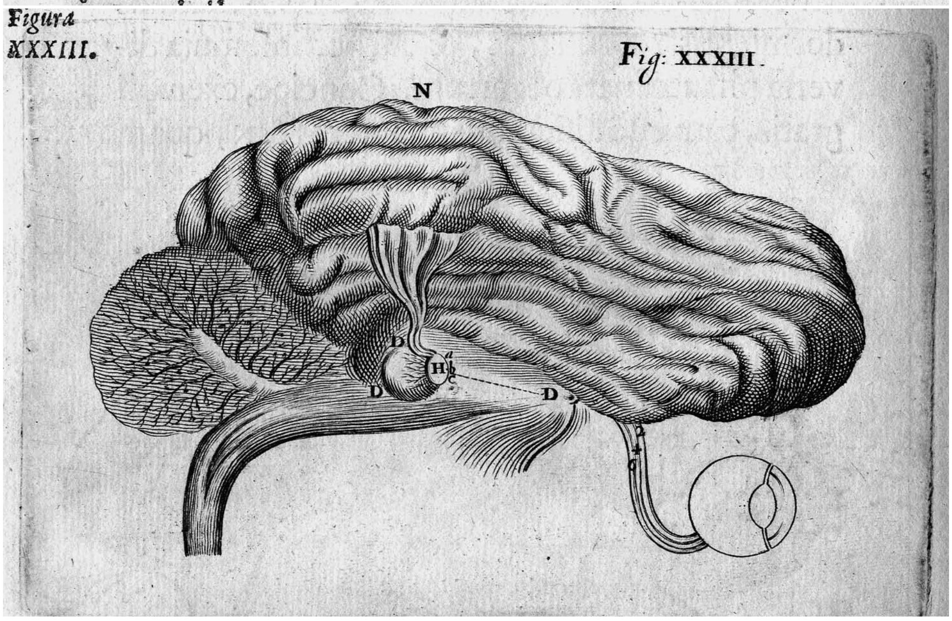
Fig. 28.



Figures 11 and 12: The brain awake and asleep, from Descartes' Traité de l'homme, ed. Clerselier (1664).

here not primarily concerned with the body machine; rather, he wants to turn his readers into observers of what the physical machine can display (*represente*), but which, nevertheless, cannot be made visible in any anatomical section, namely the production of dreams and fantasies. And so he continually appeals to the reader





Figures 13 and 14: The brain awake and asleep, from Descartes' De homine, ed. Schuyl (1662).

to look at the images, to see for themselves: "Regardez" – he exclaims – "vous pouvez voir," because the image "fait voir."[48]

So, how did the images of the two rivalling editions deal with this requested, yet near impossible task? The first of van Gutschoven's images (Figure 11) depicts the brain as a blown-up, fibrous bellows (D), which receives many spirits from the pineal gland (H), as the lines are supposed to show. The neural tubes are taut, because they are well-filled, region A has been expanded, and the spirits are spreading out through open pores to B, C, and D. Figure 12, in contrast, suggests little activity in the pineal gland and accordingly displays a sagging bellows. The nerve cords may be hanging down, but are still depicted in gentle waves, indicating occasional dream activity; like a light breeze which cannot really fill a slack sail, the spirits only occasionally manage to pass through the cords to the now more narrow region (which was previously designated with an "A") where they trigger dreams.

What Clerselier suppressed in his discussion of the intention of the text (*intelligence du texte*), to which the pictures were to correspond, is that in passages such as the one concerning dreams, Descartes's text delivers analogies and daring metaphors, which simply cannot be translated into structurally isomeric functional models, or mimetic-realistic depictions, but can at best be rendered by imaginary scenarios![49] Take, as a further illustration of this situation, the following passage, where Descartes comments upon the difference between the two brain states as follows:

> Now the substance of the brain being soft and pliant, if no spirits entered its cavities these cavities would be very narrow and almost entirely closed, as they appear in the brain of a dead man [...]. But the source which produces these spirits is ordinarily so copious that they have a capability, corresponding to the amount of them entering the cavities, to push outward in all directions the matter that surrounds them, thus causing this matter to

48 E.g., AT XI, 173.

49 Descartes' rejection of external structural models can be further supported with the evidence of his telling comparison of the distribution of spirit with the distribution of air in an organ. "You can think of the heart and arteries of our machine (which push animal spirits into cavities of its brain) as similar to the bellows (which push air into the wind trunks of organs)" (Descartes, *Of Man*, 71). But – writes Descartes – with this comparison, we should not remain focussed on the externally visible figure, as with the organ, which can look however it does, it only needs air, the pipes, and the air distribution. The functions of the brain which he discusses here, "in no way depend on the external shape of the visible parts which the anatomists distinguish in the substance of the brain nor on the shape of the cavities, but only on the spirits that come from the heart, on the pores of the brain through which they pass, and on the way in which these spirits are distributed to these pores" (*ibid.*, 72). Descartes thus begins with the visible; but the phenomena still have to be deciphered.

> expand and tighten all nerve filaments that arise there: just as the wind when somewhat strong can inflate the sails of a ship and tighten all the ropes to which the sails are attached. Whence it follows that at such times this machine, being so arranged as to obey all the actions of the spirits, represents the body of a man who is *awake.* Or at the least the spirits have strength enough to push some [of the nervous filaments] in the way indicated and [thus] to stretch certain parts of the brain while others remain free and lax: as do different parts of a sail when the wind is a little too weak to fill it. And at such times this machine represents the body of a man who sleeps and who has various dreams while sleeping.[50]

How can the physiology of a dream experience be explained with the aid of a graphic image? Descartes employs here a suggestive imaginary circle. The fantasies emerging in dreams are supposed to be made comprehensible with the aid of metaphors and images, which are themselves not 'realistic' but 'imaginative'. In creating them, we must of necessity reach back to our introspective experience of dreaming and sleep, thus to an experience which can only be had unconsciously!

Virtual Anatomy

Schuyl's images, too, fail to adequately reproduce the different states of the brain and the shifts from one state to another. Schuyl's strategy relies on an attempt to render minimal changes visible through a series of snapshots, as it were. His images are more nuanced than those of Clerselier's illustrators, and their greater detail creates the appearance of a 'realistic' depiction of the imaginary, that is, as a concrete translation of the ideas generated by Descartes' metaphors. But precisely that false realism constitutes their pitfall. The difference in volume between the wakeful and sleeping brain is clearly recognizable, for example; we see that a brain lobe (D) is first puffed out like a sail, and then sagging, and that in a sleeping brain spirits are only occasionally sent through nerve fibres to A, where they generate dreams. Yet in this case, the all-too-concrete reproduction of the sail analogy cannot do justice to Descartes' imaginary circle, as it suggests that the imaginary can actually be made externally visible, while Descartes merely sought to communicate by this image merely the *idea* of the process. In other words, he required of the images that they made visible a process that can never be seen in reality. Schuyl's realism, however, suggests that the brain's swelling and unswelling might actually be observed in the dissected brain. In this case, then, van Gutschoven's somewhat awkward depiction actually appears to be a bit more appropriate.

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[50] Descartes, *Of Man*, 81; AT XI, 173.

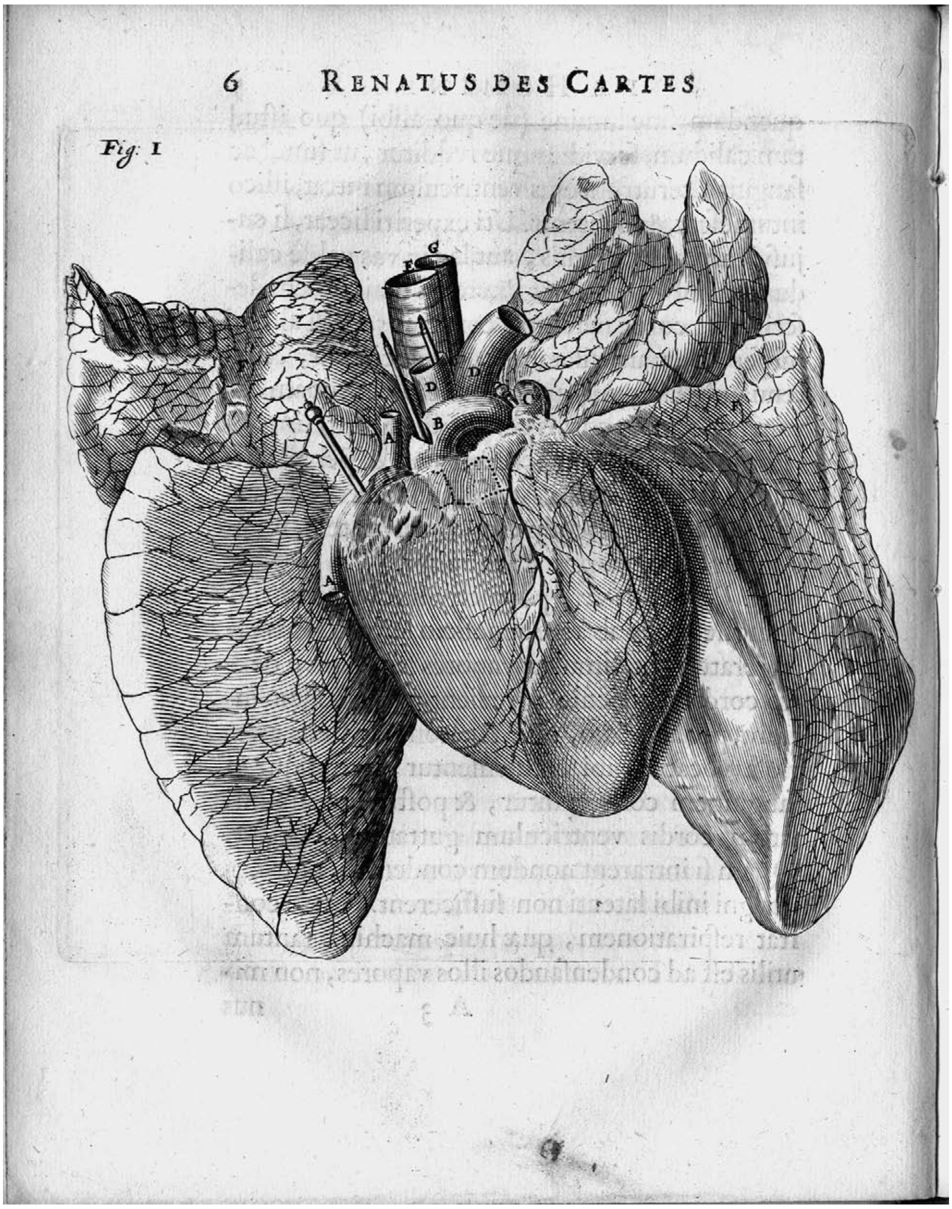

Figure 15

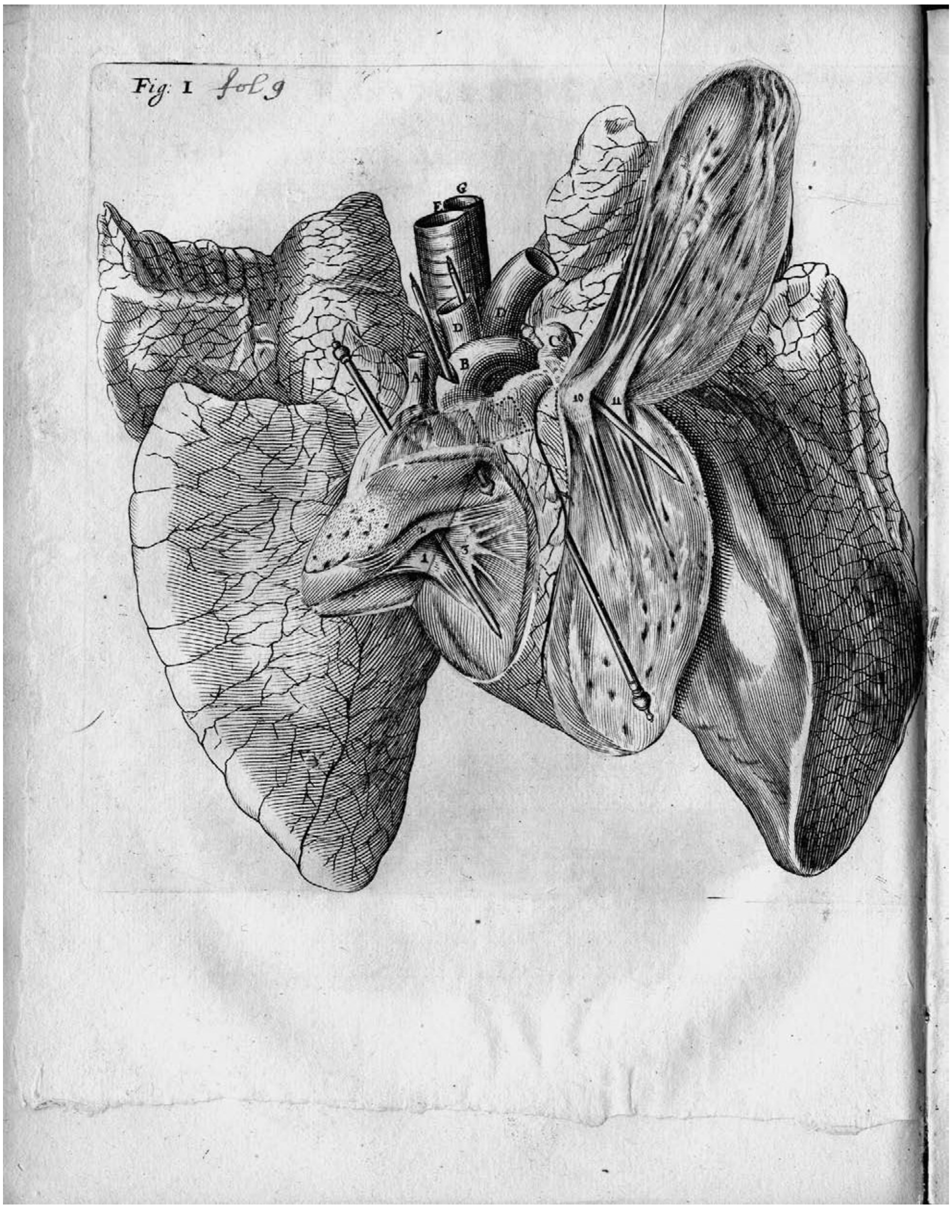

Figure 16

Figures 15 and 16: Depiction of the heart and lungs, from Descartes' De homine, ed. Schuyl (1662).

However, when viewed from a merely anatomical perspective, Schuyl's representational method reveals one of its real strengths, as it relies on an additional, new method of visual rhetoric in order to bring about the fictitious realism of an epistemically productive *demonstratio ad oculos*: for, in his depiction of the heart, a cardiac valve can be opened by the reader (see Figures 15 and 16).[51] When opened, one sees a ventricle and the blood pumped into it from the atrium through the opening mitral valve. This image thus creates an impression of three-dimensionality. The heart appears as if it had already been arranged for demonstration, and illusionistically sketched small pins hold the individual parts of the heart open; the hyper-realistic engraving intensifies the impression that we are contemplating a concrete heart whose individual lobes the anatomist has just positioned to facilitate viewing. The representation is superb. What is particularly remarkable is that the openable parts of the left and right main chambers are printed on both sides, so that the engraving accurately presents the individual details of the heart from each angle. Almost a century ago, Leroy Crummer has rightly praised this plate:

For delicacy, accuracy and attention to detail, this is probably the finest example of [a] superimposed flap to be found in medical literature, and further presents a feature not to be found as far as I know in any other illustrations of this type, since both [the] front and back of the plates show details of marvellously executed copperplate engravings; in other words, when the flaps are lifted, the details shown on the inside are just as accurate as the details shown with the flap in position. These two flaps represent windows cut in the right and left ventricle and when the flaps are down the anterior wall of the heart is shown, but when lifted, the finest detail of the mitral and tricuspid valve is represented, marked out exactly as in a class demonstration of the same organ today, by large pins inserted through all of the valvular orifices indicating the direction of the blood stream.[52]

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[51] This table is found between pages A-4 and B. While at first glance it is an exact copy of illustration 1, including all markings, it isn't, as the first table has no flaps. Once again, Wilkin has been the first to describe Schuyl's flap picture in Descartes research, while historians of medicine have for some time been aware of it. Such flap pictures were frequently used in sixteenth-century astrology, cosmology and anatomy. They tended to function in anatomy for the self-study of laypeople rather than pedagogic purposes in medical instruction. The most spectacular example is perhaps Johann Remmelin's *Catoptrum microcosmicum* (Augsburg, 1619). But even the 1554 Basel edition of Vesalius' *Fabrica* contains images accompanied by instructions on how to cut them out (pages 314-16) which are then supposed to be laid upon the tables. See Crummer, "Early Anatomical Fugitive Sheets," and id., "A Check List," 138, where it is stated that the subsequent Schuyl edition of *De Homine* (Louvain, 1664) still followed this principle, while later editions replaced the copper engravings with woodcuts and left out the flap pictures.

[52] Crummer, "A Check List," 138.

In his *Discours de la méthode*, Descartes had expresses the wish that, before continuing with his text, readers wanting to better understand his comments obtain an animal's heart and slice it open next to the book. A little while later, he relies on shared perceptions to confirm his explanations about what can be seen in the heart and felt with the fingers.[53] Schuyl appears to have been quite familiar with this passage, because he attempts to allow the reader virtually to accompany the cutting open of the heart. The reader who does so is no longer simply a passive reader, but is compelled to interact, i.e., must take part in a fictional anatomy seminar with fingers and eyes.

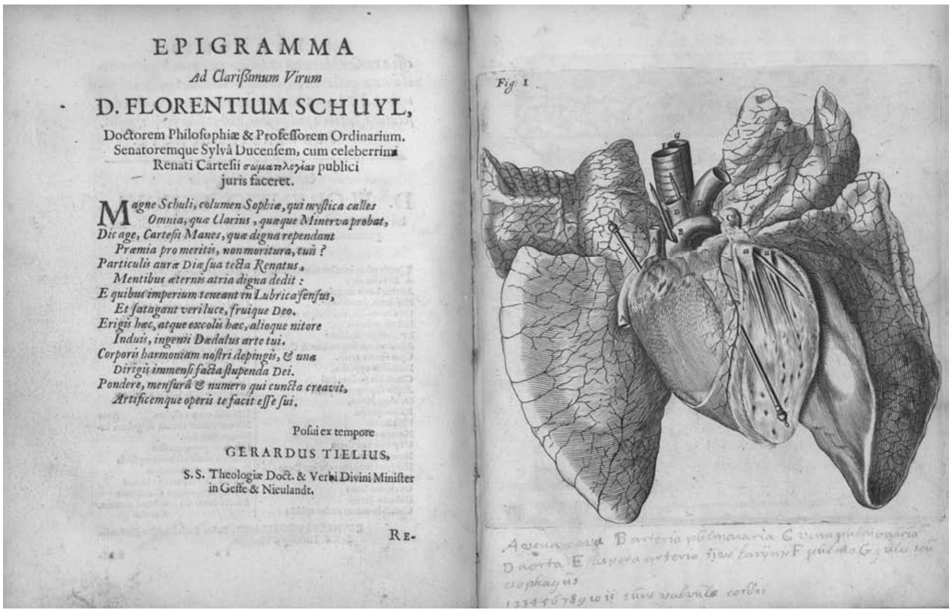


Figure 17: Frontispiece depicting heart and lungs, from Descartes' De homine, ed. Schuyl (1662).

Upon opening the treatise, the reader is immediately confronted with the double-page image, here reproduced as Figure 17. Though we cannot know how seventeenth-century readers reacted to this double page, it cannot have been the paratext (the dedicatory poem by Geradus Tielius, who praises Schuyl as a pillar of wisdom and a second Daedalus) that captured the reader's attention, but rather the spectacular representation of the heart. The arrangement of the pages does not merely direct the reader's attention to the heart as a scientific subject, but more forcefully, it is 'literally' through the *image* of the heart that entry into the text

[53] Descartes, *Discours,* AT IV, 47-48, 51.

takes place. By turning the page, the reader encounters the second image of the heart, which, while apparently a copy of the first, features the valves mentioned above. The pins can now be removed. The opening of the book becomes thus analogous to the opening of the heart, and a parallel is created between the view into the heart and the chest cavity opened and prepared for demonstration. By way of this first surprise effect, Schuyl captures his readers' *attentio*, whose visual curiosity he exploits and whose act of reading he guides by means of his images. Schuyl first conquers the readers' eyes, and then feeds them texts. Understood thermodynamically as a driving force, the heart figures as the central theoretical concept of *De l'homme* and as the starting point for the discussion of various other bodily functions, which are explained analogously. Everywhere, the image constitutes the heart of the text.

Later in the text Schuyl guides the reader's understanding by combining this form of image rhetoric with an early version of a flip-book to explain the second most central bodily organ, the brain. Eight images without page numbers are separated out into a series, making it possible to follow various stages in the dissection of the brain, one slice after the other.[54] In between, in Folio 118, image LIV, we find yet another doubly printed flap, which is so small and so delicately affixed that it could easily be lost or readily overlooked. The engraving depicts the brain. Between the diencephalon and the rhombencephalon, that is, between the third and fourth brain ventricle, the pineal gland is affixed as a small scrap of paper that can be set in motion with a gentle puff of air. After all, "spirit" signifies, first of all, "breath." Schuyl apparently takes the term literally and allows the reader to initiate the spirit's journey in order to set the pineal gland in motion (see Figures 18 and 19). The passage accompanying the depiction of pineal gland "H" states:

> But just as a body attached only by threads and sustained in the air by the force of fumes leaving a furnace would incessantly float here and there as the different particles of the fumes acted differently against it, so the particles of the spirits that hold up and sustain this gland, almost always differing among themselves in some way, do not fail to agitate it and make it lean now to one side and now to the other. See thus in the diagram [. . .].[55]

This time Schuyl's illusionism stands far above van Gutschoven's embarrassed depiction, which remains undecided between representing the pineal gland as untouchable and moved as if by smoke, or, instead, as mechanically pulled by tiny threads (see Figures 20 and 21). As for Schuyl, his image by no means stands in

54 Wilkin, "Figuring," 47 also emphasizes this point.
55 Descartes, *On Man*, 91.

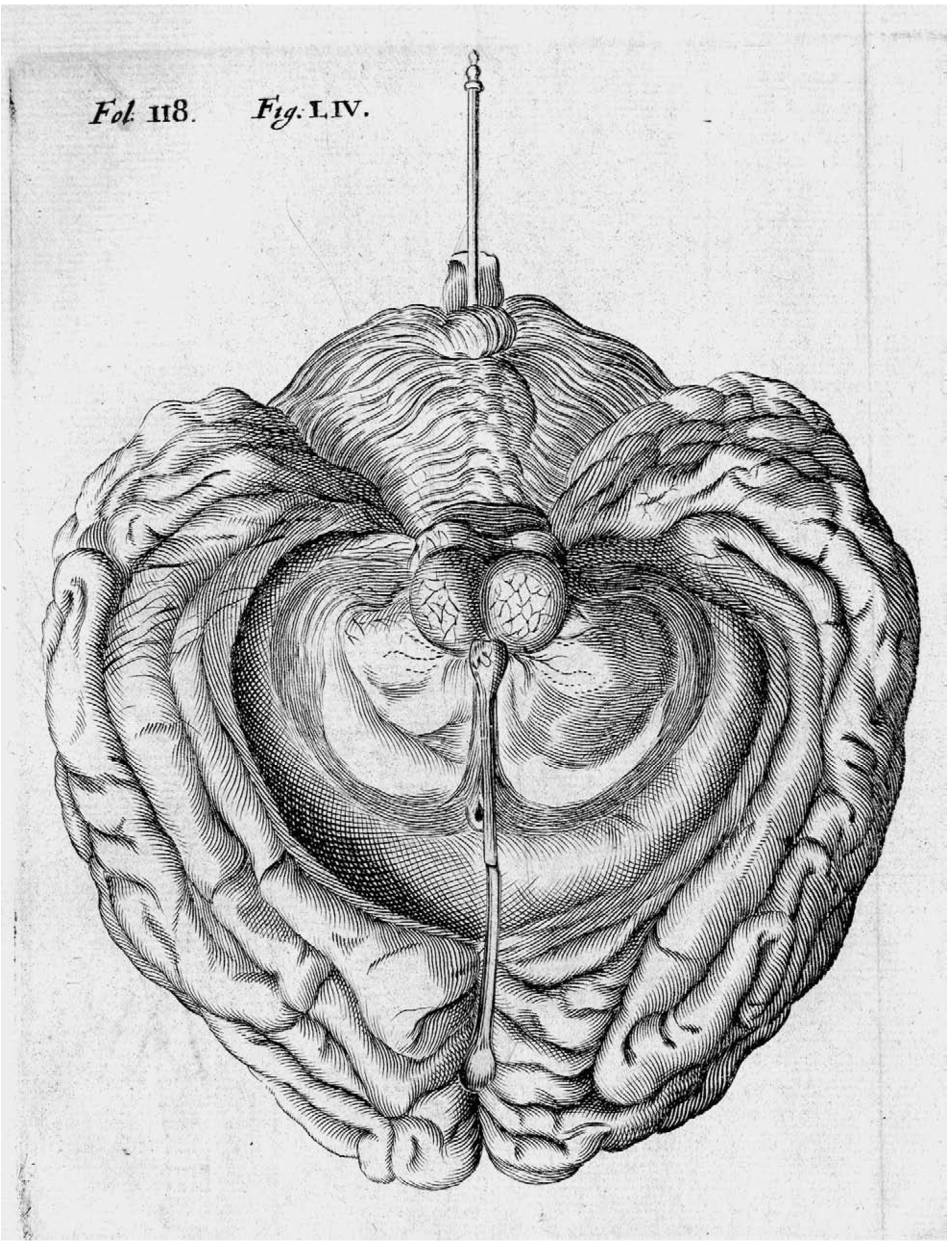


Figure 18

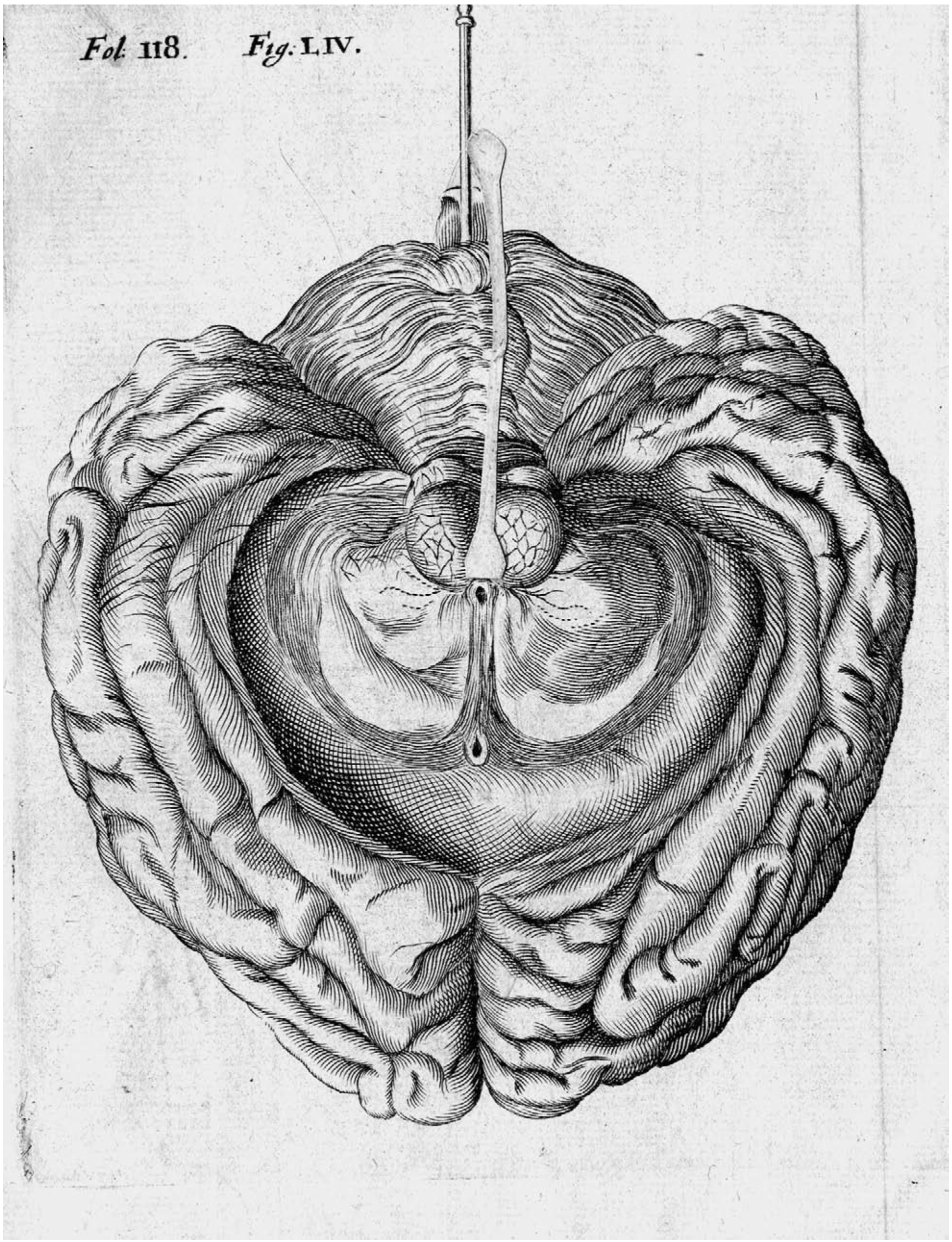


Figure 19

Figures 18 and 19: Depiction of the pineal gland, from Descartes' De homine, ed. Schuyl (1662).

