

Learning a Craft from Books: Historical Re-enactment of Functional Reading in Gold- and Silversmithing.¹

Abstract

The early modern period witnessed a great increase in the production and dissemination of artisanal handbooks, manuals and recipes. A central question is what role these texts played in the transmission of artisanal knowledge. This study explores the case of Dutch silversmith Willem van Laer (1674-1722) who published a *Guidebook for upcoming gold- and silversmiths* (1721), a comprehensive and well-received manual of the craft. To assess the role of the *Guidebook* in the acquisition of practical skills in the eighteenth century, this study employs traditional historical methods combined with historical re-enactment. I argue that effective use of the *Guidebook* depended on complementary hands-on education of master craftsmen, which suggests that the *Guidebook* was far from a DIY crash course and illustrates that the textual transmission of craft knowledge depended upon, rather than threatened, established routes to craft learning, such as apprenticeships.

Keywords

Craft education – manuals – historical re-enactment

1. Introduction

In 1721, the Dutch silversmith Willem van Laer (1674-1722) wrote that up till then “nobody has depicted with letters on Paper, the essence of a good Gold or Silversmith.”² For that reason, he took it upon himself to write a didactic manual of his craft, entitled *Guidebook for upcoming gold- and silversmiths* [Weg-wyzer voor aankoomende goud en zilversmeeden]. In just over two hundred pages, the author explains the ins and outs of his craft. The book touches upon several assaying techniques to assess the quality of gold and silver; it explains how to build furnaces; it elaborates on basic techniques like casting, soldering and embossing; it provides several recipes and even presents an invention: a machine that can be used for soldering. That Van Laer knew what he was writing about, is evidenced by a surviving set of communion-beakers (1709) that until today serve their original purpose in a church in Heino, The Netherlands.³ (Fig. 1.) (Fig. 1. here)

¹ I am particularly grateful to Tonny Beentjes and would like to thank him for all his help during this project. I would also like to thank Sven Dupré, Marieke Hendriksen, Maartje Stols-Witlox, Erma Hermens, and the anonymous reviewers for their advice and comments during the writing of this article. This project has received funding from the European Research Council (ERC) under the European Union’s Horizon 2020 research and innovation program (grant agreement no. 648718).

² Willem van Laer, *Weg-wyzer Voor Aankoomende Goud en Zilversmeden: Verhandelende veele wetenschappen, die Konsten raakende, zeer nut voor alle Jonge Goud en Zilver-smeeden* (Amsterdam, 1721), p. 1. All translations mine, unless otherwise indicated.

³ B. Dubbe, *Zwols zilver: Het Zwolse goud- en zilversmidambacht en zijn meesters* (Zwolle: Uitgeverij Waanders, 1999), p. 113.

The description of skill and technique displayed in Van Laer's work is unparalleled in other early modern sources on gold- and silversmithing. Writing on gold- and silversmithing from the preceding centuries is generally restricted to assaying techniques, mining and metallurgy, while circulating recipes and instructive texts touched upon a limited selection of techniques, such as gilding, medal making and life casting.⁴ The *Guidebook* breaks away from this tradition and its didactic voice suggests it can be considered as an early manual or textbook for the craft. Van Laer reassures his readers in the preface that "through this Sketch, the Reader will be put on his way, not only to thoroughly comprehend the many Mechanical Arts, but also to surely do them."⁵ In general, the book was quite successful. In less than fifty years, four editions were published, including a pirated edition in Mechelen.⁶ A bookseller in Middelburg suggested that the *Guidebook* was specifically "valuable to novices" and was both "scarce and used a lot on a daily basis." The same bookseller indicated that the book was sold in the cities of Zeeland, "as well as the cities of Holland."⁷ In addition, the anonymous writer of the Mechelen preface, tells us that "the art lover's favorable reception of the first edition of this little work, which already became very uncommon, moved us to publish a second edition."⁸ Furthermore, the *Guidebook* could be obtained in "de Gekroonde Smit" a hardware store for gold- and silversmiths, run by Jan Stand in Amsterdam, who sold a variety of tools and materials, ranging from English and German files to saltpetre.⁹ Jan Stand also served as the clerk of the Amsterdam guild for gold- and silversmiths.¹⁰ This shows that the book was not perceived as a threat to established routes to craft learning and supports the idea that craft secrecy was relatively insignificant in the Low Countries.¹¹ Finally, a copy signed by the early nineteenth-century silversmith W. van Calker speaks of the *Guidebook's* circulation among professional silversmiths.¹² (Fig. 2.) (Fig. 2. here)

Van Laer's objective of writing a guidebook