the tradition of a *memento mori*; instead, he employs the most advanced technique for depicting the brain available at the time.[56]

Transparent Illusions

Reflections upon the physiological or anatomical conditions of knowledge generation are a recurrent phenomenon in the history of science, and may very well be considered also a basic element of scientific depictions. To the extent that the anatomist is simultaneously the subject and object of examination, there is always from the very outset a self-reflexive component to all anatomical representations. This self-reflection is often made very explicit, for example with Vesalius and Valverde, with the depictions of a hand performing an autopsy on a hand – in an act of peeling itself, as it were – or of a corpse dissecting a corpse, or seeing that sees itself. In Schuyl, consciousness is supposed to recognize its own physiological state; Schuyl attempts to make this possible by means of a glance into one's own brain. His Figures 22 and 23 appear to possess a similarly self-reflexive dimension (but compare Clerselier's Figure 24). As Schuyl's images contain at the same time schematic and realistic elements, they may in no way be called "mimetic copies of natural entities."[57] They depict in accurate perspectival representation how human eyes perceive various objects, placed at various distances, in differing sizes. The well-known case of towers that appear to be round from a distance but which, if looked at from closer proximity, may prove to be square is introduced by Descartes in the sixth of his *Meditationes* as an example of a deception of our senses. He explored the perspectival effect of distance in his *Dioptrique*, where he explained that "it will be possible to turn a flea into an elephant, for its certain that the image formed by a flea on the back of the eye, when the flea is so close to it, is no less great than that which is formed there by an elephant, when it is thirty paces away."[58]

Wilkin says of Figure 23 that "the godlike eye in the sky reflects the omniscience of the reader," since readers not only see how the eye perceives ob-

[56] E.g., Georg Bartisch (1536-1606), *Ophthalmoduleia – Das ist Augendienst* (Dresden 1583), the first medical handbook dealing with eyes. Some of Bartisch's pictures can also be opened and closed and, as if through trapdoors, observers enter into deeper layers of the head until the optical nerve is finally visible. Bartisch teaches us how to see seeing. Even the title of Bartisch's book has a double meaning: his textbook also provides a "service for the eyes" of his readers.

[57] Wilkin, "Figuring," 53. The same also holds true of Schuyl's illustrations of the brain, where the mimesis principle is underminded by the breaking of the illusion (or rather the exposure of the mechanism producing the illusion).

[58] Descartes, *Discourse on Method, Optics, Geometry, and Meteorology,* 119; AT VI, 155.

Fig. 31.

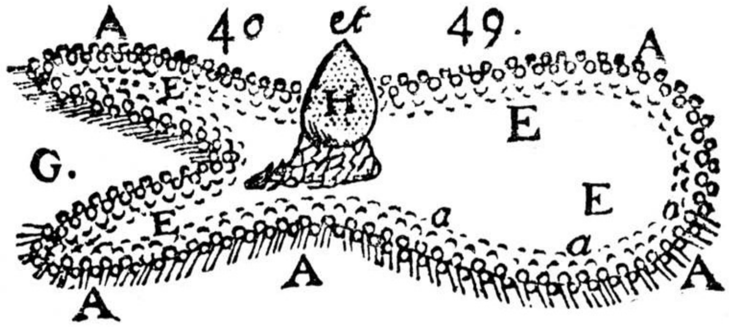
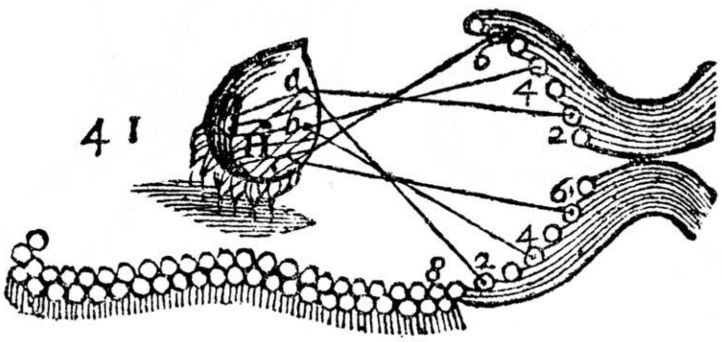


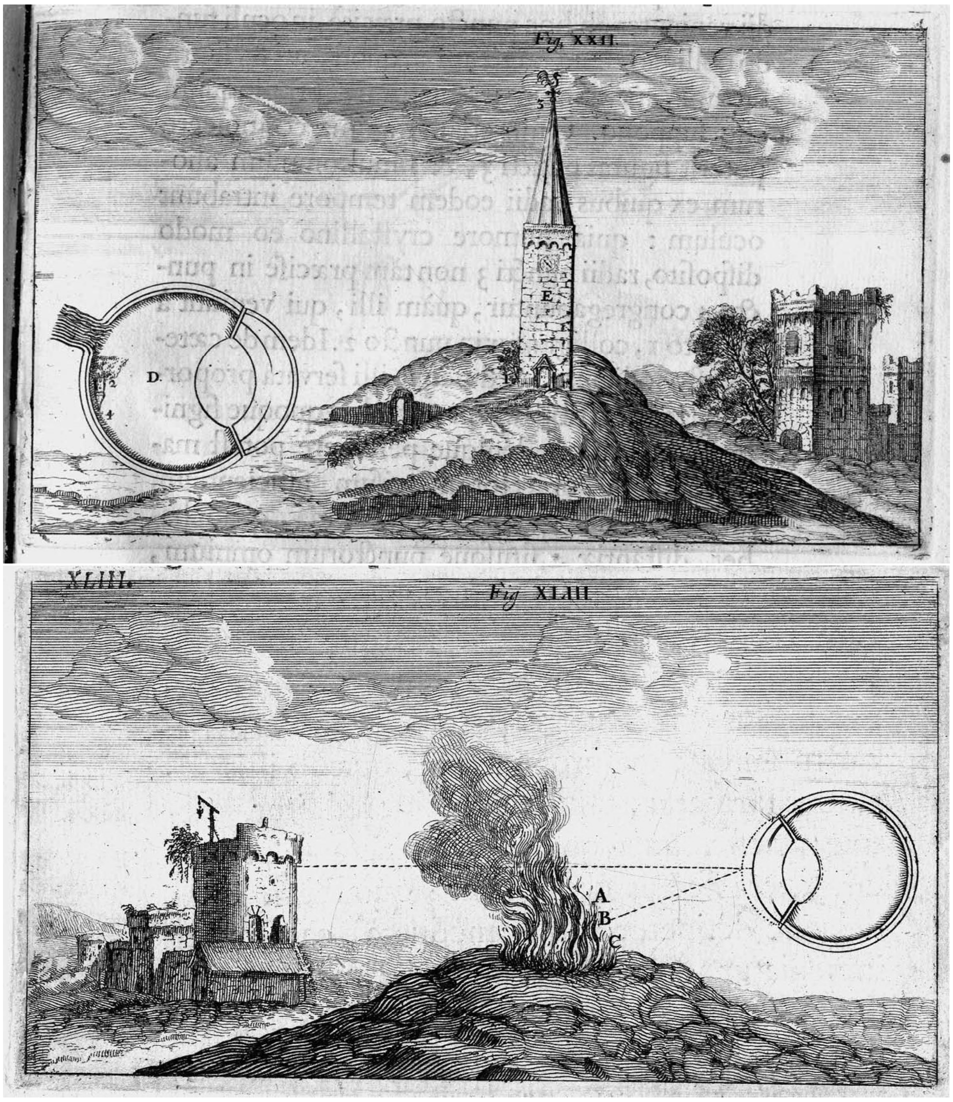
*Fig. 32.**



Figures 20 and 21: Depiction of the moveable pineal gland, from Descartes' De l'homme, ed. Clerselier (1664).

jects at various distances, but also how the illusion of distances is rendered two-dimensionally.[59] Precisely for this reason, Wilkin maintains, Clerselier rejected this image, in addition to the fact that it relied on a form of descriptive realism that Descartes sought to avoid. Yet this argument ignores that Schuyl employs

59 Wilkin, "Figuring," 46.



Figures 22 and 23: Perspectival perception of objects at differing distances and in varying circumstances, from Descartes' De homine, ed. Schuyl (1662).

a method of reproduction from the *trompe l'oeil* tradition precisely because he wants to explain illusionism. In fact, in contrast to the illusionism in the depiction of the sleeping brain, his image strategy is here successful. Schuyl's self-reflexive use of images corresponds in principle to Descartes' own 'dis-illusioning' use of images in the *Météores*, where supposed wonders of nature are made 'trans-

Fig. 29.

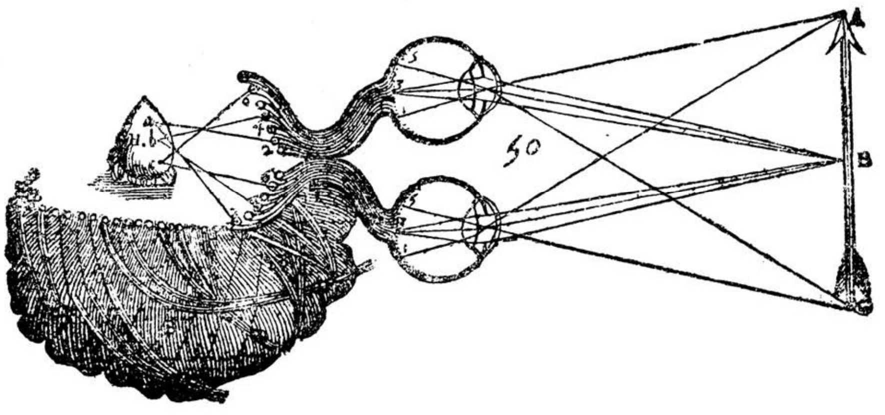


Figure 24: Perspectival perception, from Descartes' De l'homme, ed. Clerselier (1664).

parent' with the aid of images – although Schuyl goes beyond Descartes to the extent that the images themselves rely on illusionistic effects. Actually, already as a young man, Descartes had devoted a great amount of time to the analysis of optical illusions and the explanation of their functioning.[60] And in his *Dioptrique*, Descartes employs one such bodiless eye in the *camera obscura*-depiction in order to demonstrate a perspectival representation of an object. Nor does Schuyl's eye have anything 'godlike' about it – otherwise it would have had to be drawn into the heavens, above. While Descartes usually communicates methods and techniques that may lead to the expansion of knowledge, he never attributes omniscience to the understanding of an effect. He never assumes an all-knowing viewpoint from Mount Olympus; he rather attempts to formulate hypothetical models of fictional people and worlds bound by their own perspective. As the perspectives change from ontological to epistemological, and back, the explanations also change.[61] In Descartes' natural philosophy, various dispositions are designated as responsible for why an object behaves first one way and then another. Schuyl's image in fact reproduces Descartes' relational perspectivism quite adequately.

Schuyl also seems to be closer to Descartes in his image of memory, which I have analyzed elsewhere.[62] There, one sees a woman's arm embroider a pattern.

60 Cf. AT X, 215; AT X, 505.

61 Compare Jay, "Scopic Regimes," 2-27; Rorty, *Philosophy and the Mirror of Nature*, 45.

62 Cf. Zittel, "Abbilden." There, I attempt to depict Descartes' general illustration practice as an attempt to impress the memory of the reader in precisely the manner depicted in Figure 26.

In comparison to the mechanical character of the needle-brush in Clerselier's edition, Schuyl's image makes two more things clear: firstly, imagination (*phantasia*) and recollection can also freely invent images and imprint them on the memory; secondly, it is not merely fixed patterns, but variously shaped figures that are imprinted *as images* in the memory and remain fixed there. The woman's arm in Schuyl's image is seen embroidering flowers – and indeed, Descartes' own images show more than mere diagrams (see Figures 25 and 26).

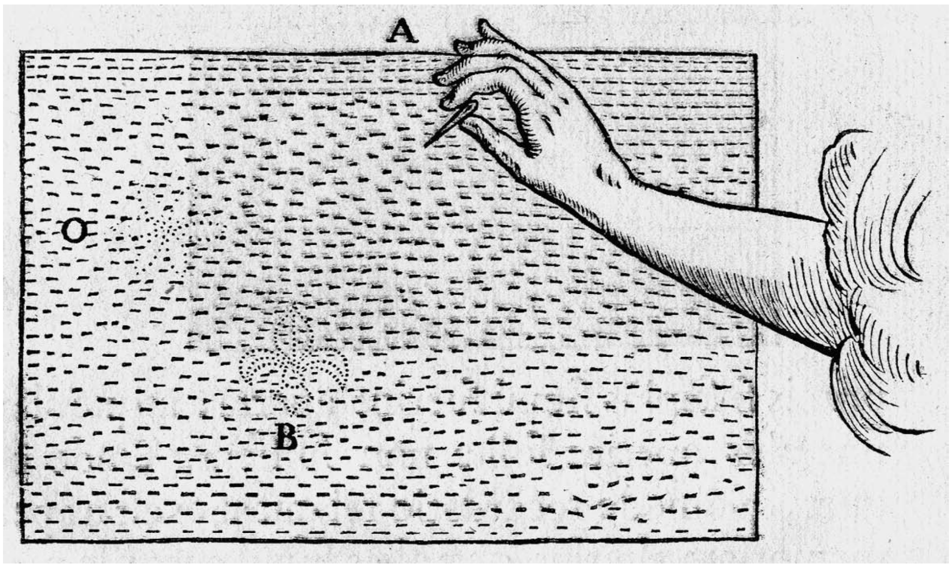


Figure 25: Impression of patterns in the memory, from Descartes' De homine, ed. Schuyl (1662).

Conclusion

A comparison of the images contained in the Clerselier and Schuyl editions reveals that Clerselier's images are neither closer to the text nor internally consistent; they are not even "clear and obvious" when examined in isolation from the text. It is a well-loved myth in the histories of philosophy and of science that the triumph of one position over another is founded on better arguments or superior knowledge. But in the case of Clerselier's editions, other explanations must be sought to explain their success. Clerselier's leading position among the Cartesians of his day certainly is a factor in the success of his set of images, but it does not suffice to explain why the images from his edition have remained so prominent, even beyond the boundaries of a purely Cartesian context. From the very beginning, the diagrammatic images in Clerselier's edition were apparently not

Fig. 3o.

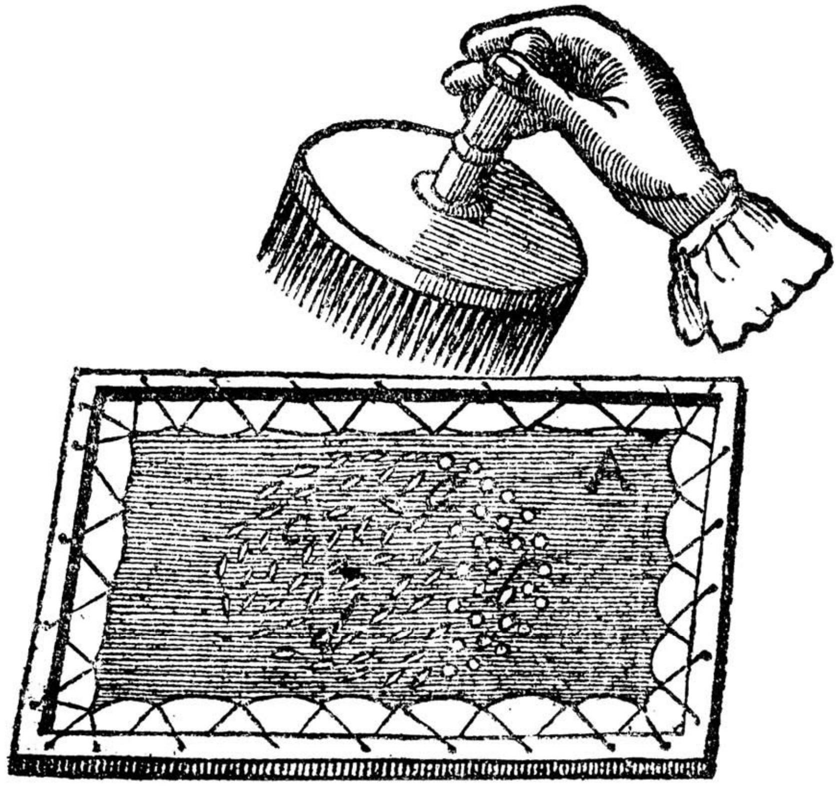


Figure 26: Impression of traces of memories in the memory, Descartes' De l'homme, ed. Clerselier (1664).

consulted and interpreted individually according to their particular textual embedding, but were perceived as a series of visual displays which referred to each other (a perception that is proven by the isolated handing-down of individual images or image series), which simply provided understandable and plausible depictions of the human body's mechanistic functions. Descartes' text came quickly to be read in light of Clerselier's images, and as a consequence of this, readers 'discovered' the functionalist concept in the text, too. Images and concepts mutually reinforce one another: the more certain and simple the interpretation of a given image, the faster the ability to see and think something different disappears. The focusing of attention on mechanistic contexts goes hand in hand with an unwillingness to seriously confront that which does not fit. Pictures and concepts form a particular style of thought within which is established what can be considered 'realistic', 'functional', or 'intelligible'.[63] The more pictures and terms or concepts correspond to each other, the more evident or 'objective' they appear – the 'harmony of deceptions' generates the appearance of self-authorization. That effect went so far in the case of Clerselier's images that only a group of them was perceived as decisive, while the rest were simply ignored. As we have seen, the complications connected with the schematic images were also ignored in favour of an adjusted reading of the images conforming to the ideal of Cartesian *clarté*.

Paradigmatic images serve to organize a perceptual and conceptual system in such a way that all cognition is reduced to the act of making the appropriate observations according to given preconditions and drawing the inevitable conclusions. Within the mechanistic paradigm, it appears in retrospect that the reductionist-functionalist variant has been particularly successful in simplifying the interplay between images and text. However, one must be careful to avoid hasty generalizations. It might, for instance, be argued that in the course of the seventeenth century's cultural, social, and economic developments, machines played an increasingly important role and that, for that reason, a collective inclination grew toward a functional understanding of causal interactions. Yet this impression is itself a result of selective historical reconstruction, because precisely in the field of biology there existed various schools of thought with a clearly anti-reductionist orientation.[64] It must, by way of conclusion, be stressed once more that Descartes' understanding of mechanistic processes was far more complex than later depicted. Moreover, there existed several forms of mechanistic thought in the seventeenth century, not just one. Yet, one variant came to achieve in the perspective of the historiography of later centuries an unchallenged dominance. This success was due to the establishment of a simple, reasonable, and correspondingly powerful functionalist-rationalist machine model. But, as I hope to have shown, not Descartes was the creator of the Cartesian *esprit mécanique*, but Clerselier.[65]

[63] On the concept of thought styles and their support of perception, see Fleck, *Entstehung*. See on this Zittel, "Harmonien," 54-75, and Zittel, "Ludwig Fleck."

[64] On anti-mechanistic biological concepts in early modern France, see Brandstetter, "Sentimental Hydraulics," 495-512.

[65] Lüthy ("But were there Mechanical Philosophers besides Descartes?" [forthcoming]) has pointed out that Robert Boyle redefined the expression "mechanical philosophy" in 1661, shortly before Clerselier's edition came out, as a collective term for Cartesianism and Atomism. Given Descartes' professed anti-atomism, this Boylean definition is of course untenable as a characterization of Descartes' own philosophy.

Trading Luxury Glass, Picturing Collections and Consuming Objects of Knowledge in Early Seventeenth-Century Antwerp

Sven Dupré

Introduction

In a letter to Pope Gregory XIII, the famous printer and publisher Christoph Plantin, who had been born in the French town of Tours, explained why he decided to move to Antwerp in the mid-sixteenth century to practice his trade:

> No town in the world provides more advantages for the profession I wanted to pursue. It is easy to get there, one sees different countries get together at the market; one also finds all the raw materials which are indispensable for my craft; for all professions, there is no problem in finding labourers who can be instructed within a short time.[1]

Around 1550 Antwerp had become the most important commercial metropolis north of the Alps. By shipping spices along the African coast the Portuguese provided serious competition to the Venetian spice trade in the late fifteenth and early sixteenth centuries. As the Portuguese decided to make Antwerp their commercial hub of the spice trade north of the Alps, Antwerp profited most from these developments in long-distance trade.[2] However, Plantin's own trade illustrates that Antwerp's economic status also made it an attractive place for the establishment of a knowledge industry; in this specific case, of one of Europe's leading publishing houses. Like that other city across the Channel, Elizabethan London, Plantin's Antwerp, by drawing together cartographers, naturalists, mathematics teachers, instrument makers and alchemists – to name but a few trades – became a 'knowledge hub' foreshadowing Baconian ideals.[3]

1 Cited and translated in Limberger, "No Town," 59.
2 Ibid., 41-44.
3 For London, see Harkness, *The Jewel House*. For some suggestions about the Antwerp knowledge economy, see Vanpaemel, "Science for Sale," 287-304.

The closing-down of the river Scheldt after the Spanish gained military and political control over Antwerp in 1585, and the subsequent development of the front line into a border separating the independent Dutch Republic in the north from the Spanish Netherlands in the south, provided a serious blow to Antwerp's economic status. Traditional historiography attributed the rise of Amsterdam in the seventeenth century, when the city came to dominate world trade, to the migration of merchants from Antwerp to the north. Similarly, migration of mathematicians, printers, and others active in Antwerp's knowledge trades to the north was held responsible for the rise of science and technology in the Dutch Republic and their so-called decline in the Spanish Netherlands after 1585. However, more recent studies have attempted to be more precise about the role of southern merchant immigrants in Amsterdam's economy. While no other city welcomed as many merchants from the Southern Netherlands as Amsterdam, these immigrants typically did not belong to Antwerp's merchant elite, but only embarked on their careers in international trade in Amsterdam.[4] Similarly, the importance of the massive immigration in the late sixteenth century to the acceleration of technological development in the United Provinces has been toned down.[5] On the one hand, the importation of technology in the north started long before 1585 by small-scale immigrations from the South and continued well into the eighteenth century. On the other hand, the Dutch Republic did not exclusively borrow technological knowledge and skills from the south. Finally, doubts have been raised about the direct connection, by massive migration, between the rise of science in the Dutch Republic and its supposedly simultaneous decline in the Southern Netherlands.[6] This is primarily a question of timing: not until the mid-seventeenth century did science and scholarship flourish in the Dutch Republic. Moreover, one can also question the continuity between the kind of 'science' practiced in the North and the South.

Amsterdam's rise to dominance of world trade has recently been attributed to the development of the city after 1600 in to one of the most important gateways of exchanges of information on geographically distributed markets across the globe.[7] Similarly – but replacing the discussion from the level of information to that of knowledge – Harold Cook has argued that "it was no accident [...] that the so-called Scientific Revolution occurred at the same time as the development of the first global economy," because both merchants and natural philosophers in the

4 Gelderblom, *Zuid-Nederlandse kooplieden.*
5 Davids, *Dutch Technological Leadership*, 203-43.
6 De Bruycker and Van Netten, "Bloei, verval en migratie," 3-30.
7 Lesger, *Handel in Amsterdam*, 209-49.

Dutch Republic came to share the same values and placed high value on knowledge that came from the acquaintance with objects.[8] In Antwerp, too, as we will see, commerce and economy, on the one hand, and information and knowledge on the other, were intimately connected around 1600. But the doubts that have been raised about the alleged 'continuity by massive migration' should make us sceptical about drawing parallels too readily between knowledge economies in the northern and the southern Netherlands.

In this essay, I will discuss the importance of the invention, the manufacture, the trade and the consumption of luxury goods to Antwerp's knowledge economy in the early seventeenth century.[9] Already in the sixteenth century the manufacture of luxury goods was important to Antwerp's economy, but in the early seventeenth century, when the economic climate in the city generally degenerated, Antwerp specialized in the invention of a particular strand of luxury goods, that is those which carried a message about the high value of knowledge. This knowledge was often (but not exclusively) mathematical. However, this knowledge, too, was gained by acquaintance with objects – mathematical objects or objects like mathematical instruments, of which the construction and use was based on mathematical knowledge. This provides us with an interesting difference with the claim made for the connection between commerce and science in the Dutch Republic. While for Cook the objects supporting his claim were *naturalia* and *materia medica* arriving through the global trade networks in collections in the Dutch Republic, in Antwerp these imported materials and objects were used to create other, newly invented luxury goods which, in their turn, exported claims about the high value of mathematical knowledge and knowledge gained by acquaintance with mathematical objects which the materials and objects as such did not carry. In Antwerp, luxury goods were thus invested with a meaning – that is, the high value placed on knowledge that came from the acquaintance with objects – about which the objects themselves were silent.

I will illustrate that Antwerp's role in global trade networks attracted foreign merchants and entrepreneurs to the city as well as the materials and foreign skills necessary to establish a local industry of luxury goods by discussing the establishment and development of a *façon de Venise* glass industry in Antwerp. However,

[8] Cook, *Matters of Exchange*, 411. Cook wishes to revive the theme of science and commerce. The merging of the fields of art history and economics has a longer recent history of fruitful collaboration. For a short overview, see the introduction to De Marchi and Van Miegroet, *Mapping Markets*, 3-13.

[9] For this connection between science and the consumption of luxury goods in seventeenth-century England, see Peck, *Consuming Splendor*, 311-45.

this essay does not only wish to illustrate the connections between luxury consumption and the import of foreign skill. The central point is that the early seventeenth century Antwerp art dealers used *façon de Venise* glass to create another luxury good: art cabinets with a so-called 'perspective' made of *cristallo* glass, a design feature invented in Antwerp which distinguished them from art cabinets produced elsewhere, which carried a message about the high value placed on knowledge. The art cabinets made similar claims as the contemporary pictures of collections (equally a luxury good), a genre invented in Antwerp, which was fashionable during the first half of the seventeenth century. While these paintings argued for the high value of knowledge by situating iconoclastic donkeys that destroyed mathematical objects and paintings in the representations of the collections, in a similar vein the users of the art cabinets were exposed to the catoptrics of Hero of Alexandria, in which Hero underscored the epistemic superiority of the mathematician over the ignorant audience, who could only undergo the optical effects.

Antwerp's Luxury Glass

After a short period of economic decline in the 1520s Antwerp began its true Golden Age. Beginning in the 1530s the export, especially to the Iberian Peninsula, of locally produced luxury goods, such as tapestries, jewellery, paintings and books was the dominant factor in the flourishing of Antwerp's economy. For the production of these luxury goods Antwerp depended upon the immigration of foreign skills.[10] The city encouraged foreigners, especially those who were capable of innovation, to settle in Antwerp by offering them premises in the city to manufacture luxury goods, privileges or a monopoly to protect the new trades from local competition. This policy made Antwerp an attractive place for foreigners to settle, but undoubtedly, the most important reasons of Antwerp's attractiveness were those that Plantin summed up in the letter with which I began this chapter. One economic historian summarized those as follows: "The town offered a combination of raw materials, highly skilled labour force and a high demand for local consumption as well as for export."[11]

Paintings, musical instruments, books and prints, as well as tapestries, made in Antwerp, were exported across the globe, but also sold to the local and increasingly wealthy elite. In Antwerp luxury goods were brought on the market at

[10] For Antwerp's luxury industry, see Thijs, "De Antwerpse luxenijverheid," 105-13.
[11] Limberger, "No Town," 54.

panden.[12] These market places, an Antwerp invention, grew out of the *pand* situated in the cloister of the Dominicans in Antwerp, where members of the Guilds of Saint Luke and Saint Nicholas marketed a variety of luxury goods, such as paintings, silk and silverware, from the middle of the fifteenth century. The Dominican *pand* was later joined, and eventually replaced, by other and sometimes more specialized *panden*, such as the *tapissierspand*, and the *schilderspand* inside Antwerp's new bourse. One of the luxury goods marketed at the Dominican *pand* as early as the late fifteenth century was glasswork. That glasswork was sold alongside paintings is, as such, unremarkable, since glassblowers, mirror-makers and painters belonged to the same guild of Saint Luke. In the *Liggeren* of 1588-1589, 33% of the masters who were members of the Guild of Saint Luke were painters, 11% glassblowers and 2% mirror-makers.[13]

The glasswork sold at the *pand* in the late fifteenth century must have been brownish *Wald*-glass. In the fifteenth century, however, the Venetians (the island of Murano being the most important centre of glass production at the time) introduced a new kind of colourless glass, known as *cristallo*, to denote that it was as clear as rock-crystal.[14] The production of this glass was based on the use of coastal plant ashes (instead of inland plant ashes which were used in regions north of the Alps, for example, in Bohemia, in the production of *Wald*-glass) and on the controlled addition of manganese oxide, the decolorizing agent that neutralised the greenish tint in the glass which came from iron impurities. Venice imported coastal plant ashes from the Levant; when a glass industry was established in Antwerp, for this same purpose the ashes of the barilla plant were imported from Spain.[15] This new type of glass allowed the move of the glass-ovens from densely forested regions, such as Hainaut, in which *Wald*-glass was made on the basis of locally available woods, to a city like Antwerp, which relied on the import of coastal plant ashes through its global trade networks.

Venetian knowledge of glass-making was imported by Italian merchants who set up their ovens and shops in Antwerp and who brought with them Italian glassmakers who possessed the know-how of the making of *cristallo* glass.[16] After several unsuccessful attempts to establish glass-ovens for the production of *façon*

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12 Vermeylen, *Painting for the Market*, 19-28.

13 *Ibid.,* 127-39. See also Denissen, "Het glazenmakersambacht," 15-30.

14 For *cristallo* glass composition and quality in Venice, see Mandò, Mercatelli, Molesini, Vannoni and Verità, "The Quality of Galileo's Lenses," 78-85.

15 See El-Dekmak-Denissen, "Glas," 15.

16 For the establishment and history of the Antwerp glass industry, see Veeckman and Dumortier, "La production de verres à Anvers," as well as other papers in this volume discussing the archaeological evidence. Older but still useful is Hudig, *Das Glas*, 14-17.

de Venise glass in Antwerp in the 1530s, the city of Antwerp awarded in 1542 a considerable sum of money to the Italian Giovanni Cornachini to establish Antwerp's first workshop producing the highly demanded *cristallo* mirrors, for which Murano had gained world-wide fame. When in 1558 Jacomo Pasquetti, an Italian merchant from Brescia, acquired from the Venetian Jacomo di Francesco the patent – and thus the monopoly – to produce crystalline glass in Antwerp, this was the beginning of a period of flourishing of Antwerp's *façon de Venise* glass industry.

The fall of Antwerp in 1585 undoubtedly created a more negative economic climate, and because of the religious troubles, painters and many other producers of luxury goods left Antwerp. In 1592 Ambrogio Mongardo, the successor to Pasquetti as the head of Antwerp's *façon de Venise* glass industry, complained that many of his highly skilled workers were secretly solicited to come to London, or Middelburg where a merchant, Govaert van der Haeghen, formely based in Antwerp, had recently established a glass industry.[17] However, by this time, Antwerp's economy was already showing a modest recovery. On the one hand, Antwerp fulfilled its role as a *Dispositionsplatz*, which means that the goods were actually not physically present in the city: merchants relied on their international network of business contacts, in which they were helped by the Diaspora of Antwerp merchants which had preceded. On the other, in spite of the migration

[17] Mongardo first complained about the competition from London and Middelburg in his request to the City of Antwerp in 1581: "[...] nevertheless it has come to our knowledge that a certain Govaert Verhaegen, coming from England, recently received from the Council of Zeeland, residing in Middelburg, or from the Law there, the privilege and the permission to establish ovens in this same city of Middelburg, and also to make there glass in the Venetian manner [...] much to the disadvantage and the detriment of the applicants" / "[...] nochtans es tot huerlieden kennisse gecommen dat eenen Govaert Verhaegen, commende vuyt Engelant, soude onlancx vercregen hebben van die vanden Rade in Zeelandt, residerende tot Middelborch, oft van die vander Weth aldaer, oirloff ende consent om binnen deselve stede van Middelborch te mogen oprechten, fournaisen ende aldaer oick maecken gelaesen opde voirs. maniere van Venegien [...] tot grooten achterdeele ende schaede vanden supplianten [...]." In 1592 Mongardo repeats his earlier complaints more forcefully: "Moreover, the masters are also secretly sollicited and requested to come to work in London in England and likewise in Zeeland, where since briefly ovens [to make] crystal [glass] have been established to draw away the art from here [Antwerp] [...] which would cause the total ruin of the applicant and his household [...]" / "Bovendyen soe worden de meesters oyck secrtelycken gesoliciteert ende aensocht, ten eynde zy tot Londen in Engelant ende disgelycx in Zeelandt souden comen wercken, alwaer tzedert corten tyt cristalyne fournaisen syn gedresseert ende opgericht, om de conste van hier te trecken [...] al dwelck soude causeren de totale ruine des suppliants ende zyn huysgesin [...]." Génard, *De oude Antwerpsche glasblazerijen*, 43, 53-54. Hudig, *Das Glas*, 16; Denissen, "Overzicht," 13. For the glass industry in Middelburg, see De Waard, *De uitvinding*, 105-114.

of skills to the north about which Mongardo complained, Antwerp continued to flourish as a centre of the luxury industry. The Twelve-Year Truce, signed in April 1609, even marked the beginning of Antwerp's 'Indian Summer'. The manufacture and trade of some types of luxury goods thrived in this period. During the directorship of Sara Vinckx, Mongardo's widow, who later re-married the Italian Philippo Gridolphi, the Antwerp glass industry flourished in the last years of the sixteenth century and the first years of the seventeenth as never before. During this period the building where the glass-ovens were in operation, the *Gelaesenhuys* at the Meir, was enlarged as to make room for two additional Italian master-glassblowers, bringing their total number to eight.[18] Only after Gridolphi's death in 1625 did the decline of Antwerp's *façon de Venise* glass industry set in.

Thus, despite the economic, religious and political troubles of the second half of the sixteenth century, Antwerp continued to flourish as a centre of manufacture and trade of luxury goods well in to the seventeenth century. The immigration of foreign – and in the case of luxury glass (but not only), Italian – knowledge of the making of luxury goods was essential to this economic success. Antwerp's position in the global trade networks (even after 1585 it continued to be important for the trade with the Iberian Peninsula) thus also attracted foreign merchants to the city. They were partly the driving force behind the production of luxury goods, as we have seen. But they were also partly – beside the local wealthy elite – responsible for the consumption of luxury goods. In what follows I will discuss the culture of collecting in early seventeenth-century Antwerp with an eye towards the mercantile collections for which luxury goods were sometimes acquired. In particular, I will be interested in the relation between the collections and the pictures of collections, a newly invented luxury good. While Antwerp relied on the immigration of foreign skills to establish luxury industries in the sixteenth century, in the early seventeenth century Antwerp became a producer of luxury goods, such as pictures of collections, which were a local invention.

Ignorance, the Consumption of Knowledge and Collections

The collection of Emanuel Ximenez shows how the spheres of commerce, luxury glassworks, and natural knowledge were connected in early seventeenth-century Antwerp.[19] The Ximenez family was one of the wealthy Portuguese merchant-

18 El-Dekmak-Denissen, "Glas," 17.

19 The collection of Emanuel Ximenez is the subject of a collaborative project with Christine Göttler. This project deals more extensively with the Ximenez family than can be discussed here.

bankers families who resided in Antwerp from the mid-sixteenth-century for several generations. They were active in global trade of bulk products and luxury goods (sugar and spices, jewellery and books, etc.) and in monetary transactions with the Spanish Crown (*Asiento's*).[20] The Ximenez family had offices in numerous cities including Lisbon, Seville, Venice and Hamburg, and close ties to the court in Madrid and the Medici in Florence.[21] In Florence Ximenez met the priest Antonio Neri, whom he later hosted in Antwerp. During his stay in Antwerp Neri observed the work in the *façon de Venise* glass factory of Gridolphi, since Gridolphi and Ximenez were neighbours (Ximenez's house was located at the Meir, an extremely wealthy area of the city, where Gridolphi's *Gelaesenhuys* was also found). Partly on the basis of his experience in Gridolphi's ovens Neri published *L'arte vetraria* in 1612, the first book to discuss the manufacturing of *façon de Venise* glass. The correspondence of Ximenez and Neri, which was only interrupted during Neri's visit between 1604 and 1611, shows that they shared an interest in Paracelsian alchemy and medicine.[22] One of the rooms in Ximenez's house was equipped as a laboratory ('distillation and alchemy chamber'). As we will see below, this same house contained the most splendid collection and library to be found in early seventeenth-century Antwerp.

The extent to which the spheres of commerce, the manufacture of luxury glass and collecting mixed in Ximenez's house is, to the best of my knowledge, unique in early seventeenth-century Antwerp. Ximenez's collection shows how the consumption of luxury goods went together with an interest in the bodies of knowledge involved in the production of luxury goods – in the case of Ximenez, glass – but we will see below that his epistemic interests reached beyond glass and alchemy to other luxury goods (such as mathematical instruments) and the accompanying bodies of knowledge. This combination was not unique to Ximenez; instead, we will see that it is a recurring characteristic of collectors, and as such,

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[20] Pohl, *Die Portugiesen*, in particular for their commercial activities, 78-83; with a family tree at 357.

[21] Fernão Ximenez, Emanuel's uncle, established a commandery of the Order of Saint Stephen in Antwerp. This military and religious order was founded by Cosimo de' Medici. The Order was irrevocably linked to the Medici, because papal bulls stipulated that the Grand Dukes of Tuscany held its Grand Magistery. Emanuel inherited the patronage of the commandery from Fernão. See Pohl, *Die Portugiesen*, 327. The Ximenez family also supplied influential members of the Florentine bureaucracy. For example, in the first decade of the seventeenth century Manuel Ximenez, another uncle of Emanuel and a Jesuit priest in Florence, and Niccolò Ximenez, a senator in Florence, were involved in the failed attempts of the Grand Dukes Ferdinando and Cosimo II to buy Sierra Leona from the Spanish Crown. See Hair and Davies, "Sierra Leona," 61-69.

[22] Galluzzi, "Motivi paracelsiani," 31-62; for the Neri-Ximenez correspondence, see 50-51.

telling of the culture of collecting in early seventeenth-century Antwerp. Moreover, the presence of a laboratory in Ximenez's house suggests an interest in a particular type of knowledge – that acquired by the tactile engagement with objects and materials. Again, this will be confirmed by other collections, and by pictures of collections.

Figure 1: Frans II Francken, Banquet in the House of Burgemeester Nicholas Rockox, 1630-5. (Munich, Bayerische Staatsgemäldesammlungen)

The pictures of collections will help us to understand why early seventeenth-century collectors in Antwerp brought together objects in a collection. But let us first turn to another aspect of the relation between the collections and the pictures of collections: are these pictures faithful to the actual collections brought together in Antwerp in the same period? The paintings of collections strike us by the juxtaposition of paintings, *naturalia* (for example, the shells displayed on the table in lower left corner of the painting of Antwerp burgomaster Nicholas Rockox's cabinet; see Figure 1) and *artificialia* (for example, the mathematical instruments, globes or telescopes and other visual aids on Pieter Paul Rubens' and Jan Brueghel the Elder's *The Sense of Sight*, see Figure 2). While these paintings seemingly give us a privileged insight in the early seventeenth-century collecting practices in Antwerp, art historical scholarship warns us against taking these paintings at face value as evidence of existing collections. Zirka Filipczak,

Figure 2: Jan I Brueghel and Peter Paul Rubens, The Sense of Sight, 1618. (Madrid, Prado)

for example, has claimed that the presence of *naturalia* and *artificialia* was the product of the painters' artistic liberty, because encyclopaedically organized displays on a large scale had not existed in Antwerp during the early seventeenth century.[23] If Filipczak is right, this would point to a significant difference between Antwerp and contemporary collections in the Dutch Republic, which did contain *naturalia*.[24] There is, however, evidence to the contrary.

If one relies on the inventories as published by Jan Denucé in *De Antwerpsche 'konstkamers'* (1932) the impression one gains is indeed that in the early seventeenth century the only existing collections were those of paintings only.[25] Erik Duverger's more recent publication of the inventories of Antwerp households

23 Filipczak, *Picturing Art*, in particular 65.

24 For *naturalia* in collections in the Dutch Republic, see (among others) Goldgar, *Tulipmania*, in particular chapter 2, 62-130; Jorink, *Het Boeck der Natuere*, 267-360; Swan, "Making Sense of Medical Collections," 199-213. Interestingly, Claudia Swan shows how the collection of the Leiden pharmacist Christiaen Porret resembled a *Kunstkammer* in that it not only contained items relating to medicinal preparations, but in addition to these *naturalia*, numerous ethnographic objects and *scientifica*. This is not to say that differences between the north and the south were non-existent. As to images of objects – in turn objects for collections – Honig argues that "no easy art historical connection exists to link Dutch imagery of things to their status as objects of commercial exchange and value, as does exist (if negatively) in the art of Antwerp." See Honig, "Making Sense of Things," 172. Older but still useful are Van Gelder, "Noordnederlandse verzamelingen," 123-44; Scheller, "Rembrandt," 81-147.

25 Denucé, *De Antwerpsche 'konstkamers'*.

in the seventeenth century, however, makes clear that Denucé systematically left out all objects other than paintings. The inventories as published by Duverger show that the paintings of collections do not represent actual collections in the sense that, unlike Denucé's notion of 'const-kamer' suggests, the collected objects were often scattered over the different rooms in early seventeenth-century houses. But the paintings were more faithful to the actual content of collections than Filipczak assumed. Besides the important collections of the merchants Nicolaes Jongelinck and Diego Duarte, which indeed were collections of paintings only, Antwerp housed many collections with a more diverse range of objects.[26] For example, the famous cartographer and antiquarian Abraham Ortelius displayed a collection of paintings, sculpture, Greek and Roman coins, shells and minerals in his house.[27] The inventory of the collection of Antwerp burgomaster Nicholas Rockox at the moment of his death in December 1640 lists not only paintings, books and antiquities, but also the *naturalia* which Frans Francken depicted in his painting of this collection (see Figure 1, above).[28] Rockox's study contained a collection of shells.

The inventories of Antwerp households of the seventeenth century show that paintings were the luxury goods that were owned in higher numbers than any other type of objects. However, other luxury goods such as *façon de Venise* glasswork, and *naturalia* and *exotica* were also often found, even in isolation, that is when no or few other objects, especially paintings, were collected. Let me give a few examples. In 1629 Johannes Bol displayed in the study above his shop a small collection of books, a few maps and two telescopes.[29] Among the *naturalia* found in the inventories are elephant tusk, sea shells, crocodiles, birds, *herbaria* and other

26 Buchanan, "The Collection of Niclaes Jongelinck I," 102-13; Buchanan, "The Collection of Niclaes Jonglinck," 541-50; Dogaer, "De inventaris van Diego Duarte," 195-221; Vlieghe, "Une grande collection anversoise," 172-204. Jaap van der Veen's discussion of collections of paintings in the Netherlands is useful, but repeats the traditional contrast between collections of *naturalia* in the northern Netherlands versus collections of paintings in the southern Netherlands. See J. van der Veen, "Galerij en kabinet," 145-64. For the collection of Cornelis van der Geest, see Peterson, "The Five Senses of Cornelius van der Geest."

27 Büttner, "De verzamelaar Abraham Ortelius," 169-80. See also Meganck, *Erudite Eyes*. For collecting material and visual evidence in the context of the related antiquarian and numismatic interests of Justus Lipsius, see Papy, "An Antiquarian Scholar," 97-131. It is worth noting that Lipsius sometimes appears amongst the *cognoscenti* depicted in Antwerp pictures of collections.

28 The inventory mentions "diversche Zeusche schelpen van veel couleuren" in the study (*comptoir*). For the inventory of Rockox's house, see Duverger, *Antwerpse kunstinventarissen*, vol. 4, 382-87, 386. For the paintings in Rockox's collection, see Van de Velde, "De schilderijencollectie," 33-56.

29 Duverger, *Antwerpse kunstinventarissen*, vol. 3, 155-56.

cruydtboecken, a piece of a whale found in the river Scheldt, and wolf teeth. An inventory of 10 April 1614 shows that Filips van Valckenisse, a friend of Rubens, possessed dozens of shells of different sizes and colours.[30] In 1617 the collection of the painter Frans I Francken contained (as is to be expected) paintings, but also shells and, especially, two large *kieckhorens*, a type of seashell that was much in demand.[31] In the shop of the apothecary Abraham van Horne, who died on 18 August 1625, a crocodile hung down from the ceiling, while also a snake, a turtle, a *vischtonge*, and an ostrich egg (*struyseye*) were displayed, providing us with a picture of an apothecary's shop more familiar from contemporary Italian examples.[32] Thus, the inventories show that a whole range of other objects besides paintings were found in the houses of Antwerp's merchants, apothecaries, craftsmen and painters.

Furthermore, in contrast to Filipczak's claim, the inventories point to the existence of several collections containing mathematical instruments only as well as collections juxtaposing *artificialia* and *naturalia* in early seventeenth-century Antwerp. Let me mention two splendid examples of this type of collection. At the time of his death in 1652 Jan van Meurs, an alderman of the city of Antwerp during the last years of his life, and otherwise printer and bookseller as well as a member of the Guild of Saint Luke, was the proud owner of a *blomhoff* or garden in which fig, pomegranate and orange trees grew. In this garden one could also find a cabinet with a few landscape paintings, a collection of seashells "and other similar curiosities." Inside his house the visitor could admire a collection of paintings, exotic objects (such as 'Indian antiquities'), more shells, mirrors, a snake, a clock made of rock crystal, corals, two globes, yet another clock, a compass and a pair of dividers, and an astrolabe.[33]

Undoubtedly, though, the most splendid example of this type of collection is that of Emanuel Ximenez. In May 1617, at the moment of the death of his wife, Isabella da Vega (of another Portuguese merchant-bankers family residing in

[30] The inventory listed "een koffer met zeeschelpen" in a room upstairs on the side of the street, and elwehere, together but organized to size, more than fifty shells. See Duverger, *Antwerpse kunstinventarissen*, vol. 1, 299-311. For Filips van Valckenisse and Rubens' entry in his *album amicorum*, see Muller, "De verzameling van Rubens," 15-17.

[31] Duverger, *Antwerpse kunstinventarissen*, vol. 1, 388-94.

[32] *Ibid.,* vol. 2, 432. For Italian examples, see Findlen, *Possessing Nature*.

[33] The inventory lists "een houten reck met diversche Indiaensche antiquiteijten," and in the garden "dry granaetboomen, dry vygeboomen, eenen grooten oraingerienboom [...] ses teylen met jonge oraingieboomkens [...]," and the *Achtercamerken op den Hoff* two landscape paintings and "een weecke casse met cieckhoorens ende andere diergelijcke rariteijten." Duverger, *Antwerpse kunstinventarissen*, vol. 6, 264-69.

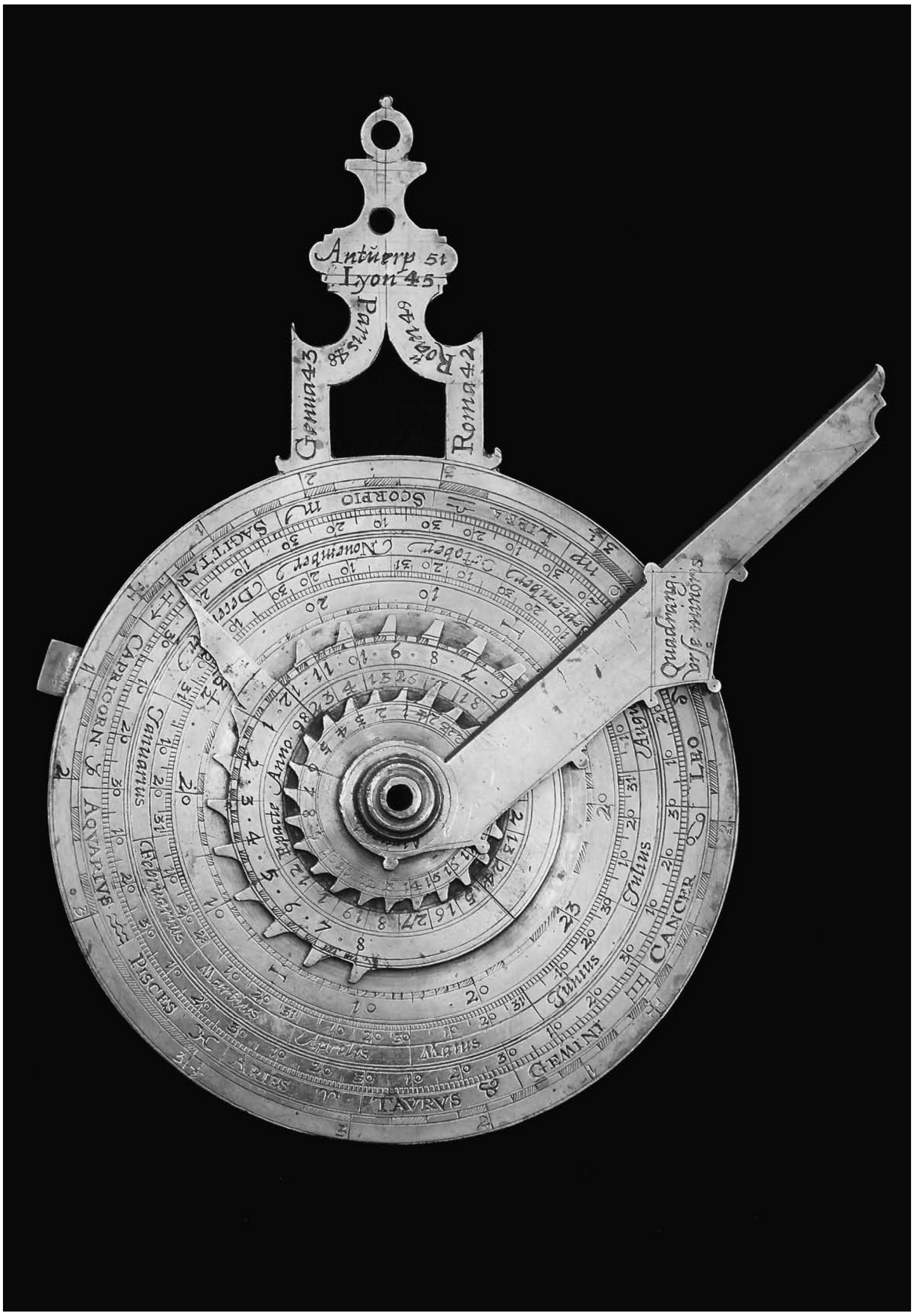

Figure 3: Michiel Coignet, Nocturnal and sundial, 1598 [brass, diameter 108 mm]. (Museum of the History of Science, University of Oxford, inv. 44721)

Antwerp), *naturalia* and *artificialia* were brought together in the same room: two globes, exotic animals, a crocodile, several maps, instruments to draw in perspective and other mathematical instruments, a sundial made by the Antwerp mathematician and instrument-maker Michiel Coignet (see Figure 3), another wooden instrument to draw in perspective, a small copper astrolabe, a wooden Jacob's staff, a wooden instrument for surveying, a telescope in three parts and coated with leather, two burning mirrors and three eyeglasses together in a wooden box, two prisms, an instrument for dialling, and so on.[34] In another room of the house, in which several paintings hung on the walls, including a work by Rubens and a large *cristallo* mirror in an ebony frame, diverse mathematical instruments were again displayed. In the study, several objects were brought together, including a quadrant and a large astrolabe, both made by Coignet (see Figure 4). Ximenez's taste for instruments does perhaps point us to a difference with collections in the north. In contrast to the cosmopolitan acquisition policies in the Dutch Republic, collectors in Antwerp cultivated a local canon of painters. Ximenez's fondness for Coignet instruments, and possibly other Flemish instruments through the family's contacts with Plantin, suggests that we are allowed to extend this preference to instruments.[35]

Local makers (whenever identifiable, mostly Blaeu and Hondius), were also responsible for the terrestrial and celestial globes found among the objects depicted in the paintings of collections.[36] In a corner of the cabinet of Cornelis van der Geest (Figure 5), cosmographers take measurements on a globe. The pose would have reminded Antwerp's wealthy collectors of a moral lesson not to indulge in their desires for riches and luxury goods, more explicitly present (as is

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[34] Duverger, *Antwerpse kunstinventarissen*, vol. 1, 400-61. For Michiel Coignet, see Meskens, *Familia Universalis*, 51-145.

[35] Plantin was a friend of the Ximenez family whose members occasionally acted as brokers and patrons of Plantin's publication projects. See e.g. Sellink, "As a guide," 40-56, and the correspondence cited there in n. 37. For the letter of Jan Moretus to Fernão Ximenez on Plantin's death, see *Correspondance de Christoph Plantin*, vols. 8-9, 559-62. The Plantin press traded not only in books, but also in Flemish mathematical instruments of makers such as Mercator and Arsenius. For example, the Plantin firm shipped Flemish instruments to Spain, including Philip II's collection of scientific instruments in the Escorial, using the Spanish theologian Benito Arias Montano, who collaborated with Plantin on the *Polyglot Bible* while he resided in Antwerp, as a middleman. See Van Cleempoel, "Philip II's Escorial," 116-23.

[36] I thank Peter van der Krogt for his help in identifying some of the globes. See Van der Krogt, *Globi neerlandici*. See also Depuydt, "Aard- en hemelglobes," 1-8 and, for an example of a Hondius globe in an Antwerp cabinet painting, see Gorman and Marr, "Others See it yet Otherwise," 85-91.

Figure 4: Michiel Coignet, Astrolabe, 1601 [gilt brass, diameter 227 mm]. (Leiden, Museum Boerhaave, inv. 3105)

Figure 5: Willem II van Haecht, The Cabinet of Cornelis van der Geest, 1628. (Antwerp, Rubenshuis)

the pose) in Pieter Brueghel the Elder's *Temperantia*.[37] But the globes also reflect the involvement of Antwerp's merchant-collectors in global trade networks and refer to the navigational and cartographic knowledge on which their commercial activities depended. In one of these paintings of collections (Figure 6), a *liefhebber* takes measurements on a celestial globe, while two other *liefhebbers* gather around a table to investigate and talk about a set of maps and a book of coastal profiles, perhaps those of Blaeu's *Licht der Zeevaart*.

Equally remarkable in the case of the globe is the tactile engagement with objects, even if the pose is admittedly stylized. Globes were not the only objects to elicit tactile engagement in paintings of collections: paintings, too, were in the beholders' hands (see Figure 7).[38] *Liefhebbers* are portrayed in the act of picking up a painting and discussing it while holding it in their hands. Something

[37] Härting, "Doctrina et pietas," 104-11.

[38] For the tacticle dimension of pictures of collections see Gage, "Some Stirring," and Peterson, "The Five Senses of Cornelius van der Geest."

Figure 6: Workshop of Frans II Francken (?), Cabinet of a Collector, c. 1615-20. (Madrid, Prado)

similar could be argued for contemporary books on cosmography. The paper instruments in those books (Figure 8), perhaps most famously in Peter Apian's and Gemma Frisius's multiple editions of *Cosmographia* produced in Antwerp and found, for example, in Ximenez's library, invited the reader to tactile engagement and interaction.[39] Moving the paper parts helped the reader to understand basic mathematical relations in cosmography.[40]

Ximenez also had an impressive library. A majority of the books were on chemistry, mathematics, astronomy, medicine, and natural history, in Latin and in half a dozen vernacular languages.[41] That ownership of a considerable number of mathematical and optical instruments went together with a library on issues of natural and mathematical knowledge is a pattern that is confirmed by other col-

39 Ximenez owned two editions of *Cosmographia* (1581, 1584). Duverger, *Antwerpse kunstinventarissen*, vol. 1, 438.

40 On paper instruments, see Vanden Broecke, "The Use of Visual Media," 130-50; Gingerich, "Astronomical Paper Instruments," 63-74.

41 Duverger, *Antwerpse kunstinventarissen*, vol. 1, 434-61.

Figure 7: Petrus Apianus and Gemma Frisius, Cosmographie ou description des quatre parties du monde (Antwerp: I. Bellere, 1581), p. 20. (Ghent University Library, BIB.182B13)

lections in early seventeenth-century Antwerp.[42] In 1619 Marcus Voitier, a priest, owned a collection which is remarkable by the almost complete absence of paintings and *naturalia*.[43] He possessed eyeglasses, compasses, several kinds of mathematical instruments, and an important collection of mathematical books, which included works of Daniel Speckle, Regiomontanus, Oronce Finé, Sebastian Mün-

[42] However, this is not to say that ownership of books was widespread in Antwerp in this period. Ria Fabri has calculated that only 6.6% of inventories of Antwerp houses in which one or more objects of art were displayed listed one or more books. See Fabri, "Diversche boeken," 9-27. Then again, Rockox's library illustrates that ownership of a considerable number of objects other than paintings in a collection went together with a library on issues of natural knowledge.

[43] Duverger, *Antwerpse kunstinventarissen*, vol. 2, 49-54.

Figure 8: Frans II Francken, Cabinet of a Collector, c. 1612-16. (Munich, Bayerische Staatsgemäldesammlungen)

ster, Peter Apian and Giovanni Paolo Gallucci. In 1625 Gillis de Kimpe, a notary, had an important collection of prints and paintings, *exotica*, sea shells, corals, a turtle and other *naturalia*, a telescope and a sundial, and a library of 405 books of all sizes and in diverse languages.[44] The fact that a collector possessed a library with books on issues of mathematical and natural knowledge, related to the instruments and other objects in his collection suggests that the owner wished to understand the objects, and that mathematical instruments were perhaps manipulated in his collection.[45]

Thus, it seems that collectors in early seventeenth-century Antwerp eagerly sought after luxury goods (paintings, mathematical instruments, globes and glass-

44 The books are not listed: “405 boecken soo cleyn als groot van verscheyden taelen.” *Ibid.*, vol. 2, 399-415, 399.

45 We see similar patterns of collecting objects and books on the making and use of these objects, and displaying them together, in the *Kunstkammer* in Dresden. There, evidence is strong that instruments were manipulated, even by the Electors. See Dupré and Korey, “Inside the Kunstkammer,” 405-20.

work, etc.), but not only for the purpose of displaying wealth. They were also interested in the luxury goods as objects of knowledge. Just as wealthy merchants in the period took lessons in drawing from artists to develop a good eye to judge paintings, collectors were also interested in acquiring the bodies of knowledge – mathematical, natural, alchemical, medical – that would allow them to understand and judge other objects in their collections.[46] This consumption of knowledge was a vehicle of social cohesion and mobility. Antwerp's wealthy merchants aspired to acquire aristocratic status, and in case they failed in this attempt, at least to imitate aristocratic ways of life. In 1584 Ximenez requested a correspondent to send him seeds of some New World flowers cultivated in the garden of the Escorial, the palace of the Spanish King Philip II.[47] Likewise, Ximenez's laboratory must have been modelled after the ducal *fonderia* of the Medici situated inside the Palazzo Vecchio, and later Palazzo Pitti, which functioned as a chemical and pharmaceutical laboratory, a forge and an arsenal for several generations at the Medici court.[48] In Florence, the alchemically interested Don Antonio de' Medici was the patron of Ximenez's friend Neri.

Court collections, then, functioned as ideal images of the collections of a wealthy merchant like Ximenez in early seventeenth-century Antwerp. Pictures of collections fulfilled a similar role. The pictures of collections were more faithful to the type of collections found in contemporary Antwerp, but their ambition was nevertheless not representational. Elizabeth Honig has argued that "the gallery picture did not represent the collection of which it was a part; rather, it served as the image of an ideal to which both the collection itself, and the activities that took place in the real 'const-camer', could be compared."[49] What the paintings of collections tell us about the actual collections is that they were places where friendship was celebrated. They were not unlike that other collection, Ortelius' *album amicorum*, reflecting his network gathered through trade and learning, a celebration of friendship (i.e. civility and learning), "intended as a bastion against time and trouble, an attempt to salvage a sense of stability and civility in a period of social and cultural disintegration."[50]

A contemporary description of the collection of a family member of Ortelius illustrates this well. The biography of the Antwerp merchant Emanuel van Me-

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46 For merchants learning how to draw, see Goldgar, *Tulipmania*, 120-21; Marr, *Between Raphael and Galileo*, Chapter 3.
47 Pohl, *Die Portugiesen*, 331.
48 Butters, *The Triumph of Vulcan*; Devlieger, *Benedetto Varchi*, 203-9.
49 Honig, *Painting and the Market*, 203.
50 Harris, "The Practice of Community," 315. See also Harris, "Het *Album Amicorum*," 117-35.

teren by his friend Simeon Ruytinck, pastor of the Dutch nation in London, in an appendix to a posthumous edition of his *Historie der Nederlanscher … Oorlogen en Geschiedenissen* (1623), portrayed his collection as a place of friendship and conversation. Van Meteren fled Antwerp because of the war and settled in London, where he became Consul of the Netherlandish traders. He was the nephew of Abraham Ortelius, and counted among his friends – all of whom signed his *album amicorum* – the painters Joris Hoefnagel and Lucas d'Heere, the merchant-humanist Johan Radermacher, and the learned men William Camden, Carolus Clusius, Iacobus Colius Ortelianus and Justus Lipsius, among many others.[51] In his biography we read that during his illness, preceding his death in London in 1612, merchants and "other good friends in great numbers" still came to visit him, and that on those occasions, Van Meteren "thanked them for their entertaining conversation in the past." Moreover, "he also wanted to see for once his medals, foreign coins, shells and other rarities, with which he sometimes (after his ordinary labour) used to entertain, although he said that such was nothing but vanity […]."[52]

In this connection, and especially with regard to the paintings in the collections, it has been noted that the *liefhebber* had to demonstrate his ability to talk about art to be allowed to participate in the community of connoisseurs – an observation that, I would argue, should be extended to the other types of objects, such as the *naturalia* (as is evident in the description of Van Meteren's collection just cited), the *exotica*, and the mathematical and optical instruments.[53] Appropriately, the latter objects are prominently displayed in the *Linder Gallery Interior*, recently discussed by Michael John Gorman and Alexander Marr.[54] The painting celebrated the shared – i.e., mathematical – knowledge on which the community of *liefhebbers* was built. If the pictures of collections are the ideal to which the

51 *Album Amicorum Emanuelis de Meteren Mercatoris Antverpiani* [Oxford, Bodleian Library, MS Douce 68]. For the perhaps least well-known friend in this company, Johan Radermacher, see Bostoen, *Bonis in bonum*.

52 "[…] durende sijn sieckte, soo nam hy seer vriendelick oorlof aende cooplieden ende andere goede vrienden, dien hem in grooten ghetale quamen besoecken, ende bedacktese voor haer voorgaende vermaeckelicke conversatie, hy wilde oock noch eens besien zijn medaillen, vrende munten, schelpen en andere selsaemheden, daer in dat hij hem somtijdts (na sijnen ordinaren arbeydt) plagh te vermaecken, doch seyde dat sulcks al maer ydelheyt en was […]." Van Meteren, *Historie*, cited from the appendix: "Het leven ende sterven van eerweerdigen, vroomen ende vermaerden, Emanuel van Meteren: Kortelijck beschreven door sijnen ghetrouwen vriendt Simeon Ruytinck."

53 Honig, "The Beholder," 280.

54 See Gorman and Marr, "Other see it yet otherwise"; Marr, *Between Raphael and Galileo*, Chapter 6.

actual collections aspired, then collectors in early seventeenth-century Antwerp did not aim to display wealth by acquiring luxury goods, but instead by acquiring luxury goods to argue for the high value to be placed on knowledge – knowledge on which the making of the luxury goods, as much as decisions about their acquisitions, depended.

Thus, for the merchant-collectors in Antwerp knowledge, as embodied in luxury goods, was a vehicle of friendship and social mobility. We should note, though, that pictures of collections show that there also was a religious angle to collecting objects of knowledge in early seventeenth-century Antwerp. In Rubens' and Brueghel, Jan I's *The Sense of Sight* (Figure 2) mathematical instruments, visual aids and a telescope figure prominently as objects of mathematical and optical knowledge. The painting argues, however, that this knowledge was to be put in the service of *pietas*. From the monkey with eyeglasses and the telescope the beholder's gaze is drawn to a depiction of the Madonna and a painting showing the healing of the blind. According to Justus Müller Hofstede, Brueghel, Jan I and Rubens show here different stages of vision, from terrestrial vision to the contemplation of divine truth.[55] More explicit religious references to the iconoclastic movement of 1566, when Calvinists cleansed most of the churches in the Netherlands of their images, are found in other pictures of collections. In several of these paintings knowledge is contrasted to ignorance, personified by iconoclastic donkeys, which smash and destroy paintings, mathematical instruments and other collectables carrying knowledge (see Figure 8).[56] Yet again, the paintings of collections argue for the high value that is to be placed on knowledge. By making use of references to the iconoclastic movement the pictures emphasize that this knowledge is to be acquired through familiarity with objects.

Art Cabinets, Glass and Optical Knowledge

The fashionable art cabinets produced in Antwerp in the first half of the seventeenth century carried a similar message about the high value of knowledge (see Figures 9 and 10). Their production arose in the same economic context as that of the pictures of collections. After the blockade of the Scheldt manufactures and merchants re-oriented the Antwerp economy towards the export of luxury goods. Cabinetmakers, too, began targeting a wealthier buying public. The art cabinets produced in Antwerp were exported, especially to the Iberian Peninsula, through

[55] Hofstede, "Non Saturatur Oculus Visu," 243-89.

[56] Härting, "Doctrina et pietas," 123-128. For the donkey as a symbol of ignorance, see Weber, "Poetenhafer," 87-89.

Figure 9: Art cabinet, mid-17th century [160 cm x 110 cm x 47 cm]. (Antwerp, Museum Rockox, KBC Bank NV, Erwin Donvil, inv. 77.144)

the networks of the art firms of such families as Forchondt and Musson.[57] Collectors bought these cabinets to display small statues and crucifixes, shells and other *naturalia*, clocks and astrolabes.[58]

If not exported, art cabinets were available for sale in local shops of art dealers, such as that of Cornelis de Wael, a merchant of ebony and mirrors, appropriately

[57] Fabri, *De 17de-eeuwse Antwerpse kunstkast*, 161-70.
[58] *Ibid.,* 184-88.

Figure 10: Art cabinet, ca. 1650 [160 cm x 108 cm x 49.5 cm]. (Amsterdam, Rijksmuseum, BK-NM-4789)

named *den Veneetsen Spiegel* (or 'The Venetian Mirror'), whose shop was located at the Steenhouwersvest in Antwerp.[59] Ebony and mirrors, indeed, were the two most important materials from which Antwerp art cabinets were made. Like other luxury industries, the manufacture and trade of ebony cabinets in Antwerp depended on the importation of foreign skills and entrepreneurs. The place of origin of the Antwerp ebony cabinet was likely Augsburg, which had a reputation as the cradle of the southern German art cabinet.[60] In fact, the first ebony workers to set up in Antwerp were German. Nevertheless, like the pictures of collections, a genre

59 *Ibid.,* 163.

60 De Munck, "Construction and Reproduction," 94-95. Perhaps most famous were the cabinets assembled by the Augsburg art dealer Philipp Hainhofer, on which see Hauschke, "Scientific Instruments," 49-55. See also Letocha, "The Augsburg Art Cabinet," 9-13.

invented in Antwerp, the Antwerp art cabinets were products of local invention. Antwerp art cabinets had a *perspectiefje* or perspective (Figure 11), made of *façon de Venise* mirror glass, a design feature that differentiated them from art cabinets produced elsewhere. Thus, Antwerp ebony cabinetmakers re-used a luxury good of Italian origin (*cristallo* glass) in combination with a luxury cabinet of southern German origin to invent a new luxury good – an art cabinet with perspective – that argued that high value was to be placed on knowledge.[61]

Figure 11: Art cabinet, ca. 1650 [160 cm x 108 cm x 49.5 cm]. (Amsterdam, Rijksmuseum, BK-NM-4789, detail: perspective)

The most important category of craftsmen working on the Antwerp art cabinets was that of the carpenters specialized in working with ebony.[62] Ebony workers belonged to the carpenters' guild or to the Guild of Saint Luke (to which the

[61] Likewise, the art cabinets re-used (borrowed) existing designs and paintings of Rubens, and from the workshop of Frans II Francken. See Fabri, *De 17de-eeuwse Antwerpse kunstkast. Kunsthistorische aspecten*, 14-80.

[62] *Ibid.,* 112-44.

mirror-makers also belonged), and these two guilds competed about who was allowed to work on the art cabinets.[63] But the ebony workers were by no means the only craftsmen to work on art cabinets. In contrast to the high-level collaboration on Antwerp paintings of collections, such as that between Brueghel, Jan I and Rubens (a collaboration which made these paintings attractive to an audience willing to show off its expertise in recognizing the different hands in a painting), the Antwerp art cabinets were a collaborative effort of lower level artists and craftsmen.[64] In addition to cabinetmakers, embroiderers, carvers, painters, mirror-makers, inlayers, etc. were also involved. They were brought together by wealthy art dealers as those of the Forchondt and Musson families, who contracted them for the making of the cabinet. For example, on several occasions the Forchondt family hired Michiel Coignet, son of the mathematician and instrument-maker with the same name, to do the painting for some of their cabinets.[65] The dealers, sometimes in communication with the client if the piece was commissioned, not the makers of the cabinet or the free masters were responsible for the design of the cabinets.

The role of these merchant-entrepreneurs was to design the cabinet and to bring the different craftsmen together in an efficient network to realize the cabinet design, not to work on the cabinets with their own hands; the importance of the art dealer lay indeed elsewhere. As it became increasingly more difficult for customers to assess the quality of such a complex luxury good as the Antwerp cabinet, the role of the art dealer was comparable to that of the connoisseur in painting. On the one hand, the art dealer was important because of his knowledge of the taste of his clients. On the other, the reputation of the art dealer was increasingly important in determining the value of luxury goods. The value of an art cabinet was not just determined by the use of exotic timbers, ivory, silver, tortoiseshell, *façon de Venise* glass and other materials, but also by the name of the art dealer and his knowledge of networks of craftsmen, that is, his judgment on the quality of their work. As Bert de Munck has recently shown, the product's quality was not so much the outcome of the apprenticeship system; instead, the apprenticeship system was the representation and legitimization of that quality.[66] When cabinets became more luxurious and 'artistic' from the turn of the century, the importance of the apprenticeship for the transfer of skills and technical knowl-

63 De Munck, "Construction and Reproduction," 87-89.

64 For collaborative practices in Antwerp painting, see Honig, *Painting and the Market*, 177-89. Honig connects elite collaboration to friendship in Honig, "Paradise Regained," 271-300.

65 For Michiel II Coignet, see Meskens, *Familia Universalis*, 147-51.

66 De Munck, "Construction and Reproduction."

edge waned. The symbolic properties of apprenticeship became more important: apprenticeships legitimized the producers of the art cabinet, and as such, they became a mark of the quality of the cabinet. While at the level of the producers the transfer of knowledge became less important, knowledge was central to the art dealers' and his clients' determination of the value of an art cabinet. In line with their role as merchant-*kenners* they produced a specific type of art cabinet that, like pictures of collections, emphasized the value of knowledge.[67]

This claim for the high value of knowledge largely depended on the art cabinet's 'perspective' (Figure 11). This perspective was a catoptrical construction in which three, four, five, six or seven plane mirrors were aligned as to form a small mirror cabinet.[68] This was the basic construction pattern, on which multiple variations, with several combinations of reflective and painted surfaces existed. The invention of the perspective, like that of the making of the *cristallo* mirrors from which it was made, might be due to Italian import in Antwerp. A certain Venetian, Baptista Redor, applied for a patent for a "very nice and new invention of a cabinet of mirrors, most excellent and very pleasant to see," but it is unclear whether this is directly connected to the perspectives in the art cabinets.[69] In any case, as already mentioned, the perspective differentiated the Antwerp art cabinets from those made elsewhere.

What did one see in these perspectives?[70] In some cases the mirror reflections revealed a painting (whether or not anamorphically produced) that remained otherwise invisible for the viewer; in other cases, the player of such an optical game was expected to introduce an object (for example, a coin or a statuette) in the perspective to enjoy the multiple reflections in the mirrors. The depth effects created by these multiple reflections were enhanced by columns and chequered floors with which the perspectives were sometimes decorated. It should be evident that these games were highly interactive – not unlike paper instruments in books, they involved the active participation of the user – and, therefore, the owner of such an art cabinet (or the visitors to his house or collection) had to have optical knowledge to play these games. One of the most likely sources of this type of knowledge is Giovanni Battista della Porta's *Magia naturalis*, of which the first edition was published in four books in 1558, and in which the catoptrical constructions and

67 For this notion of merchant-*kenner*, see De Marchi and Van Miegroet, "Art, Value, and Market Practices," 451-64. On the role of art dealers more generally, see Montias, "Art Dealers," 244-56.

68 Fabri, "Experiment en doctrina," 241-61; Fabri, "Perspectiefjes in het spel," 109-17.

69 On 13 April 1575 Redor applies for a patent for "fort belle et nouvelle invention d' un cabinet de miroirs, fort excellent, triuphant et tres plaisant a veoir, demonstrant ung tresoir de grant nombre de joyaux chose jamais usee nij veue." Cited in Fabri, *De 17de-eeuwse Antwerpse kunstkast*, 77.

70 *Ibid.,* 72-85.

effects used in the perspectives were discussed. It was translated into several languages, including Dutch, as published by Plantin in 1566.

In *Magia naturalis* della Porta discussed, for example, the so-called *theatrical mirror*, in which mirrors were aligned along the circumference of a circle, or also a combination of plane mirrors revealing a hidden statuette, both catoptrical systems at the basis of the design of the perspectives of the art cabinets.[71] Della Porta specified that *cristallo* mirrors were necessary to obtain these optical effects, for example in his description of the so-called *polytaton*. The *polytaton* consisted of two *cristallo* mirrors, combined in such way "that like a book they can be opened and closed, and so that the angles can be varied, like one uses to make them in Venice."[72] Della Porta did not invent these mirror combinations to obtain the effects of multiple images changing sizes and places; he was explicit that he took the designs from Ptolemy. In fact, in these sections della Porta paraphrased the *Catoptrics*, now attributed to Hero of Alexandria, but first printed together with Sacrobosco's *Sphere* in Venice in 1518, and then known as Ptolemy's *De*

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[71] "The wise ancients found a way to make a mirror out of plane surfaces in which, if one holds one thing [in front of it], many equal images are seen, as one may notice in the writings of Ptolemy. This mirror was made in the following way: On a plane table or other location where you would like to place such a mirror, one shall make half a circle and divide this in equal parts by as many points as the number of images. Draw the cords and cut off the little strips. Then place perpendicularly on [the cords] plane mirrors of equal breadth and height next to each other [. . .] Therefore this mirror is called in Latin *Theatrale*" / "De wijse ouders hebben ghevonden de maniere om een spiegel te maken van effen superficien / voor dewelcke houdende een dinghen / veel ghelijcke dinghen ghesien werden / ghelijckmen uit den schriften van ptolomeus mercke mach: dewelcke aldus gemaect wert. Op een effen tafel oft andere plaetse daer ghy sulcke spiegel stellen wilt / salmen maken een halve cirkel en desen ghelijck deelen met punten na het getal vande figuren / trect daer onder de coorden ende snijt de reepkens af: daerna so recht daer op effen spiegels vande selfde breedde en hoochde gelijc tegen malcander gestelt / [. . .] Daerom wordt dese spiegel in latijn ghegheeten Theatrale." Porta, *Magia*, 267-68.

[72] "One also makes a mirror called *polytaton*, that is, to see many things, because by opening or closing with only one finger one sees more than twenty figures or images in it. You shall make this mirror in the following way: One shall place two crystal mirrors on a feet [. . .] so that like a book they can be opened and closed, and so that the angles can be varied, like one uses to make them in Venice" / "Men maect oock eenen spiegel polytaton ghenaemt / dat is te segghen / om veel dinghen te sien: want metten open doen oft sluyten van alleene een vingher / so sietmen daer in meer dan twintich figuren oft beelden. Desen spiegel sult ghy aldus maken. Men sal op een voet over eynde stellen twee stralen oft cristalline spiegels [. . .] so datse ghelijc eenen boec meugen open ende toeghedaen werden / ende dat de hoecken divers comen / gelijcmen te Venegen pleecht te maken." Porta, *Magia*, 268-69.

speculis.[73] Thus, the Antwerp art cabinets, with their *perspectiefjes* of mirror glass, embodied Hero's catoptrical knowledge.

However, these art cabinets did not only transmit a body of optical knowledge. They also exported Hero's rhetoric on the value of 'mechanical' knowledge. Hero's descriptions of catoptrical systems underscored the epistemic superiority of the mathematician, who understood the underlying optical foundations, over the unknowing audience, who only experienced the optical effects.[74] The message that these art cabinets embodied was, in a similar vein, that their users (as they are knowledgeable of optics) will not be deceived, only the ignorant. The Antwerp art dealers who commissioned and exported art cabinets thus traded in Hero's wonders creating an intellectual and social boundary between the effects and the mechanism that produced it and between those who understood the causes and those who were deceived. The perspective of the Antwerp art cabinet thus allowed collectors to share the knowledge on which their community was built, but also to exclude the ignorant from this community. Moreover, it should also be noted that the art cabinets show that wonder – but then not so much as a disinterested passion remote from the spheres of commerce – had its place in a mercantile culture of collecting characterizing the city of Antwerp. That Antwerp art dealers traded in Hero's wonders shows that attempts to oppose the world of wonder to that of commerce in the Netherlands would be misguided.[75] Like the pictures of collections, the wonderful Antwerp art cabinets carried a message about the high value of knowledge.

Conclusion

While Antwerp was already an important centre of luxury industries in the sixteenth century, the newly invented luxury goods, in the manufacture and trade of which art dealers and craftsmen specialized after the blockade of the Scheldt in

73 Sacrobosco, *Sphera*, 250v-52v: "Ptolemeus De Speculis." For the history of the transmission of the manuscript, its publication history, and a recent edition of the text, see Jones, "Pseudo-Ptolemy *De Speculis*," 145-186. For the Renaissance reception of Hero's works, see Marr, "Understanding *automata*," 209-14. Marie Boas discusses how della Porta's catoptrical devices are copied from Hero in "Hero's *Pneumatica*," 38-48.

74 Tybjerg, "Wonder-making," 443-66.

75 Cook opposes his views connecting commerce and Early Modern science to those which give pride of place to wonder, however, defined – following the work of Lorraine Daston – as a passion characterized by disinterestedness. See Cook, *Matters of Exchange*, 45. For the reintroduction of commerce in to the history of the marvellous and wondrous, see Alexander Marr's introduction to Marr and Evans, *Curiosity and Wonder*, 1-20.

the early seventeenth century, carried a message about the material culture produced and consumed in the city. The manufacture of luxury goods, such as *façon de Venise* glass, depended upon the transfer of skills and technical knowledge to the city of Antwerp, mostly by immigration. The consumers of these luxury goods did not necessarily appropriate the bodies of knowledge on which the production of the luxury goods was based. However, as I have argued in this essay, in early seventeenth-century Antwerp a culture of collecting thrived in which merchant-collectors not only consumed objects as commodities to display wealth, but also as objects of knowledge. The Portuguese merchant-banker Ximenez is presumably unique in developing, together with his Florentine friend Neri, an interest in the manufacture of luxury glass, but other Antwerp collectors (and Ximenez) developed similar interests in the bodies of knowledge on which the making and use of other objects in their collections were based. This culture of collecting supported the building of a community based on shared knowledge. Material objects did not only belong to networks of trade; they were also vehicles of the circulation of friendship, and they were so, because collectors in Antwerp recognized them as objects of knowledge.

The newly invented luxury goods – the pictures of collections and the art cabinets – allowed Antwerp craftsmen, artists and art dealers to export the message that the material objects in which they traded were objects of knowledge, however not to all without discrimination or distinction, but only to those friends who desired membership of their community. They re-packaged a luxury good such as *façon de Venise* glass to produce a new type of luxury good which carried a message about the high value of knowledge. But which type of knowledge did they value? Was it the kind of knowledge acquired through acquaintance with objects (*naturalia* and *materia medica*) found in collections in the Dutch Republic? Surely, the knowledge about which the pictures of collections valued included connoisseurship – that of paintings and other man-made art objects though – as Elizabeth Honig has argued. Nevertheless, the knowledge on which the perspectives in Antwerp art cabinets were based was mathematical, and those cabinets (as well as some pictures of collections – those most prominently displaying mathematical objects) underscored the high value of mathematical knowledge. However, even mathematical knowledge, according to the message carried by these luxury goods, was preferably acquired through bodily engagement with material objects (mathematical instruments) – though not exclusively: the libraries of early seventeenth-century collectors in Antwerp and della Porta's *Magia* on the perspectives show that the acquisition of mathematical knowledge was assisted by the reading of texts.

While the differences between the culture of collecting in the Dutch Republic and the Spanish Netherlands should not be exaggerated – indeed, as I have argued, some of these differences do not reflect the available but still incompletely explored evidence of the inventories of collections – there are good reasons to add to the growing scepticism about the continuities between the south and the north in the spheres of economy, technology and science, briefly reviewed in the introduction to this essay, some supplementary caution as regards north-south continuities between the cultures of collecting. That the VOC conquered the world seas, bringing Asian and New World objects to collections in the Dutch Republic, while Antwerp, after the blockade of the Scheldt, specialized in luxury industries did make a difference, but perhaps less to the objects that were collected than to the reflection on Antwerp's material culture and how it connected to issues of knowledge. The emphasis on luxury goods, mathematical objects and wonder made Antwerp's knowledge economy significantly different from the portrayal of that in the seventeenth-century Dutch Republic in accounts connecting science and commerce in the United Provinces. The newly invented luxury goods that Antwerp produced – pictures of collections and art cabinets – not only placed high value on knowledge nor did they solely emphasize the role of objects in knowledge acquisition and consumption. They also commented on the limits of objects to function as carriers of knowledge. While in practice the acquisition of mathematical knowledge was assisted by the reading of texts, those luxury goods which embodied the high value of knowledge highlighted that only knowledgeable *friends* were able to recognize material objects as objects of knowledge. *

* Material from this chapter has already appeared in Intellectual History Review 20(1), 2010, 53-78, and the author is grateful to Taylor and Francis for permission to reproduce copyright material.

Circulating Knowledge or Superstition? The Dutch Debate on Divination

Koen Vermeir

During the last days of May 1696, the famous Dutch microscopist Antoni van Leeuwenhoek (1632-1723) was busy peering through his microscope at a piece of hazel rod. After careful scrutiny and consideration, he concluded that hazel "has a particularly large amount of very little horizontal vessels."[1] Van Leeuwenhoek had been drawn to a closer study of hazel and other kinds of wood, because of a particular controversy in his circle. Indeed, some of his friends were engaged in a debate on divination, and they had called for his help to resolve their disagreement.

Leeuwenhoek's intervention was part of an international controversy about the divining rod. The Dutch reception of this controversy gives us a beautiful picture of the ways in which natural philosophy was practiced and disseminated in the Low Countries at the turn of the seventeenth century. It offers us an idea of the scientific demonstrations going on in Dutch bourgeois domestic settings, the personal contacts by which scientific claims were transferred, as well as the ways in which controversies were initiated and perpetuated. This sometimes intense and venomous controversy between advocates and opponents of the divining rod developed in journal publications, books and pamphlets, enrolling the local doctors, literati and savants, but also drawing in intellectuals of international stature.

In discussing this episode in the history of wonders, I will take the notion of 'circulation of knowledge' seriously. Asking whether 'knowledge' – both skills and theoretical knowledge – is something that can be circulated has led me to distinguish three crucial levels in the circulation of knowledge. The first level of circulation comprises the circulation of material objects. Meanings are not transmitted as abstract entities but are always already 'embodied' in material objects that can be circulated, such as books, sounds, drawings, specimens, instruments

[1] Leeuwenhoek, "Leeuwenhoek to Rabus, 1 June 1696," in *Boekzaal*, 522-25.

or human bodies.[2] The materials that are passed on, the problems encountered in the circulation process, the changes to which the materials are subject, all warrant careful study, because the material objects are co-constitutive of the meanings and knowledge claims that they embody. A second level of the circulation of knowledge is the reception and appropriation of these objects by historical actors, the new practices to which they are introduced, and the changes in meanings and knowledge claims that result from this.

At the third level, we need to ask how and why these (sometimes considerably changed) knowledge claims that are circulated are *accepted as knowledge* by the historical actors. In order to study this third level, we will have to come to understand the epistemic structures in which the historical actors are embedded, such as the justificatory role of testimony, experience and experiments, issues of (local) rationality, and the epistemic role of belief, faith and trust.[3] When trust breaks down, the circulation of knowledge freezes. Information and knowledge claims can keep flowing – people still know what is going on – but this is not accepted *as knowledge* anymore. This makes clear that networks of trust are essential to a smooth functioning of the knowledge economy. Trust is challenged and breaks down most clearly in exceptional epistemic circumstances, when people are confronted with special, wondrous, even 'incredible' events, such as divination. In studying the Dutch reception of the controversy about divination, I will take into account the three different levels of the circulation of knowledge. In this way, I aim at a fully embodied historiography that combines the intellectual and material aspects of the history of science.

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2 I cannot elaborate here in detail how information and knowledge claims can be embodied in material objects. Even the case of texts, in which this kind of embodiment seems obvious, is not evident at all. On the contrary, issues of readership, interpretation and appropriation make the 'embodiment' of information in texts a very intricate issue (as is evident also from seventeenth-century discussions of Bible interpretation, literal and 'true' meaning). The theory of embodiment I adhere to here is Wittgensteinian in nature. 'Embodiment' refers to the practices in which the material objects are embedded, between which these objects travel, and from which these objects derive their (changing) meanings. When a certain knowledge claim, a piece of information or meaning is 'embodied' in an object, it means that this object plays a specific, meaning-constituting role in a certain practice.

3 With local rationality, I want to make clear that I am not referring to sweeping philosophical judgements of rationality or to Lakatos' rational reconstructions of episodes in the history of science. On the contrary, I want to indicate the local structures of rationality in which the historical actors take part. In this sense, medieval magic, for instance, can be pre-eminently rational. For this particular instance, see Kieckhefer, "Specific Rationality," 813-36. See also Vermeir, "The Rationality of Magic and Science," 349-72.

Lyons and Paris: The Origin of a Controversy

In the summer of 1692, thieves had broken into a wine shop in Lyons, stolen the money and killed the owners. When the police failed to make any progress on this case, the neighbours told them that there was a diviner, Jacques Aymar, who could find criminals. Called for by the police, Aymar 'took his impression' with his divining rod at the site of the crime and led them out of town for what would become an almost incredible journey. Aymar followed the trail of the murderers even on rivers and he pointed out all the places where the criminals had been, and the things they had touched, with his divining rod. After a long trip through many provinces, he found one of the murderers, a hunchback, who confessed his crime. Aymar set out again to follow the trail of the others, but this led him to the sea where they had boarded a ship, and so crossed the limits of the jurisdiction.[4]

This remarkable feat sparked a huge controversy. The facts were recorded in legal documents and testified to by the magistrates and other honourable men. Experiments were performed to test Aymar's abilities. The magistrates of Lyons had already performed some simple tests; they buried the murder weapon and some other tools, for instance. They asked Aymar to find them and to distinguish the murder weapon from the others. After the execution of the murderer, several more experiments were carried out, and Aymar succeeded in many, even when the experimenters attempted to trick him. Provincial physicians and theologians, trying to understand Aymar's curious ability, came up with diverse explanations, based on astrology, Cartesian subtle particles, but also demonic action.

The discussion did not remain confined to the provincial level. Letters were written to savants, courtiers and the nobility in Paris, which allowed the Parisians to become virtual witnesses of this curious case.[5] These letters were circulated at court, where they caused much pleasure and divertissement. Some of these letters were later bundled and published. These pamphlets were in their turn followed by a number of books reporting and interpreting the case. Reading letters about these events and even looking at other dowsers, who started to appear all over the country, was not the same as seeing Aymar in person. Therefore, Henri-Jules de Bourbon (1643-1709), one of the country's most prominent noblemen, decided to

4 I have related the essentials of the French episode in Vermeir, "The Physical Prophet," 1-24. See also Figuier, *Histoire du merveilleux,* 59-70, and Lynn, "Divining the Enlightenment," 34-54. The most prominent historical sources that include descriptions of the basic facts of the case are Vallemont, *La Physique Occulte* and Le Brun, *Histoire critique*. Due to a lack of space, I cannot give an extensive bibliography of this case here.

5 For the notion of virtual witnessing, a crucial form of 'circulation of knowledge', see Shapin and Schaffer, *Leviathan.*

bring Aymar to Paris. The prince did not just do this for the stir it would create. He performed experiments with Aymar, sometimes in the salons of his peers, sometimes under the guidance of the Royal Prosecutor and of the *Académie Royale des Sciences*. Strikingly, they reported that Aymar failed at finding hidden gold or water, performing far below the strained expectations of the witnesses.[6]

This sparked a huge controversy. Discussions and disputes started in the 1693 and 1694 editions of the primary popular and intellectual journals, including the *Mercure Galant*, the *Journal des Sçavans*, and the *Mercure Historique et Politique*, as well as in many books and pamphlets. Several leading French intellectuals were involved. Different books appeared in Paris and in the rest of Europe. Pierre Lorrain de Vallemont, one of Aymar's most prominent defenders, explained the phenomenon in a natural way. Pierre le Brun, his major opponent, gave a demonic explanation.[7] Le Brun found it particularly striking that the divining rod worked sometimes unquestionably, but at other times failed to get it right, and he recognised demonic whimsicality in this. Others detracted Aymar and denounced him as a fraud. The controversy had repercussions in Italy, England, Germany and the Netherlands. In this paper, I will detail the particularities of the circulation of this wondrous case within the Low Countries.

The circulation of information and knowledge claims was mediated by a number of prominent intellectuals. These authors did not function as passive mediators, however. They tried to form their own judgement on this case, based on the available information and their philosophical or religious position. Some of them changed their mind during the writing of their account of the case; the commitment of others to the case became transformed when family members were personally drawn in. I will pay special attention to these savants' literary and personal networks, through which the information was disseminated, but I will also look at the reasons and arguments they used to make a judgement on this case. Their aim in writing was to convince others. They tried to appropriate and enlist this controversy for their own aims, be it the fight against superstition, the educa-

6 See e.g. "Lettre de M*** à Monsieur… " and "Lettre De Mr. Robert Procureur du Roi au Châtelet de Paris" in the April 1693 issue of the *Mercure Galant*, 262-94. In contrast, in an earlier issue of the *Mercure Galant* (February 1693, 311-13), a (probably fraudulent or misinformed) account had appeared claiming that Aymar had performed many successful experiments with the Prince de Condé in Paris. Vallemont claimed that he had done a different set of experiments in Paris at which Aymar was successful. These contrary accounts make one suspect that these reports might be somewhat skewed or exaggerated, and this makes it difficult to assess precisely how (un)successful Aymar was in Paris.

7 See Vallemont, *La Physique Occulte* and Le Brun, *Histoire critique*.

tion of the public, finding out the secrets of nature, or protecting the honour of the family. (Figure 1)

Balthasar Bekker: Crushing Demons but Defending Divination

News of the spectacular feats of Aymar reached the northern Netherlands by a variety of channels, amongst which, most prominently, published books, journal issues and personal contacts between members of the Republic of Letters. Communication was not as self-evident as is often supposed. During the wars between the Netherlands, France and England, the Low Countries were practically isolated, and letters as well as books generally did not cross the border easily. In the 1694 issue of a local journal, the journal-editor Pieter Rabus wrote that there were not many foreign books around to review because of the state of war.[8] Because many French books were printed at presses in the Netherlands, however, the Low Countries were still a relatively good place for international exchanges, especially with France.

Of the French books discussing the Aymar case, it was especially Vallemont's *Physique Occulte* that was widely read abroad. This was due partly to its sensational content and its fashionable Cartesian approach to divination, and partly to the fact that it was printed in many editions and translations, and was published beyond Paris, in Amsterdam, The Hague, Nuremberg and Bamberg. Balthasar Bekker (1634-1698), a reformed theologian who had just moved to Amsterdam, was one of the first to pick up the story from the Amsterdam edition of the *Physique Occulte*. This edition, which appeared shortly before the second part of Bekker's own *Betoverde Weereld* went into print, gave Bekker just enough time to include the new spectacular events it reported in his analysis.[9]

In 1693, Balthasar Bekker stood at the centre of his own controversy, which had been kindled by the publication of books 1 and 2 of his *Betoverde Weereld* in 1691.[10] Another Dutchman, Anthonie van Dale, had caused great consternation a few years before by arguing that the pagan oracles had not been demonically inspired prophecies, but frauds set up by priests to enslave the people.[11]

8 *De Boekzaal of Europe*, July-August 1694, 119.

9 In his analysis of the case, Bekker referred especially to the factual accounts written by the provincial abbot De Lagarde and the Lyons physician Garnier, both reprinted in Vallemont's *Physique Occulte*.

10 The publication story of Bekker's controversial book is complicated but relevant to the dissemination of the ensuing controversy. Bekker relates his account of these events in the introduction of the 1693 edition of the *Betoverde Weereld*.

11 Van Dale, *De oraculis veterum ethnicorum.*

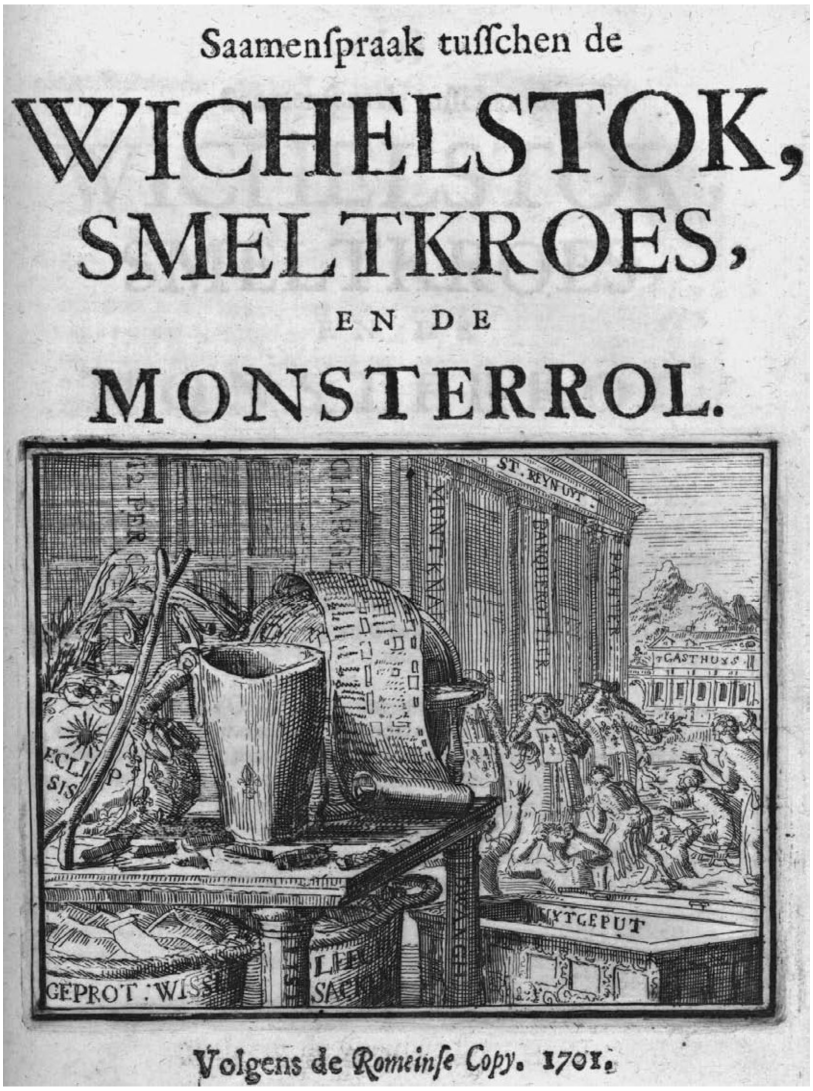

Figure 1: Frontispiece of a seven-page Dutch pamphlet of 1701, after an earlier Roman edition, by Romeyn de Hooghe (1645-1708), the most important Dutch graphic artist of the time and a prominent intellectual and political figure in Haarlem. The pamphlet has also been published as part of Romeyn de Hooghe, Esopus in Europa, Amsterdam, sold by S. Petzold, 1701. The pamphlet contains the discussion between the divining rod, the melting pot and the muster-roll. The reference to the divining rod refers to the discovery of criminals in Lyons (related on page 4) and to the practice of searching for gold. The three characters discuss French and European politics, war and prosperity, drawing on the associations of their different functions: the finding of gold, the melting of riches in order to fund war, and the register of enlisted men. By courtesy of the Koninklijke Bibliotheek, Den Haag, Record ID 11117, Pamphlet Nr. 14621.

In his *Betoverde Weereld*, Bekker claimed in a more general way that the devil had no power over mankind whatsoever. When many readers perceived his argument as a veiled way of saying that the devil did not exist, all hell broke loose. Jonathan Israel writes that the Bekker furore was "the biggest intellectual controversy of Early Enlightement Europe, producing a stupendous 300 publications for and against."[12] The Aymar case was widely publicised, albeit in a controversial way, because Bekker appropriated the story in the second part of his best-seller, and made it bolster his own argument.[13]

Bekker was particularly interested in this case of divination because, just like Le Brun, the prominent philosopher Nicolas Malebranche had ventured a demonic explanation of the event.[14] Bekker, himself known as an avid Cartesian, thankfully followed the naturalist explanation of the French provincial physicians and Vallemont, in order to counter all suspicion that the devil might be at work here.[15] Bekker had also read about the negative results of the Prince de Condé's experiments in one of the French journals that enjoyed an international readership.[16] Orchestrated by the Prince de Condé, who felt the public had to be informed about this deceit, letters and declarations had been published in the major French journals, detailing how Aymar had failed. In another article, Vallemont's naturalistic explanations of Aymar's failures in Paris are derided. The journalist notes that this kind of philosopher never admits his mistake, and he dismisses Vallemont as an enthusiast.[17]

Bekker carefully weighs all these testimonials. On the one hand, Vallemont and others wrote in support of Aymar, and what they asserted was attested to by credible persons. On the other hand, de Condé and his followers claimed that Ay-

12 Israel, *Radical Enlightenment,* 382.

13 The Aymar case is analysed in book 4, chapter 23 of Bekker's *Betoverde Weereld*.

14 Malebranche, "Réponse de l'Auteur de la Recherche de la Vérité" and "Réponse du même Auteur."

15 For Cartesian explanations, see esp. Vallemont, *La Physique Occulte*; Garnier, *Dissertation Physique;* Garnier, *Histoire de la baguette*. See also the work by Panthot, the dean of the medical faculty of Lyons and of one of the witnesses of the Aymar experiments in Lyons: Panthot, *Lettre de M. Panthot*. There is also a pamphlet, [Panthot] *La Baguette de Lyon.* This is a pirated version of Panthot's letter, with a number of variations to the original. Panthot's letter was circulated widely, and was reprinted many times. It was published in the *Mercure Galant* of October 1692, 13ff., with new additions on 213ff., and again with supplements in the different editions of his *Traité de la Baguette*.

16 In the May issue of the *Mercure Historique et Politique*, Bekker had read letters by Abbé Nicaise, by Buissière, the apothecary of de Condé, and by Robert, the Royal Prosecutor in Paris, that Aymar was a fraud, in the May 1693 issue of the *Mercure Historique et Politique* (section "On publie qu'Aimar est un fourbe. Lettres à ce sujet," 558).

17 "Nouvelles Reflexions sur Aimar," *Mercure Historique et Politique,* May 1693, 565.

mar was a fraud. If we cannot even confirm the facts, Bekker remarks warily, it does not make much sense to look for their causes. So many great thinkers have already been embarrassed in this way. What tipped the scales in Aymar's advantage, Bekker pointed out, was the fact that some credible men had themselves the gift of dowsing.

Bekker mentions Monseigneur Galet, Bishop of Saint-Jean-de-Maurienne and a great astronomer, Pierre Tonnelier, an apprentice apothecary in Paris, a certain Grimaut, an officer of the douane in Lyons, and Besson, a young prosecutor in Lyons, all of whom had the gift of dowsing. Bekker probably read about the first two in the April 1693 issue of the *Mercure Historique et Politique* and of the latter two in a letter written to the abbot Jean-Paul Bignon, a famous intellectual in Paris, and reprinted in Vallemont's book.[18] Regarding Tonnelier, it was said that experiments had been performed in the garden of the *Académie des Sciences* in Paris and in the houses of officials and noblemen. At first, these experiments did sometimes fail, but in the end they turned out to be convincing and successful, even when the witnesses present tried to trick Tonnelier into making mistakes.[19]

Furthermore, Bekker noted, there are all these people walking in the mountains with their divining rods: would they all be frauds? And why would they do this? Also in his own town, Bekker remarked, it was possible to find credible diviners. Bekker himself had a good friend, a man of much experience, judgement and reason, who had the gift of dowsing. The friend that Bekker mentioned can be identified as the publisher and bibliographer Cornelis van Beughem, who will appear again later in this paper. By accident, in his youth, this man had discovered a treasure with his rod. Afraid of being branded a magician or a witch, he had left the treasure where it was. Someone else later discovered the treasure, and it was not difficult to guess who this was, as one of the neighbours became suddenly a spendthrift.

From his theological position, denying all demonic action in the world, it is clear why Bekker was attracted to Vallemont's naturalist Cartesian explanation of dowsing. Bekker proposed, following Vallemont, that murderers and other criminals exhale very specific subtle particles. These particles are different from those exhaled before the crime, because the criminal act causes fear and passions in the criminal, which affects his blood, and changes his body economy and exhalations. The corpuscles can enter the pores of the skin of the diviner, affect his blood and

18 *Mercure Historique et Politique,* April 1693, 434ff. and Vallemont, *La Physique Occulte*, 36-41.

19 On Tonnelier, see Comiers, *La Baguette Justifiée*, 59. This text was also printed in the *Mercure Galant*, March 1693, 104-210. For more on Tonnelier, see also Comiers, "Observations touchant les tresors cachez," 66-119, esp. 91.

cause fermentations, if the diviner's body is attuned to these specific particles. The fermentations in the body of the diviner affect his nerves and this causes convulsions and heart spasms. These particles also fill the divining rod, but their free outflow is hindered, and this makes the rod contract and turn (this is similar to contemporary models of muscle contraction caused by animal spirits).

Bekker presented this as a possible natural explanation of the phenomenon of divining. He did not need to come up with the final word on the issue, but he found this explanatory model convincing enough so that he could reject the possibility of demonic involvement. Bekker did not naïvely accept Vallemont's account, however. Denouncing the events as frauds instead of demonic action could also have been an attractive possibility. Indeed, he also took into account the accusations of de Condé and others of the Prince's entourage. That other credible men who did not have anything to do with Aymar or the Aymar case also claimed to have the gift of dowsing, and especially given his own personal acquaintance with a dowser, these facts trumped the Prince de Condé's claims of unmasking Aymar. Bekker concludes that the circumstances have been too well inquired into, and that fraud was very implausible. There must be another, yet undiscovered, reason why the divining rod did not work in Paris.

Piere Bayle: The Sceptical Philosopher

Pierre Bayle (1647-1706), a French Huguenot exiled in the Netherlands and one of the most famous thinkers at the turn of the seventeenth century, heard about the Aymar case in different stages during the unfolding of the plot.[20] He reported it extensively in the first pages of his widely read *Dictionaire* [sic] *historique et critique* (1697). The *Dictionaire* was an encyclopaedic dictionary meant to educate the public and to eradicate the multitude of errors that had crept into the accepted body of knowledge. At the time, it was widely believed that knowledge had been corrupted because of defectives modes of circulating knowledge. Incorrect knowledge claims were uncritically copied and widely disseminated and new errors crept in during the process of circulation. Instead of carefully checking the available sources, using sound judgement as well as textual criticism, the same mistakes were perpetuated time and again. If one also calculated in the possibility of conscious frauds, the problems became even worse.[21] Even the major dictionaries and encyclopaedias perpetuated more errors than truths. At first, Bayle

[20] For a classic appraisal of Bayle in his times, see Hazard, *La crise de la conscience européenne*.

[21] On early modern fraud, see Grafton, *Forgers and Critics.* See also Nummedal, *Alchemy and Authority.*

conceived of his *Dictionaire* as a point-for-point rebuttal of the famous (but not critical) dictionary by Louis Moreri. For Bayle, Moreri was someone who poisoned the public, and Bayle wanted to counter him by starting a collection of errors.

"Around the month of December 1690," Bayle wrote, "I made the plan to compose a critical dictionary that would contain a collection of the mistakes that were made, by those who made dictionaries as well as by other writers, and which would enlist under each name of a man or a city all the errors that were disseminated about this man or city."[22] Errors were powerful and obstinate. They spread like weeds and their circulation seemed to go much more smoothly than the circulation of knowledge. "There is by no means a lie, as absurd as it could be, that does not pass from book to book and century to century. Tell lies audaciously, print all kind of extravagancies, one could say to the most miserable lardhead (*lardonniste*) of Europe, you will find enough people who will copy your stories, and, if someone rebuts you at a certain time, there will arise conjunctures in which someone else will have an interest to have you resuscitated."[23] Errors were considered the major obstacle for making progress in the generation and circulation of knowledge, and Bayle made battling these perpetuated errors and superstitions one of the major goals of his life.

In an article ostensibly on the myth of the arrow of Abaris (with this arrow, Abaris was said to be able to fly and accomplish other wonders), the discussion of the various stages of the Aymar case took up most of the space in interminable footnotes.[24] Bayle compared the divining rod with other conjuror's rods, and mocked that this wand was almost as miraculous as the mythical arrow of Abaris. He had heard that one could find anything with the divining rod, not only treasures, metals and the boundaries of lands, but also thieves and adulterers. Somewhat ironical and sceptical, Bayle did not deny the power of the rod outright, and he even suggests that it might serve as a vindication or as the historical root of the story about the arrow of Abaris. He notes that the rod was so successful that Malebranche and others could not dismiss the feats and were obliged to ascribe its action to the devil.

Bayle's article on Abaris is a good example of a text in which developing authorship is still visible, where the different stages of the text are preserved in little

22 Pierre Bayle to his nephew Naudé, 22 May 1692, cited in Hazard, *La crise*, 104-5. See also Bayle, "Projet d'un Dictionaire Critique à Mr. De Rondel," the introduction to his *Projet et Fragmens d'un Dictionaire Critique*.

23 Bayle, *Dictionaire*, art. *Capet*, letter Y, cited in Hazard, *La crise*, 106.

24 Bayle, *Dictionaire*, 1697 edition, art. *Abaris*, 1-5.

hints that we can read as a palimpsest. The materiality of the text, the lay-out, the division of the paragraphs and Bayle's special use of different kinds of footnotes, can tell us a lot about how this text was constructed, and how it was corrected and amended over time. This also has a bearing on Bayle's assessment of the Aymar case. We can read his shifting assessment of the divining rod case from this text, depending on the stage of the controversy and the new information he received. Starting to write his *Dictionary* in the winter of 1693, he noted in a neutral way in a note in the beginning of the article that the last summer, a famous 'wand-conjurer' had appeared in Lyons and was brought to Paris for experiments.[25]

Later, he added a few sentences to the body of the article. First, he adds a more sceptical phrase that 'they attribute' such a virtue to Aymar's wand, and he explains in footnote (G) that he had recently heard – apparently while writing up the article during the spring of 1693[26] – that the supporters of Aymar had been frustrated in their expectations. He would not recant, however, that, if it were true, such an invention would be very useful, as it would keep everyone honest and virtuous. He is more sceptical as before, but he still contemplates the possible truth of the case and is far from affirming that Aymar is a fraud. He finds the case interesting and adds that Aymar's story would deserve to be explored in a separate article. In a letter to Vincent Minutoli, written in Rotterdam on 14 September 1693, he writes positively about Vallemont's defence of Aymar. He likes the fact that Vallemont explains everything mechanically, by means of flows of corpuscles, without taking recourse to demons or spirits, as Malebranche had done. He does not chide Vallemont for credulously accepting such a strange phenomenon and building theories about it without first inquiring into the fact of the matter.[27]

By the next stage, while preparing this first article for print, he had clearly come to reject the truth of Aymar's capacities, injecting some rationalist rhetoric against credulity and impostures. He also added a last sentence to the article, noting that the rod had faced its doom at the Prince de Condé's palace. In a new footnote (H), he argued that the Prince de Condé's extraordinary abilities had ex-

25 *Ibid*., 2, around note (b) and (c). Note (c) explains that 'last summer' refers to 1692.

26 In Bayle, *Dictionaire*, 1702 edition, there is a note † added on page 4, which mentions that this part was written in 1693.

27 Bayle, Letter to Minutoli of 14 September 1693: "On a réimprimé à Amsterdam le leivre de Mr. De Vallemont, Prètre & Docteur en Théologie, sur la Baguette Divinatoire. Il explique tout ce qui fait Jacques Aymar, par la Mécanique, & les Ecoulemens de Corpuscules, sans recourir à la direction d'aucun Esprit, comme le P. Malebranche. Le Livre est assez curieux." (Lettre 152, in Bayle, *Oeuvres Diverses*, IV, 695-96).

posed all impostors and their credulous followers.[28] To plead the uncertainty of the case was in vain, since the Prince had informed the whole world about it. Bayle points out that there is something to say for the idea that the impostors had timed their cheat badly, as this was a Philosophical Age, and so they were more easily exposed than before. At the same time and at a personal level, Bayle remained pessimistic, suggesting that his age might be just as gullible as any other. In writing this, he might in fact have been referring to his own earlier, frivolous and ironic attitude and his failure to take a stronger stance. Making up for this earlier weakness, he now accuses Vallemont of obstinacy in defending the genuineness of Aymar's gifts, even in the face of the strong evidence delivered by the Prince de Condé, and in finding reasons for Aymar's glitches in the Parisian experiments. People like Vallemont "do not respect the deceivers less for it, [and they] do not cry less against the faith of those who have not been deceived."[29]

In the 1702 edition, Bayle added yet another layer to the story.[30] He now included extra text to an already extensive footnote, making it run to several pages. He remarked that the Aymar polemic had been quiet for three or four years, but that new information had reached him recently. In the April issue 1697 of the *Mercure Historique et Politique*, it was reported that Aymar had found the parents of a foundling with his rod. This positive story could not count on much support from Bayle, given his previous strong dismissal of Aymar's capacities. He notes that we cannot be certain of the truth of this story published in the *Mercure*, and he casts doubt on the honesty of the journalists. The story could have been invented, there are always people who love fiction, and the authors know that few will trouble to check the veracity of the story. Here we can see Bayle's strong criticism of fallacious modes of the circulation of knowledge claims and of the dissemination of errors, sometimes by conscious fraud, come to the fore. Even if the story were true as narrated, Bayle argued, one cannot silence the incredulous with such an account. There are other explanations possible which did not involve accepting divination with a rod. Maybe Aymar knew everything about the secret relationship of the foundling's parents by informants, and they might have had their reasons for bringing it to light in this way, without exposing themselves.

In the 1715 edition, Bayle adds conclusive proof and further reflections to the story. He had inquired more about Aymar with his friends in the Republic of Letters, and he had received a letter, dated 25 July 1698, by Paul Buissière, apothecary

[28] This footnote starts with exclaiming that this case had hardly lasted the time needed to compose and print an article for his dictionary.

[29] Bayle, *Dictionaire*, 1697 edition, art. *Abaris*, 5, note H, just before (a).

[30] Bayle, *Dictionnaire*, 1702 edition, art. *Abaris*, 4, note H.

to the Prince de Condé. This letter provided Bayle with the 'most positive proof' that Aymar was a cheat: Aymar had confessed this himself to Buissière and de Condé. After this confession, Buissière wrote, Aymar received 30 golden coins from the Prince, so that he would return to his village. Buissière also mentions a fourteen-year old boy, who had been trained and managed by a gentleman to do similar tricks with a divining rod. After shutting him up for several days without contact with this gentleman, some money, promises and threats made the little boy confess that it was all a trick. Bayle adds to this story a rather unenlightened remark, suggesting that once Aymar had tracked the murderer, the magistrates of Lyons should have threatened to burn him alive as a wicked magician, and the executioner should have been present with all his instruments of the rack to substantiate the threat. According to Bayle, this would quickly have procured a confession of how Aymar had secretly learned all about the assassination in Lyons, how he had been able to follow the criminals and to point out the murderer. This remark concords too well with the actual trials of alleged witches and magicians, who in those years were still tortured into confessions and executed, to be palatable for the modern reader.[31]

Bayle is much less optimistic than some of his peers, such as Van Dale, Bekker and Rabus, about the fight against credulity and superstition. People do not need much coaxing by others to believe deception and imposture, he writes, their own credulity is sufficient in itself. Furthermore, the credulity of the people seems to be incurable. Even if a cheat is exposed, the people forget such a thing very quickly, and in a few years, we will see the same comedy all over again. For Bayle, the story of Aymar's new successes in the province was sufficient proof of this.

In the case of Bayle, we see that a circulation in distinct stages, sometimes exacerbated by problems in the material circulation of the information (e.g. because of war and problems with the postal system), affects the material structure of a text under construction, as well as the author's judgements on the knowledge claims expressed in it.[32] New information about the development of the Aymar case led Bayle to revise his position radically, from moderately positive to distinctly sceptical and critical, inveighing against the credulity of Aymar's supporters. We have seen the tenor of the text changing from the report of a curious event into a critical assessment of defective modes in the circulation of knowledge. In the final version of the text, Bayle wants to show us how laziness and the failure to check the facts,

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[31] Bayle, *Dictionnaire*, 1715 edition, art. *Abaris*, 5, note H, above note (f).

[32] The time delays between the occurrence of events and Bayle's writings about them suggest difficulties in distributing letters, journal issues and books. In this case, Bayle inquires in letters about issues that had been reported in print months earlier in France.

credulity with respect to strange phenomena, prejudices, dogmatism, the stubborn adherence to one's opinions even in the face of refutation, as well as conscious fraud by both the reporters of the story and the actors involved, all caused the spreading of errors instead of knowledge.

Pieter Rabus: Teaching the Public How to Divine

A friend of Pierre Bayle, Pieter Rabus, would get involved in the dowsing controversy in an unexpected way, causing much confusion for Bayle and other intellectuals living in the Netherlands. Pieter Rabus (1660-1702) was a public notary and a teacher at the Erasmian high school of Rotterdam. He was a figure well known for his educational commitment and his fight against ignorance, credulity, short-sightedness and dogmatism. In his youth, he had been a friend of the poet David van Hoogstraten and belonged to a circle of poets, booksellers and literati. He wrote and translated a number of books, but his most lasting literary feat was the foundation of an intellectual journal, the *Boekzaal van Europe.*[33]

An acquaintance and ardent admirer of his fellow citizen of Rotterdam, Pierre Bayle, Rabus styled his journal after Bayle's *Nouvelles* and other intellectual journals, such as the *Journal de Sçavans* initially, but later also journals published in the Netherlands such as Jean le Clerc's *Bibliothèque* and Henri Basnage de Beauval's *Histoire des Ouvrages*. Distinctive about the *Boekzaal* is that its articles were written in the vernacular, opening admission to the Republic of Letters to a much wider circle of less educated people. *The Boekzaal* bears witness to Rabus' pedagogical commitment. There was also a commercial component to this enterprise, of course, as Rabus was thus able to reach a new, eager and growing public in Dutch bourgeois society. This explains why the *Boekzaal* was also interesting for its publisher, Pieter van der Slaart. In his journal, Rabus reviewed what happened in the Republic of Letters with "objectivity and justice."[34] Most prominently, he summarised the contents of recently published books, with a special focus on the Netherlands. Van der Slaart advertised his bookshop in the *Boekzaal,* and pointed out that he printed or sold most of the books that were reviewed by Rabus.[35]

Already the first issue of the *Boekzaal* provoked a strong debate. Rabus had there offered an extensive review of Bekker's *Betoverde Weereld*, and this drew

33 On Rabus and the *Boekzaal*, see esp. de Vet, *Pieter Rabus;* en Bots, *Pieter Rabus en de Boekzaal van Europe*.

34 See the 'manifest' at the beginning of the first issue of the *Boekzaal*, 1692.

35 Rabus had started his own journal with book reviews with the Rotterdam publisher Barend Bos in 1701, after a row with Van der Slaart. As a result, the publisher Van der Slaart went bankrupt: in 1702 he had to sell his printing press and inventory.

him into the Bekker furore. The Church Council, finding that Rabus had failed in his self-proclaimed aim of impartiality, accused him of Bekkerianism and even Spinozism. Rabus had frequented circles of progressive thinkers, but he took care not to associate himself with overtly radical currents. He did not extend his rationalism to matters of religion, for instance, and although he knew numerous members of different Dutch sects and non-church groups, he took a moderate stance or hid his less orthodox views from the public eye. Where popular credulity and superstitions were concerned, however, he sided with Bekker and Van Dale, with whom he became good friends. Furthermore, Rabus was somewhat quick-tempered and contentious, taking part in a number of quarrels and pamphlet wars. Even in the tolerant Dutch Republic, Rabus was thus a controversial figure. After a few years, the city council had to impose censorship on the *Boekzaal*, although it was only minimally enforced.

Rabus probably first read about the Aymar case in Bekker's *Betoverde Weereld*. In his review of books 3 and 4, Rabus writes that Bekker conscientiously deliberates the contents of the stories about Aymar, the conflicting judgements of the learned, and then tries to find the most plausible explanation of the case.[36] Rabus' interest was aroused and a few months later, he extensively reviewed the 1693 Amsterdam edition of Vallemont's *Physique occulte*.[37] "There will be hardly any diligent investigator of natural philosophy, or any curious reader of news that comes to us from France, I believe, here or in the neighbouring countries, who can be ignorant of the notorious effects, that man has found, that a certain peasant Jakob Aymar is able to perform."[38] Rabus attests to the widespread commotion aroused by this case. There was so much talk, writing and circulation of news going on, and new information kept flowing into the country, Rabus said, all of which contributed to confirm that "this history has, by flying rumours, become so well known, and by fresh news, become so indubitable, that it cannot be suspected of falseness by anyone."[39] The sheer flood of information seemed to invest it with a ring of truth.

36 *Boekzaal*, September and October 1693, 335-57.

37 *Boekzaal*, March and April 1694, 357 ff.

38 "Naawelijks, geloove ik, is 'er in deze, of nabuerige landen eenig naarstig onderzoeker der Natuurkunde, of nieusgierig lezer van allerley maren, ons uit Vrankrijk overkomende, die onkundig kan zijn van de berugte uitwerkingen, welke men bevonden heeft, dat zeker boer Jakob Aymar magtig is te bewijzen, niet alleen in nasporen van waterbronnen, bergstoffen, en verborgene schatten, maar ook van vlugtende dieven, moorders, enz. alles door behulp van een wichelstukje, dat hy in zijne handen houd, en waar mede hy achter 't geheim raakt" (*ibid.*, 357-58).

39 *Ibid.*

Rabus did not only rely on stories that came over from France. He reported that a famous Dutch writer had a good friend outside Holland who possessed the capacity of finding gold and silver by means of a divining rod. Rabus himself knew this man, who had told him all about his feats of divination when he had visited Rabus in Rotterdam. Sometimes, the rod turned so strongly in that man's hands that it almost ripped off his skin. From later writings, we can deduce that Bekker is the famous Dutch writer mentioned by Rabus, and that Cornelis van Beughem, a publisher, famous bibliographer, mathematician, and city official of the town of Emmerich, is the dowser mentioned by both Bekker and Rabus.[40] A phenomenon, inquired into and found true by so many, could not be a deceit and should be attributed to the pure workings of nature, Rabus proclaimed. If the power of the loadstone was not generally known, it would strike us as at least as strange.

For Rabus, the case of the divining rod fitted well into his fight against credulity and superstition as well as into the context of the Bekker controversy. Not that he was sceptical of this new phenomenon; quite the contrary. But he could chide those who imagined that incantations or rituals were involved in the practice of divination, which illustrated for Rabus that these people had the foolish idea that the devil's tricks played a role here. On the other hand, idolaters who attributed to the rod higher powers than it actually possessed were equally mistaken. Rabus stressed that there were no spiritual powers involved, and that it was a purely natural and material phenomenon. Therefore, it was important to know that a divining rod could be made of a branch of any kind of tree, cut at any time of the day and the year, without any muttering of special words or performance of special gestures. In order to make sure the phenomenon was natural, attention to the circumstances of the material production of the rod was crucial.

Sure enough, it remained a curious fact that the divining rod, contrary to the loadstone, did not work in the hands of everyone. For many, this was a reason to suspect demonic involvement after all. Rabus appreciates especially the profundity of Vallemont's naturalist explanation of this curious problem.[41] Vallemont argues that the practice of divining depended much more on the body of the diviner than on the properties of the rod. Not everyone is a dowser, and not every dowser can find the same kind of objects. This is because the temperament of the body has

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[40] For Bekker, see *Boekzaal*, May-June 1697, 389-437; for Van Beughem, see idem, and also *Boekzaal* May-June 1696, 495-500, and the pamphlet *Nodige Verantwoordinge*, e.g. 22-23. See also Palm, "Antoni van Leeuwenhoeks reactie." On Van Beughem as a founding father of modern bibliography, see the famous bibliographer of bibliographies Theodore Besterman, *The Beginnings of Systematic Bibliography.* For Bayle's appreciation of Van Beughem, see Bayle, *Oeuvres Diverses*, IV, 681.

[41] *Boekzaal*, March and April 1694, 364. Vallemont, *La Physique Occulte*.

an important role to play. Vallemont gives this a Cartesian twist by relating this to the texture of the fibres of the body, which are different in each person, and to the circulation of subtle effluvia. "I explain the sympathy of the divining-rod with metals and other things to which it inclines by the flow of subtle matter, which transpires from all bodies, and disperses in the air, and the Jesuit [Caspar] Schott says that this is the right way to explain effects, which were previously ascribed to occult qualities."[42] The material circulation of this subtle matter, transpiring from all kinds of bodies, connected everything in an intimate way. By reference to these circulations, a natural philosopher could explain the strangest phenomena.

The pores of the body have to correspond exactly to the volume and figures of the corpuscles of the vapours in order to let them through.[43] Therefore, some people have the right temperament only for finding gold, others for silver and yet others for water. It was just as with dogs: only some breeds possess a good nose for hunting, and there are dogs that hunt only foxes or hares. The bitter and acid salts in the exhalations of metals, water and even criminals can only be taken in by the corresponding pores. They become mixed with the blood and cause violent circulations, and these in their turn cause the faintness and heart spasms the dowsers experienced. The capacity of dowsing is thus dependent on the present state of the body (conditioned by food or the saturation of the blood) and its general complexion, such as its temperature and way of perspiring. If the air about oneself is saturated by vapour, one will be unable to receive other corpuscles. It follows from this analysis that the divining rod was not really necessary in dowsing, as was attested to by many dowsers. It merely enhanced the phenomenon, and subtle muscle spasms were also made visible more easily by the twists and turns of a hazel stick. Therefore, Vallemont asserted that the divining rod enhanced our tactile sense, just as microscopes and telescopes enhanced our sight.[44] (Figure 2)

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42 Vallemont, *La Physique Occulte*, 142. See also Hutchison, "What Happened to Occult Qualities," 233-53.

43 Vallemont, *La Physique Occulte*, 423.

44 Ibid., 447: "Mais quand l'impression est foible, & qu'on se sent peu ému; on a recours à la Baguette, qui est dirigée par ces corpuscules invisibles, & qui fait sentir par son mouvement, ce que l'on ne découvriroit point par la seule voye de la sensation du toucher. C'est ainsi qu'un Microscope fait voir, en aidant la Nature ce que jamais l'oeil humain n'avoit vû. C'est ainsi qu'une lunette d'aproche découvre dans le ciel des Etoiles qu'on n'aurait jamais vûës sans le secours de ce merveilleux instrument."

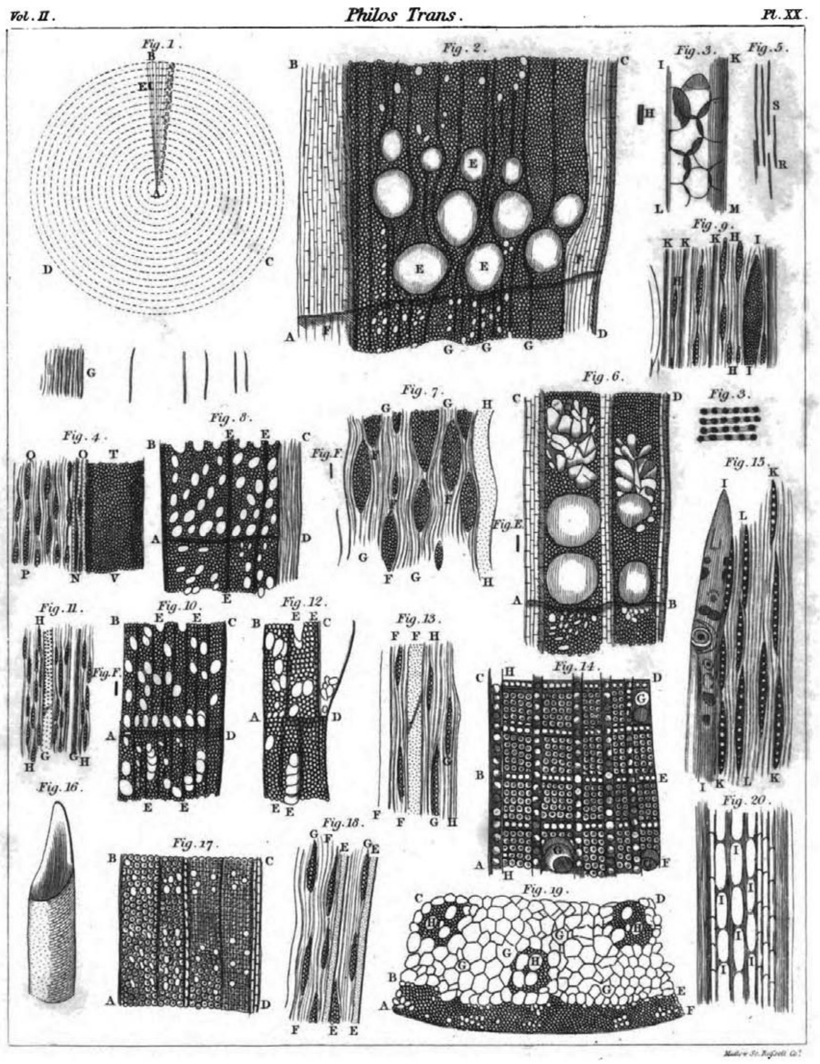

Figure 2: Pieces of wood, studied with a microscope and drawn by Antoni van Leeuwenhoek. Here, pieces of oak, elm, beech, willow, alder, ebony and palm are depicted. The drawing accompanied a letter from Leeuwenhoek to Robert Hooke. From 'An Abstract of a Letter from Mr. Anthony Leewenhoeck of Delft to Mr. R. H. concerning the Appearances of Several Woods, and Their Vessels', letter of January 12, 1680, published in The Philosophical Transactions of the Royal Society of London in 1683. This reproduction is from The Philosophical Transactions of the Royal Society of London, from Their Commencement, in 1665, to the Year 1800: vol. 2: 1672-1683; Printed by and for C. and R. Baldwin, 1809. The letter is printed on pages 618-24, and the figure is reproduced as Plate 20 at the end of the volume.

Leeuwenhoek: The Divining Rod and the Microscope

Two years later, on 16 May 1696, Rabus was still wondering about the properties of the divining rod. Puzzled by new experiences, he wrote to his friend Antoni van Leeuwenhoek (1632-1723), the famous microscopist, asking him whether he could take a look at the divining rod with his microscope: "But since it is difficult to disclose the reason of this secret of nature exactly, I would request you to cast your far-sighted eyes over it and, if you have thought of something in connection with the gold or the hazelnut tree, to inform me of it."[45] Rabus explained that some attempted to explain the phenomenon by reference to small corpuscles. Others, by contrast, stressed the temperament or natural aptitude of the person who uses the rod. He had not much hope, however, that a study of the rod itself would yield great results: "This much is certain that there cannot be much hidden power in the bit of wood, for if this were the explanation, any person would be able to make such a demonstration."[46]

Before turning to his request for assistance at the end of his letter, Rabus tried to convince Leeuwenhoek of the truth of divining by relating new and stunning information. From his words, it becomes obvious that Rabus had recently become personally involved in the divining case. On Saturday, 12 May, Cornelis van Beughem had visited Rabus for a second time. They were colleagues in the publishing business as well as in bibliographical work, and they were on friendly terms. Still curious about the divining rod, Rabus broached this subject once more with the renowned dowser. As he explained to Leeuwenhoek:

> Although I am a mortal enemy of superstition and very rarely accept the truth of something on the basis of hearsay or rumours, I am never suspicious when an honest man confirms a curious matter, which he considers true on the grounds of his experience. However, sight is better than hearsay, and so far I had no experience of my own to satisfy myself by accurate ascertainment of this strange process.[47]

In order to accept rumours as true pieces of knowledge, the word of an honest and experienced man was crucial for Rabus.[48] Still better, however, were experimental proofs. In response to Rabus' request, Van Beughem repeated his previous

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[45] Rabus' letter was printed in the *Boekzaal*, May-June 1696, 495-500. The letter can also be found in Leeuwenhoek's published correpondence, see Palm, *Alle de Brieven,* XI, 260-67; quote at 264-65. On Leeuwenhoek and Rabus, see also Palm, "Antoni van Leeuwenhoeks reactie," and van der Saag, "Pieter Rabus en Antoni van Leeuwenhoek," 343-82.

[46] Palm, *Alle de Brieven*, XI, 260-67.

[47] *Ibid.,* 261.

[48] In order to convince Leeuwenhoek of the trustworthiness of Van Beughem, Rabus pointed out that Leeuwenhoek and Van Beughem were acquaintances: together with another gentleman, Van

statements, corroborated them by relating many credible circumstances, and also offered to give a demonstration.

The next day, they went to a garden outside the city to get some new forked hazel twigs, and when they returned, other curious guests stood waiting for the demonstration to begin. Some of them were considerably more incredulous than Rabus, one of them declaring that he should be pleased if cured, like doubting Thomas, of his doubts, but that in the meanwhile he hoped one would not blame him if he suspected fraud. Van Beughem's son, Cornelius, alone among nine children to possess the gift of dowsing, came to his father's defence and proposed to do the demonstrations himself. His father explained that his son was even more gifted than himself. With his father's blessing, Cornelius gave more than 25 demonstrations before the gathering, before and after dinner. Everyone was stunned and convinced, including the very incredulous friend who had expressed strong scepticism beforehand. According to Rabus' description, the piece of wood turned so strongly in the hands of Cornelius that it almost lost its bark.

After these demonstrations, Van Beughem suggested that everyone present could take a try. Not one in a hundred had the gift of dowsing, he explained, but one could never know beforehand. One for one, they tried, but the twig remained rigid. When Rabus' wife took her turn, however, the twig shook and trembled almost as strongly as in the hands of Cornelius.[49] After discovering her natural aptitude for divining, Rabus' wife, Elisabeth Ostens, did at least as many trials as Cornelius had done. Rabus stood aghast. He took the twigs with him that night and since then, he explained to Leeuwenhoek, his wife had performed many demonstrations for him on a daily basis, giving indubitable proof of the workings of the divining rod. Intrigued, Leeuwenhoek travelled from Delft to Rotterdam and Elisabeth treated him to a demonstration of divining at Rabus' house. Leeuwenhoek was thoroughly surprised by this curious phenomenon, but was afraid that his friends would not believe him were he to tell them about it. For this reason, Rabus organised another demonstration at Leeuwenhoek's home in Delft, with

Beughem had visited Leeuwenhoek at his home some time before to admire his collection and his discoveries in natural philosophy.

[49] Rabus wanted to keep the identity of the newly discovered diviner hidden, and deleted the name of his wife from the published version of the letters. But it is clear from later letters, pamphlets and a satiric poem published in 1713, that it was Rabus' wife, Elisabeth Ostens. (See the "Sprookje van Gijsje den Os," below.)

five distinguished gentlemen present.[50] Again, Elisabeth did twenty astonishing and convincing tests.

After these demonstrations, Leeuwenhoek found out that there was also a dowser living close to him in Delft. During the next few days, Leeuwenhoek did a number of experiments with that person. After all rods had been broken in the trials, Leeuwenhoek had to go and collect new ones. He cut new divining rods from willow, apple, pear and alder trees and handed these to the diviner without telling what kind of twig it was. All these rods worked properly, to Leeuwenhoek's surprise, but when he finally handed over a hazel twig, the movement was visibly stronger. Thereupon, Leeuwenhoek dissected the branch of a hazel tree to find out what was so special about it. By means of his microscope, he established that hazel has an uncommonly large number of very fine horizontal vessels, "only eight or ten of which lie together in a straight line, without their constituting any greater width than the diameter of a vessel [cell], and this so close together that it seems to me that between all the vertical vessels, there are horizontal vessels again."[51]

How these findings could come to bear on the practice of divining was still unclear. Given Vallemont's theory of corpuscles that entered the divining rod and the body of the dowser, it was relevant to look at the fine structure of hazel, of course, but much more had to be done.[52] In other experiments, Leeuwenhoek had established that gold was not attracted by the divining rod, but that the rod moved towards the gold. He compared this to his recent experiments with magnetism. Leeuwenhoek carefully described an experiment with balances and large magnets by means of which he had shown that there was no movement from the loadstone to the iron. There was only the opposite movement, from the iron to the loadstone. (This was contrary to William Gilbert's idea of a 'coitus' in which both iron and magnet were attracted to each other.) Leeuwenhoek remained baffled by the phenomenon of divining, however, and the more he thought about it, the more intractable the problem seemed. Especially the fact that the rod did not work in everyone's hands was as yet inexplicable. For, as Rabus had stated in his letter to Leeuwenhoek, this suggested that the key to the mystery might not be so much in the rod, but in the body of the diviner.

It is clear that the circulation of the divining rod itself was not essential. This

50 Leeuwenhoek's letter to Rabus, 1 June 1696, printed in *Boekzaal*, May-June 1696, 522-25, and reprinted in Palm, *Alle de Brieven*, XI, 270-75. I have translated "vijf distincte heren" as "five distinguished gentlemen" rather than pleonastically as "five distinct gentlemen."

51 *Ibid*., 272-73.

52 It is striking, however, that Leeuwenhoek did not study the pores of the diviner himself.

instrument could easily be produced. Crucial was rather the circulation of diviners themselves. The Aymar case only gained momentum when Aymar was transported from the province to Paris and the Prince de Condé could do tests with him directly. Similarly, the Dutch debate about the divining rod took off when a German diviner came to visit Rabus, and when new diviners suddenly sprang up in their own midst. If we accept Rabus' account, divination spread by travelling diviners and as people discovered that they also possessed this secret gift. But divination was more than a mere gift. It was also a technique, which involved tacit knowledge, and this had to be learned by demonstrations by experts and by practice. Many diviners in France commented on, and fought about, the right technique of divining. Elisabeth Ostens, for her part, had learned from Van Beughem how she had to hold the rod.

The circulation of these diviners is not the same as the circulation of experts and expertise that is usually discussed in the history of science. In this case, the diviners are the actors in a specific practice that has to be learned, but at the same time, they are the scientific objects under scrutiny. They, that is, their bodies are an indistinguishable part of the object of enquiry, namely the phenomenon of divining. In order to reproduce the phenomenon, the body of the diviner seemed to be indispensable. Typically, the diviners themselves were not part of the learned community – they were women, peasants or children –, they did not study their own strange capacity, and we seldom find their own voice recorded in historical records. Diviners were in a very literal sense 'silent messengers'. Not their voices, but their bodies mattered.

Van Beughem was an exception in this respect, because he was an adult man and moreover with a career in the literary world, as a publisher and bibliographer. There were a few other men of considerable social standing reported as diviners, such as Monseigneur Galet in France, the bishop mentioned by Bekker, but even these educated and literary men did not engage directly in the debate. Van Beughem did not write about his capacity of divining, and except for some simple trials, he did not do systematic experiments on himself in order to find out more about the phenomenon of dowsing. We can find his voice, the voice of his son, Cornelius, and to a lesser extent the voice of Elisabeth Ostens, only represented in the letters and publications of Rabus. These voices rarely tried to detail or explain divination; this was left to the natural philosophers who studied them.

One might speculate that the diviners were uncomfortable under the objectifying gaze of the natural philosopher. But the opposite seems to be the case. Diviners did not oppose the scrutiny of natural philosophers, such as Leeuwenhoek or Rabus, who wanted to discover the natural properties of the phenomenon of divining. But when critics suggested that these diviners were not just natural objects, but that they were persons who could try to trick and deceive these natural philosophers as well as other credulous bystanders, diviners tended to react with indignation, as such criticism questioned their moral and social status. Natural philosophers, while also concerned about the credibility of the diviners, tried to eliminate their testimony as much as possible. Most important for them was the circulation of the diviner's body, which was under close scrutiny by the curious savants. Aymar's pulse and physical condition was monitored by physicians. Osten's hands were examined to see how she held the rod and to find out how the rod could twitch. Especially interesting for the theoreticians was the materiality of the diviner's body, with its humours, skin, pores and fibres, in order to explain how the divining rod could work in the hands of some but not of others.

On the one hand, the divining rod and the body of the diviner are the objects of natural philosophical enquiry. On the other hand, one could also see them as instruments that were able to detect invisible vapours or signals in nature that indicate the presence of hidden metals, water or (in Aymar's case) even criminals. Not only was the divining rod an instrument, but the whole body of the diviner was seen as a large organic instrument that measured invisible qualities. In his *Physique occulte*, Vallemont compares the body of the diviner with a scientific instrument, such as a barometer, hygrometer and thermometer, the workings of which he describes at length. These instruments do not only enlarge images, like the microscope or the telescope, but they measure vapours. The body of the diviners also had to be tested and calibrated, and only some of them (possessing the right complexions, nutrition, or temperament) met the standards for dowsing. Just like the maintenance and transportation of precision instruments, the circulation of diviners was fraught with complications. The materiality of the diviner's body was considered to be crucial for the phenomenon, and circulating it in different environments could affect this 'instrument' in a negative way. Instruments should be handled with care; they needed time to reach a new equilibrium state and should not be used to measure extreme conditions, at the risk of damaging them.[53]

When Leeuwenhoek, after some interruption, wanted to return to his experiments with the diviner from Delft, they both found out, to their consternation, that the man had lost his capacity for divination.[54] The dowser, dismayed, thought that fresh rods would easily solve the problem, but this was not the case. The phenomenon turned out to be less constant than Rabus had assumed, as Leeuwenhoek remarked. When Rabus told this news to his wife, Elisabeth thought he was

53 See my paper "Divination and the Circulation."

54 Leeuwenhoek, "Leeuwenhoek to Rabus" in Palm, *Alle de Brieven*, XI, 272-73.

joking. Rabus replied to Leeuwenhoek that the right "disposition of the body" (*gesteltenisse des lichaams*) would probably soon return, and he remarked that at Rotterdam his wife's capacities had so far been infallible.[55] She had always delivered, beyond expectation, even when Rabus had tried to trick her. Rabus tried to convince Leeuwenhoek of the matter by giving more details of his new experiments. The more gold there is, the stronger the twig moves in her hands, pointing to the centre of the treasure. Rabus noted the curious fact that gold hidden under porcelain caused a much reduced movement in the stick, when compared to the movement provoked by gold hidden under other materials. But if there is the least opening in the porcelain, the activity was as strong as usual. This suggested that the material of porcelain might be able to stop the vapours and corpuscles exhaled by the gold, where other materials could not.

Nor was the material state of the twigs irrelevant. The twigs were best when they were young, not too fresh, but not too old either. Moreover, the more Elisabeth's hands had been at work with the rod, and were red and warm, the more vigorous was the movement of the rod. If the rod was too thick, it would hurt her hands and rip away the skin. Until now, Rabus added, no-one else among their acquaintances had been able to use the rod, but they had noted that if someone took the rod from Elisabeth's hands, there remained some perceptible movement in it. When this person took a new twig, however, it remained immobile. These curious detailed descriptions of some of the properties of the practice of divination, and especially the role of the divining rod itself, were meant to convince Leeuwenhoek to continue his inquiry. It seems that Leeuwenhoek became disillusioned and disinterested in the phenomenon, however, after the diviner close at hand in Delft had lost his capacity for divination. Rabus' own confidence in the infallible and unwavering capacities of his wife would also be put to the test during controversies later that year. (Figure 3)

The Collegiant Controversy

In the autumn of 1696, Rabus and his wife were travelling from North-Holland back to Rotterdam, when they met Rabus' publisher, Pieter van der Slaart, in Amsterdam. Van der Slaart insisted on visiting some acquaintances on the way to Rotterdam. It turned out that some people wanted to put Elisabeth to the test. Without informing Rabus, Van der Slaart had made a bet with Lambert ten Kate, a Collegiant from Haarlem,. They carried out a trial, and Elisabeth found a gold

[55] Rabus' letter to Leeuwenhoek, 30 July 1696, printed in *Boekzaal*, July-August 1696, 152-56, and reprinted in Palm, *Alle de Brieven*, XII, 24-29.

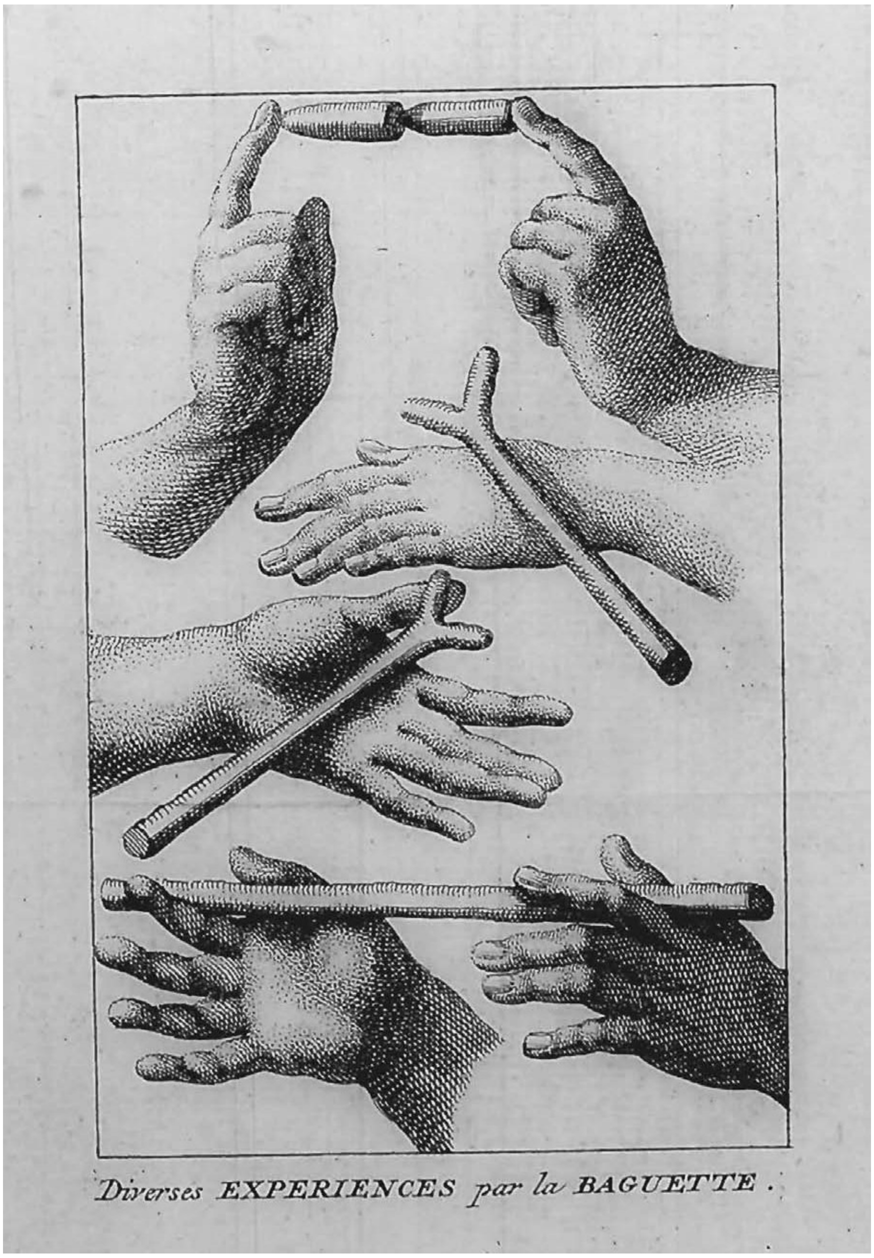

Figure 3: Diverse ways of holding different kinds of divining rods, from P. Le Brun, Histoire critique des pratiques superstitieuses, 1733 edition, part of Plate A. Le Brun's book was one of many polemical works about the divining rod that were published in France after the remarkable feats of divination by Jacques Aymar in 1692.

purse in the corner of a strawberry bed. But, if we may believe Rabus, Ten Kate and his friends did not want to pay their share of the bet, because they claimed that Elisabeth had not been precise enough when she pointed out the location of the purse. Rabus called them hair-splitters and claimed that they were prejudiced. The Collegiants, in turn, spread the news that they had seen Rabus' wife fail with the divining rod. Rabus retorted by claiming that they gave a distorted account of what had happened.[56]

Rabus was convinced that these men tried to bring his wife into disrepute because he had written critically about the Collegiants in a book review on the History of the Quakers and elsewhere in the *Boekzaal*.[57] The Collegiants formed a radical religious movement that had grown out of the Dutch Arminian tradition in the first half of the seventeenth century. After the Arminian ministers had been exiled from the Dutch Republic around 1620, some congregations continued to meet without a minister. People came together to pray, sing and discuss, relying on spontaneous testimony and on the inspiration by the Holy Spirit. They strongly opposed Protestant theology, authority and hierarchy. They interpreted God's word according to their own insight, propounded freedom of creed and rejected the intellectual authority of others. The Collegiants tended to be intellectually active merchants and professionals who spread and radicalised progressive ideas. In their meetings, which were open to everyone, daring new ideas were often propounded, which is why they attracted all kinds of radical thinkers.

According to Rabus, religious interests and strife played a major role in the controversy over his wife's performance in the strawberry patch. Indeed, a striking illustration of the religious overtones of the debate is found in the Collegiants' description of a wrong turn of the divining rod as "bowing before an unconsecrated altar."[58] Although, in the *Boekzaal*, Rabus had never clearly defined his own religious commitments, he presented himself as a moderate reformer. He stressed reason, tolerance and education, a combination of values that became particularly

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[56] For two contrary accounts of this controversy, see Rabus' letter to Mierink, published as "Opregt verhaal van eenige proeven der wichelroede," and two pamphlets in which the author satirizes Rabus and sides with the Collegiants: Anon., *Nodige Verantwoordinge* (this anonymous pamphlet can be found in the copy in the Municipal Library of Rotterdam of Rabus, *De Weergalooze Dichter*) and the sequel of this pamphlet, Anon., *Panegyricus*. The publisher and occasional poet Isaac Vander Vinne wrote in *Ondervindingen wegens de Wichel-roede* his account of the divining rod experiments performed in the presence of the rich merchant Pieter Koolaart and his wife, the poet Elisabeth Hoofman.

[57] *Boekzaal*, January-February 1696. See also the remark on this review by Rabus in the satirical pamphlet *Panegyricus*, 22.

[58] *Boekzaal*, May and June 1697, 409ff.

visible in his fight against superstition and his defence of Bekkerian ideas. He was probably a Remonstrant, or Arminian, belonging thus to the progressive side of the Dutch religious landscape; yet he opposed extreme ideas concerning scriptural interpretation or the invalidity of all authority.

Rabus was thus sceptical of the Collegiants' tradition of 'free speech' or 'free prophecy'.[59] While some Collegiants were prudent and intelligent, he thought, many used their membership as an excuse for being sanctimonious, self-opinionated and stubborn. They allowed themselves to be guided by their own emotions, deluding themselves to be feeling the inspiration of the Holy Spirit. Rabus thought that it was wrong to presume that anyone, even without the least knowledge or expertise, could speak up and propound inspired ideas, however crazy. 'Free speech', he felt, implied its own dogmatism: not accepting any authority, the Collegiants could neither be instructed nor corrected, and they never saw any reason for changing their mind. This attitude was reflected in the remark by one of the Collegiants as recorded by Rabus: "he said he did not want to believe the workings of the divining rod, even if he saw them tenfold."[60] From Rabus' point of view, an excess in so-called 'openness' of mind could in fact close the mind, leading to unjustified prejudices and hindering the circulation of knowledge. Ignorance could be hidden under the cloak of 'Christian freedom.'[61] As a consequence, these so-called defenders of 'free speech' were in truth intolerant of public criticism, and tried to obstruct the truth about divination not just by their excessive denial of the evidence, but even by spreading false accounts.

Rabus thus sketches an unflattering portrait of the Collegiant group from Haarlem, calling them hot-tempered, impertinent and deceitful impostors and suspecting that they were motivated by revenge. But Rabus' word may not be the ultimate on this issue. In fact, both Ten Kate and Trioen, Rabus' two most prominent opponents in this affair, were respected citizens of Haarlem. Jan Trioen (1657-1721) was dean of the Collegium Medico-Pharmaceuticum, the guild of physicians and apothecaries, and deacon of the reformed church. Furthermore, he did some serious work in historiography and linguistics.[62] As for the fellow-Collegiant Lambert

59 On Rabus' view of the different factions of Dutch Protestantism, and notably the Collegiants, see De Vet, *Pieter Rabus*; and especially van Herpen and Kok, "Pieter Rabus en zijn houding," 157-78.

60 *Boekzaal*, May and June 1697, 399: "dat hy de uitwerkselen der Wichchelroede niet wilde gelooven, al zag hy die nog tienmaal."

61 *Ibid*., 396-99: "Komen ze in hun stout vragen en hervragen bekaaid uit te vallen, 't welk meer als al te veel gebeurd, straks bezwagtelen zy die misdragt hunner onkunde met de lueren van een Christelijke vryheid."

62 Jongeneelen, "Fonetiek en verlichting." For Trioen's historiographical and linguistic writings,

ten Kate (1674-1731), he was a wheat merchant and a linguist who would later publish important work on phonetics and phonology. Fascinated by Newton, Ten Kate also worked on optics and aimed at constructing mathematical theories of language, art and religion. In 1710, he discovered the vowel gradation and became the founding father of historical-comparative linguistics.[63] Both Trioen and Ten Kate were members of the Collegium Physicum Harlemense – probably the precursor of the Hollandsche Maatschappij der Wetenschappen –, an informal society that discussed natural philosophy. Rabus spoke disparagingly of this society, claiming that its members were amateurs and had no official credentials. Trioen, in his function as secretary of the society, was responsible for all correspondence, and exchanged polemical letters and tracts with Rabus.[64] During the controversy, the Collegium did not only question the demonstrations of Elisabeth Ostens, but also challenged Rabus on theoretical grounds, arguing for the impossibility of divining. Rabus, who derived his explanation of divining from the Cartesian explanations he had found in Vallemont and Bekker, replied that the members of the Collegium Physicum Harlemense did not even understand Descartes' natural philosophy.

Leaving aside the questions regarding the intellectual credentials of the Collegium and the Collegiants, this episode illustrates how lack of trust and excessive scepticism interferes with the circulation of knowledge, especially where the knowledge involved is perceived to be unorthodox, or is new and thus still vulner-

see manuscript hs. 187 A 56 in the Stadsbibliotheek Haarlem. It is interesting to note that a small circle of well-known publishers, literati and linguists stood at the centre of the controversy, including besides Pieter Rabus himself also Cornelius Van Beughem, Jan Trioen, Lambert Ten Kate, Katharine Lescailje, Elisabeth Koolaart-Hoofman, Isaac Vander Vinne and Pieter Van der Slaart.

63 See, e.g., Ten Kate, *Verhandeling over de klankkunde*; Ten Kate, *Wiskundig ontwerp der schryfkunst*; Ten Kate, *Aenleiding tot de kennisse van het verhevene deel der Nederduitsche sprake*. See also Jongeneelen, "Lambert ten Kate," 201-91. Ten Kate, "Proef-ondervinding over de scheiding der coleuren." See also Vermij, "The Formation of the Newtonian Philosophy"; Margocsy, *Commercial Visions*, ch. 5.

64 The two pamphlets mentioned are probably written by Trioen, although his authorship cannot be established beyond doubt. De Vet attributes the authorship of *Nodige Verantwoordinge* to François van Bergen, another opponent of Rabus (albeit mainly in another controversy), on the grounds that he attributes also authorship of the *Panegyricus* to François van Bergen. I do not have any proof of this latter claim, however. Gerrit H. Jongeneelen (in "Fonetiek en verlichting") has found a written version of the *Nodige Verantwoordinge* (called *Satyrische Verantwoordingh*) in the papers of Jan Trioen. Textual evidence suggests that this version is probably a copy of the version that went to the printing press. While this copy provides us with no conclusive evidence that Trioen was the author, it does establish that the writer of the pamphlets was very close to the *Collegium Physicum Harlemense* and its secretary.

able. Rabus complained that "suspicion comes up, as soon as they declare their sentiment to someone else. They trust nobody, and they want to be believed by everyone."[65] He was painfully aware that doubt, wielded intentionally, could undermine the truth and acceptance of any phenomenon. Ten Kate had demanded certain and infallible proof that the divining rod really worked. Such certainty was of course unattainable, and to Rabus' exasperation, Ten Kate and his friends could continue to cast doubt on both the empirical procedures or the integrity of the witnesses. What complicated matters even further was that the relationship between accuracy of measurement and acceptance was perceived differently by sceptics and believers. For Rabus, a positive result in a majority of experiments carried out constituted a clear confirmation of the successful workings of the divining rod. For the Collegiants, by contrast, each failure appeared to confirm their previous belief that divination was impossible. Rabus fumed against this exceptionally high barrier of scepticism, arguing that if expertise, demonstrations and proofs, judged with some measure of benevolence, were not accepted anymore, this had to lead to intellectual anarchy. In this case, benevolence was clearly lacking, and the circle of trust necessary for transmitting Rabus' theoretical explanations as well as the practice of divining was broken.

A comparable dynamic was present in many of the demonstrations and experiments that were in those years performed in the houses of prominent intellectuals at different locations in the Netherlands. The circle of Collegiants around Ten Kate were unwavering in their dissatisfaction with the evidence. At a meeting in the house of the Quaker Benjamin Furly, John Locke's one time host, Ten Kate suggested that Rabus' wife had failed in his presence and that Rabus was well aware of this. This promptly evoked a row. An eminent physician present supported Rabus and told the assembly that he had witnessed similar feats of divining at the court of a German prince. Furly, a prosperous cloth merchant, host to passing Englishmen of unorthodox intellectual tastes, and himself an intellectual of some stature, was intrigued. His curiosity piqued, he visited Rabus a number of times to do extensive and detailed observations when Ostens handled the rod. According to Rabus' account, Furly was completely satisfied of the truth of the phenomenon.[66]

Elisabeth Ostens also demonstrated her skills in Haarlem at the house of the

[65] *Boekzaal*, May and June 1697, 396-99: "D'Argwaan doet zig op, zoo haast als ze hun gevoelen aan een ander verklaren. Zy vertrouwen niemand, en willen bij elk geloofd zijn."

[66] On Furley and his circle in Rotterdam, see Zijlmans, *Vriendenkringen*, 175-94; Hull, *Benjamin Furley*.

famous physician and demon-sceptic Anthonie van Dale.[67] According to Rabus, who since 1692 had been a close friend of Van Dale, the latter was equal to the Collegiants in scepticism but not in slander. During the evening, gold was hid under hats scattered in a small attic room. This demonstration turned out to be a partial failure, and Rabus went out of his way to point to the experiment's unfavourable circumstances: the room was too small, many onlookers also had gold in their pockets, which disturbed the experiment, and some quick-tempered Collegiants had started their accusations even when Elisabeth was still testing and calibrating her divining rod. The experiments were subsequently repeated in the kitchen, where Ostens found gold under a cushion on the last chair. She had, however, walked past the first chair, on which a golden watch lay hidden, so that new claims of failure were voiced. Rabus defended his wife once more by arguing that she was still merely testing the rod as she passed the first chair, and weren't the many times that Elisabeth had successfully located the hidden treasures sufficient proof of her capacities? In response, the Collegiants pointed out that Rabus and Van der Slaart had been present when the gold was hidden and might have given secret clues to Elisabeth, helping her find the gold and tricking the audience.[68] Van Dale continued to support Rabus, however, and the bond of trust between them was not broken.

It is obvious that the open-ended Dutch debates were similar to those surrounding Aymar in Lyons and Paris. Aymar, too, had performed very well in a convivial and trusted setting, while his powers seemed to fail him in a sceptical and critical environment. Some supporters found explanations and excuses for such failures, as Rabus did with respect to his wife's, arguing, for example, that there was too much other gold present in the room, which interfered with the experiments, or that the conditions were not optimal. Others attempted a theoretical explanation of the diviners' failure by pointing out that the phenomenon depended on subtle mind-body interactions. When the diviners felt under pressure, for instance, their mental experience effected their body, causing sweat and a different exhalation of vapours, possibly preventing the effluvia of the gold from entering their pores. Aymar had certainly been exposed to considerable stress during the experiments performed before the royal family and famous scientists. Similarly, Elisabeth Ostens must have been under pressure as her and her husband's honesty and credibility were at stake – a credibility that was crucial for Rabus' profession as a journalist and public educator. In short, the diviners' mental well-being

[67] *Boekzaal*, May and June 1697, 404.
[68] *Nodige Verantwoordinge*, 7.

seemed crucial, and trust, support and the absence of stress were important conditions for their successful operations.[69]

When his wife had failed to find the golden watch in the kitchen of Antoni van Dale, Rabus even suspected outright fraud: had someone put the golden watch there afterwards, in order to discredit her? Such suspicions were heightened by the events that unfolded later in the evening. After Elisabeth Ostens' demonstrations, others were invited to try out the divining rod. Suddenly a young lady, sister of one of Rabus' opponents, proclaimed that the rod worked in her hands, too. Rabus and his wife, pleasantly surprised, witnessed the rod turning in her hands and affirmed that she also seemed to have the gift of dowsing. Upon which the lady declared that she had consciously moved the rod by means of small hand movements, making Rabus and his wife looking like fools.[70] A whole discussion ensued on how to hold the rod, and whether trickery was possible. Rabus made many prominent people attest that they had conclusively convinced themselves that it could not be done by sleight of hand. Furly, for instance, had clearly seen and attested that Elisabeth Ostens wielded the wand with immobile hands, even to the point that the twig broke into pieces.

The Collegiants, averse to all claims to authority and expertise, were not impressed by Rabus' collection of attestations of credible gentlemen, and did not waver in their criticism. Traditional modes of convincing other people – the testimony of credible witnesses – seemed to fail in the particular religious and epistemic context of the Dutch Republic at the end of the seventeenth century. More experiments followed, and the Collegiants from Haarlem even summoned the boy, Cornelius van Beughem, for trials.[71] The boy's father was enraged by this attempt to abuse his son for their campaign of slander and forbade him to demonstrate his skills again. For the Collegiants, this was only further proof that dowsing was all deceit and fraud. Rabus, by contrast, claimed that the boy had told him that the Collegiants had not only misrepresented the events but had explicitly told him that their aim was to discredit Rabus. Indeed, they were reported to gloat over the fuss that was made and over Rabus' bad luck.

If pressed, father Van Beughem would still let his son be subject to experiments, as is shown in a detailed manuscript report by Izaak vander Vinne, but

69 See my paper "Divination and the Circulation."

70 Of course, this witty trick cuts both ways. It exposes Rabus and Ostens' lack of expertise in distinguishing genuine diviners from frauds. But their willingness to accept the women's capacity as genuine might also be interpreted as an indication that they honestly believed in the phenomenon. If they were frauds themselves, and if they thought the phenomenon was impossible, they would not have fallen into the Collegiants' trap.

71 *Boekzaal*, May and June 1697, 430-35.

the father insisted on being present himself and refused the participation of troublemakers. Sometime in June 1697, experiments were performed at the house of the merchant Pieter Coolaart in Haarlem, in the presence of Van Dale. Coolaart, initially a staunch sceptic, could not deny that the divining rod worked after all experiments turned out to be successful. Nevertheless, he was reluctant to affirm that the working was natural, artificial or illusionary. Furthermore, worried about his own reputation, Coolaart explicitly asked Van Beughem to keep the matter secret.[72] Even if many of the witnesses did not dare to speak up, afraid of being ridiculed by colleagues and friends, Van Beughem and Rabus tried to enlist as many as possible in their support. Rabus mentioned many credible witnesses in various issues of his *Boekzaal*, and Van Beughem appealed to indubitable proofs carried out before the mayor of Amsterdam and Dr. Balthasar Bekker, for instance. In this way, they tried to rebuild the trust and credibility that the Collegiants so effectively challenged.

Trust was never completely rebuilt, however. The controversy went on, with insult being added to insinuation. In pamphlets, it was suggested that Rabus did not dare to accept bets anymore, because his wife had lost the capacity of dowsing. Elisabeth Ostens was told to have lost too many effluvia during a recent childbirth, depleting her resources of vapours necessary to wield the rod.[73] For why else would Rabus forgo the opportunity to obtain the huge sum of 2000 guilders, given that under normal circumstances, his wife could easily perform the set task? But even if he lost the bet, his moneybox must be sufficiently filled, with a wife who can find gold at each corner.[74] The symbolic meaning of gold and riches was central for the mercantile Dutch Republic in its 'golden century'. In this particular case, however, it played a negative role, being an occasion for foul play, suspicion and satire. The Collegiants jokingly suggested that Rabus deserved a statue for his efforts in purifying the Dutch language, and that his wife deserved one for giving the city of Rotterdam such a useful tool for finding gold. These statues should be adorned with divining rods, books and sceptres.[75]

Rabus was drawn into an ever-increasing number of controversies and torrents of abuse concerning literature, natural philosophy and religion, and the controversies started to overlap. The case of the divining rod stood out, however, and was

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[72] I have found a report of these experiments, written down on 23 June 1697 by Izaak vander Vinne after an oral report of the proceedings by Pieter Coolaart. Vander Vinne, *Ondervindingen wegens de Wichel-roede* [MS UVA hs. VIII E 2].

[73] *Nodige Verantwoordinge*, 20.

[74] *Panegyricus*, 34-35.

[75] *Nodige Verantwoordinge*, 16.

vividly remembered more than fifteen years later, ten years after Rabus' death. A satirical poem of 1717, which formed part of an elaborate literary controversy in which Rabus had once played a role, defended the poet David van Hoogstraten, Rabus' friend in youthful years, against Gysbertus Ostens, Rabus' brother-in-law. In the following passage, which is rich in allusions, the families Ostens and Rabus are satirised, being still remembered for Elisabeth Ostens' notorious exploits with the divining rod.[76]

> Like your Uncle, the atheist[77]
> Of which your brother-in-law Pieter [Rabus] knew
> To speak so masterly[78]
> When he had to miss
> His long-sought love.
> Then Vettekeuken came along.[79]
> Then you gave him your sister,
> Then he was much more at ease,[80]
> She wielded tight the divining-rod
> And was never tired of looking for gold
> Even when it was not lost.
> Who wouldn't be beguiled by this?[81]

Conclusion

In this chapter, I have given a detailed description of the material and intellectual aspects of knowledge claims, their status and their circulation in the course of a curious controversy about divination, taking place in the Netherlands of the late 1690s. Information about dowsing had first reached the Netherlands from France

76 See "Sprookje van Gijsje den Os," and Gysbertus Ostens poetic reply, "Sprookje van het Buffeltje," published in Anon., *Vervolg van de Nederduitse Keurdigten,* 74-81. For an analysis of this passage, see De Vet, "Het beeld van Rabus," 139-56.

77 This hints at Rabus' radical (and improper) connections. It was said that Jacob Ostens, who had frequented Spinoza, was a Spinozist.

78 Rabus was a school teacher.

79 Vettekeuken married another sister of Gysbertus, and Rabus provided the wedding poems, introducing him to the intimacy of the family.

80 Although not well-to-do, Rabus was able to marry into the rich family Ostens.

81 "Gelyk uw Oom den Atheist, / Waar van uw Zwager Pieter wist / Zoo Meesterlijk te spreken, / Wanneer hy was versteken / Van zyne lang gezochte min. / Toen quam 'er Vettekeuken in. / Toen gaaft gy hem uw zuster / Toen was hy veel geruster / Die voerde strak de Wichelroede./ En was nooit gout te zoeken moe, / Al was het niet verloren. / Wien zou dat niet bekoren?"

and subsequently circulated between different places in the Low Countries in letters, books, pamphlets as well as by personal interaction. The material aspects of the production of these different knowledge claims and their circulation (as diverse as printing places, availability of dowsers, distances between experiments and the readers of the reports, wartime blockades, etc.) are important for understanding the dynamics of this controversy. I have also shown that the materiality of the rods mattered, too: they had to be of the right quality, fairly young twigs of hazel trees giving the best results. But the rod was by no means sufficient: maybe even more important were the skills and tacit knowledge involved in holding the rod – knowledge that had to be transmitted from one dowser to the next. Disagreements over all these material, personal and skills-related aspects escalated during the most vehement episodes of the controversy. Arguments concerning the materiality of the bodies of the diviners and notably the fine structure of their skin, membranes and fibres were invoked in explaining the phenomenon of divining. One of the central problems was the nature of the mysterious subtle effluvia that were supposed to circulate between the gold, the divining rod and the diviner's body.

In my introduction, I have drawn a distinction between different levels involved in the circulation of knowledge. In this chapter, I have focussed on the third level: How and why did the historical actors *accept* or *reject* the knowledge claims with which they were confronted? How did they become convinced? Can we understand their justifications for adhering to a certain opinion, or for changing it, according to their own criteria? I have analyzed the reasons given by Bekker, Bayle, Rabus and others in their assessment of the information they received. We saw, for example, the changes in Bayle's reading of the dowsing reports by looking closely at the materiality of his publications. Because of information he obtained later, he came to view the initial reports about the dowsing case in an entirely new light. Bekker, for his part, seamlessly integrated the controversy into his own programme of devil-slaying.[82]

In order to make up their minds, savants collected and pondered reports by credible men. But they preferred to witness the curious phenomenon of dowsing themselves, desirous to interact with the dowsers, touch their hands and the moving rod they clasped, or even try dowsing for themselves. In order to render such hands-on experiences possible, the diviners were taken to different places. Indeed, the material circulation of the bodies of the dowsers was decisive for convincing members of the Republic of Letters to accept the reports as genuine claims to

[82] Jonathan Israel describes coined medals on which Bekker is represented as a devil slayer. See Israel, *Radical Enlightenment*, figure 18 (inserts between pp. 394-95).

knowledge. We have also seen, however, that though savants were able to specify reasonable grounds for their opinion, their acceptance or rejection of claims to successful divination were very different, as were their judgements on the explanations offered for such divinatory events. A complicating factor we have encountered is the initial bias of some of the actors, which was due to family-related, ideological or theological reasons. Finally, the exchanges between Rabus and the Collegiants also suggests that some foul play might have been involved.

I have shown that traditional modes of truth assessment, by testimony and witnessing, failed in the specific, religiously divided and epistemically fragmented context of the Dutch Republic at the end of the seventeenth century. The differences in epistemic culture between Pieter Rabus and the Collegiants should not be underestimated. They held different standards in accuracy, in allocating credibility, in judging opinions and reports, and in dealing with expertise and authority. In particular, all standards of credibility and trust seemed to be challenged by what Pieter Rabus considered the Collegiants' excessive reliance on 'freedom of speech'. This epistemological clash involved all the criteria that were central to the circulation of knowledge in the early modern period. At stake were the fundamental concepts that the early Enlightenment had constructed, debated and revised. Many of these fundamental concepts were related to *trust*. But trust was crucial for the circulation of knowledge, particularly in cases where new and still fragile knowledge claims were involved. In the particular case of the divining rod, some participants even maintained that a minimal presence of trust was essential for the very functioning of the divinatory act. This case, in which the historical actors themselves stressed the importance of effects that blend or cross the realms of body and mind, powerfully illustrates the importance of looking beyond the merely material aspects of circulation.

Controversies are always good moments for the circulation of *knowledge claims*. But they are at the same time detrimental to the circulation of *knowledge itself*. During a controversy, the material production and circulation of information multiplies, and all aspects of a case are widely publicised. Conversely, a controversy destroys the fragile networks of trust between people. It creates factions, scepticism and suspicions. Heightened scepticism and doubt, in turn, corrode the phenomena, procedures and theories that are at stake, preventing their widespread acceptance. The more heated a controversy becomes, the more unlikely a fair exchange of information, unbiased judgements and rational discussion gets, while prejudices, self-interest and bad rhetoric usually take over. Historical actors come to see fraud as a distinct possibility, not only at the level of production (the diviners), but at all levels of circulation (witnesses, authors, journalists and even editors), which destabilizes the knowledge economy.

The episode analyzed here provides us with a beautifully close view of the interactions and exchanges in the Republic of Letters. It also reflects some of the big issues that were at stake at the end of the seventeenth century: the role of religion in society, the contested demarcation between the natural, the preternatural and the supernatural, and the meaning and credibility of wondrous phenomena. Some of the most pressing topics of the time were related to what we call the programme of the Enlightenment, which required the free circulation of knowledge, by involving questions of trust, testimony, free speech and scepticism.

When the controversy over the divining rod flared up in the Netherlands, with his personal acquaintances at the centre of the skirmishes, Pierre Bayle did not know what to believe anymore. Confused, he turned to his friend Jean-Baptiste Dubos for advice. Dubos responded offhandedly that he imagined seeing the Dutch bourgeoisie excited about an old Parisian vogue, but that in Paris, the savants considered all this fuss about the divining rod passé: "No-one here doubts that Jacques Aymar was nothing more than a rogue and that he would find no-one to dupe anymore among the savants."[83] But even though in Paris the savants thought that they had closed the case, the controversy continued in the French province, in Holland and in other neighbouring countries.

[83] Dubos's letter to Pierre Bayle, 14 June 1697, in Émile Gigas (ed.) *Choix de la correspondance*, 299. See also the account in an earlier letter, *ibid.*, 261.

Closing Comments

Harold J. Cook

The fine essays composing this excellent volume all represent the recent move from seeing the history of science as an aspect of the history of ideas and culture to something more encompassing. Recent developments acknowledge the central importance of the material, bodily, and social constraints on those who participated in investigations of natural phenomena, as well as the information, concepts and values that shaped their expression. Histories of science, medicine, and technology are not, therefore, simply a subset of the history of philosophy. Philosophy was only one of the resources available to students of nature. Hence the welcome focus here on entanglements among "scientific" activities and travel, correspondence, social networking, book production, political and religious struggle, commerce, and above all the arts and crafts, specimen making and collecting, and the construction of instruments.[1] By being attentive to the ways in which material objects could be both foci for scientific study and embodiments of contemporary knowledge, the authors are contributing to the fresh and important corpus of studies on how a new understanding of nature emerged from certain kinds of engagements with the material world.

From the perspective of the history of science, medicine, and technology, then, these papers press forward the current agenda of seeing how body and mind, action and thought, arise from the same sources in the world rather than from distinct and separate ones. The model for science in the twentieth century was predominantly that of mental insight. It is well represented by the Institute for Advanced

1 I use the word "science" loosely, but deliberately. While many historians now avoid it for periods before the word "scientist" became common in English (in the nineteenth century), and while "science" in the early modern period might be used to refer to a certain kind of reasoned wisdom (*scientia*), confining historical studies to the early modern subject of "natural philosophy" alone omits a great deal of mathematics, mechanics, medicine, chymistry, natural history, and other kinds of natural investigation that should be studied in conjunction. For the counter argument, see Cunningham and Williams, "De-Centring the 'Big Picture'."

Study in Princeton, where its most famous mid-century resident, Albert Einstein, is reported to have been asked by a journalist for a glimpse of his laboratory, and to have answered by tapping a pen against his temple and saying something like "here it is young man, here it is." The Institute had chalk and blackboards and a library, and now has computers and online subscriptions, of course, but there was self-consciously no provision made for laboratories – in fact, they were, and are, forbidden. Some historians of science tried to counter this idealized picture of pure thought by arguing for the importance of "external" factors, but their aim remained showing that such things as social or political changes caused the origin of the scientific concepts that were the focus of their work, too.[2] But more recently, most historians of science have come to see their subject as a set of practices rather than contemplations, something that involves acting as well as thinking, with groups of investigators doing things together, often in laboratories, as well as speaking and writing.[3]

Along with the move toward practice has been a more general move to consider different kinds of causality. Like those in so many other academic fields, historians of science have stepped back from the kinds of clear and distinct arguments that set out (or attempted to set out) how B could be explained by the real or primary cause A. This often went by formulas such as "the careful reading of X caused so-and-so to draw conclusion Y," or the looser and more common "X influenced Y." Instead, an appreciation for multiple conjunctures and contingencies, and many-branched communication networks, have offered the possibility of seeing how scientific practices are affected by the complexities of ways of life, which create possibilities and constraints for action and discernment but without determining the "content" of anyone's "thought." In other words, Newton's world gave rise to the opportunities and challenges that enabled him to accomplish the work that made him famous (as well as other matters in his life), but did not "cause" him to construct arguments in one way or another, nor cause others to interpret his printed, written, or oral pronouncements in certain ways. It would be foolish to pretend that we know fully what goes through our own "minds," much less the minds of people who lived in worlds no longer completely accessible to us. They left words and symbols on paper, which we can study and interpret. But to imagine that we can know exactly what they were thinking when they set them

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[2] Again, I will use "history of science" as a shorthand for the history of a number of fields, including the history of medicine and technology.

[3] The most important early expressions of this view are found in Latour and Woolgar, *Laboratory Life,* and in Shapin and Schaffer, *Leviathan and the Air Pump*, drawing in part on Fleck, *Genesis and Development of a Scientific Fact*, eds. Merton and Trenn.

down on paper (or what the printers were thinking when they set them in type), or that we can imagine what caused them to think this or that, is the result of best-educated-guesses at best.[4]

What historians such as the contributors to this volume can say with more confidence is what happened on certain occasions (including what words were committed to paper), and how those acts were related to other contemporary and former events. In other words, historians can investigate the connectedness of events in the past while remaining agnostic about "why." In exploring the intertwining of people and events, it is possible to be analytical as well as descriptive. In doing so, we are following in the footsteps of our early modern forebears who argued that understanding the first causes of things was impossible but that investigating the so-called "secondary causes" could led to sound conclusions. Historians can explore some of the kinds of causes invoked by detectives – opportunity, means, and (probable) motive – without needing to console the reader with an explanation for why things happened as they did.

In taking such an approach to the history of science, the authors in this volume move toward more robust descriptions of how certain forms of knowledge arise from past engagement with material objects. They might be said to be exploring the material culture of science, in that most of them focus on what is both material and cultural. It is cultural in the ethnographic sense of showing the usually unexamined assumptions, values, and affects that make certain kinds of knowledge important to particular groups of people at particular moments; it is material in supposing that the knowledge of nature first arises from the five senses responding to tangible substances. It is also partially materialist in that many of the authors point to the involvement of market exchanges of objects in their accounts. The work particularly of Sven Dupré on cabinets made in Antwerp to show various ingenious tricks of optical perspective, Koenraad van Cleempoel on the mathematical and astronomical/astrological instruments of the "Louvain School" (which he calls "materialized knowledge") and Fokko Jan Dijksterhuis on mathematical instruments and manuscripts in The Netherlands, Eric Jorink on Dutch natural history collections, Dániel Margócsy on the making of anatomical specimens in Amsterdam and Leiden, and Koen Vermeir on inquiries in Delft into divining rods, all show how important both natural and artificial objects were to the making of science. In doing so, they are advancing further into the historical territory that treats head and hand as part of the same human existence, seeing

4 I set aside the vexed philosophical problems about the nature of mind, thought, etc., in order to focus on the historical problems.

knowledge as bound up with experience and practice, as "embodied."[5] Several authors (particularly Dupré, Van Cleempoel, and Margócsy) also emphasize the high monetary value placed on scientific objects, which in turn represents the high value placed on this kind of knowledge, at least by those in the market for it. Dijksterhuis underlines the significance of the personal networks created by commerce. Additionally, Vera Keller and Dijksterhuis further develop a long-standing argument about how critical it was for artisans and scholars to work together.

At the same time, however, as Sven Dupré puts it, the sale of perspective cabinets on the luxury market in Antwerp shows not only the value placed on mathematical design but also shows "the limits of objects to function as carriers of knowledge." Objects were the focus of attention, yet needed not only making but interpretation, which means that words and symbols are also necessarily associated with objects.[6] According to María Luz López Terrada, Vittoria Feola, Dijksterhuis, and Margócsy, however, even books, manuscripts, and letters can usefully be treated as objects. Understanding the drawings for Descartes' *L'Homme* as objects, and relating them to various (materialized) editions of the text, Claus Zittel can even show how it was not Descartes but the later Clerselier edition that created the "esprit mécanique." By giving their attention to the materialistic dimensions of their subjects, all the authors therefore are deeply involved in the new project of showing the entanglements of objects, words and symbols, and representations.

They are all also concerned with the ways in which objects and their meanings are constituted by relationships among interested parties. All therefore carefully describe what kinds of objects and words were exchanged, and through which personal networks they travelled. Objects can relatively easily move from place to place, conveying meanings or allowing new meanings to be constructed in each location. But even more than the movement of objects, López Terrada and Dijksterhuis emphasize the travels of people, which allowed them to meet one another and to engage in the exchange of things, information, and meanings. In their studies, Keller, Vermeir, Feola, Jorink, and Zittel show that the circulation of objects helped to undermine views that gave attention to texts and words alone, giving rise to an empirical approach to nature.

This empirical objectivity may also point to how the encounters among acquaintances who had a common interest in material objects and their descrip-

5 See especially Christopher Lawrence and Steve Shapin, eds., *Science Incarnate*; Pamela Smith, *The Body of the Artisan*; Roberts, Schaffer, and Dear, eds., *The Mindful Hand*.

6 On this point, also see the papers of López Terrada, Van Cleempoel, Jorink, Margócsy, and Vermeir.

tions allowed common agreement about the aims of their communications, which were often across boundaries of language and culture. López Terrada, Dijksterhuis, Keller, and Vermeir point to an important attribute of scientific knowledge that Robert K. Merton and other students of science developed long ago (although they do not always use the word): consensus. It is an attribute famously attached to scientific knowledge but not to other kinds of learned discourse, and it may be that it arises from focusing attention on objects and their attributes rather than on abstractions. In any case, being attentive to objects and communicating about them helped certain kinds of learned sociability to develop, or so say Dupré, López Terrada, van Cleempoel, Keller, and Vermeir. Networked sociability around the objects of scientific discourse certainly connected many places. For instance, given their common political and economic connections, the Low Countries and Iberian lands were well interlinked, as several authors demonstrate.[7]

Taken together, then, these essays contribute rich and varied analyses of the ways in which scientific objects gathered the attention of well-placed figures in the Low Countries and elsewhere in the early modern period. The development of the new science had many sources, from intellectual debate about substances and examples to the pleasures of aristocrats and merchants, and from the new abilities of mathematically-inclined craftsmen to the pride of physicians in showing off the construction of anatomical specimens. By taking some of the best recent approaches to the writing of history, the authors show connections among people over sometimes far distances, connections initiated and sustained by common interests in the material structures of the world. Through their work, we can see how merchants and mathematicians at different ends of the Mediterranean might share excitement in the discovery of ancient manuscripts on conic sections, as well as curiosity about mummies and new preparation methods. Careful attention to scientific objects provided the foundations for new kinds of consensus-building about the elements of natural knowledge. Objectivity was becoming philosophical. It did so because of the connectedness of historical events.

It would not be right to step away from these studies without asking some additional questions, however. By focusing on objects and the human networks that supported their study, the importance of connections and commonalities can be seen. Yet differences remained. Differences of interpretation, but also differences of language and of values, could divide people and undermine the consensus that seems so important to the creation of scientific objectivity. Perhaps the possibility of consensus about the material world based on the exchange values of commerce helped to tame religious conflict in the period – but the outcome of the warfare

[7] Especially Dupré, López Terrada, Van Cleempoel, and Feola.

of the period and the growth of nation-states was equally important, and all of that came at enormous human cost. The intellectual controversies that an older generation of historians reveled in, with winners and losers, may be surpassed by the new approaches that look for multiple lines of convergence and conjuncture, but the networks that bound people together could also experience tensions and ruptures. The sources of disagreement were many; does this mean that the sources of agreement were few and widespread?

Moreover, while objects and the descriptive language about them – often termed information, or matters of fact – may be easy to transport, and so the key commodities in the knowledge economy of commerce, meaningful statements are not so easily moved from place to place. That is, the aspects of culture that are rooted in places, upbringings, languages, religions, family structures, food ways, and so on are much more difficult to communicate without large-scale human migration. Indeed, it is along such fault-lines that conflict often developed. The movement of objects and information across such boundaries is very important, and deserves the attention that these and other authors have given it. But the difficulties of exchanging the kinds of ideas that give meaning to such objects and information – the sense of cultural context and of why things were as they were – is also intertwined with the analytical problems raised by movement. It has recently generated an interest in intermediaries, go-betweens, brokers, and translators.[8] In other words, what moves from person to person and place to place can sometimes also shed light on what does not move, or not so easily. Perhaps it is precisely the "objective" stripping away of cultural meaning and context that characterizes scientific knowledge and enables its mobility.

The authors are clearly aware of such questions, and would be able to address them had the focus of their attention been directed elsewhere. By limiting the boundaries of inquiry to the ways in which early modern European natural knowledge was deeply connected to material objects, they have pressed their analyses far. No one should overlook the ways in which scientific activity is engaged with worldly things, especially after reading these papers.

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8 For example, Liu, ed., *Tokens of Exchange*; David Turnbull, *Masons, Tricksters, and Cartographers*; Raj, *Relocating Modern Science*; Schaffer et al., eds. *The Brokered World*.

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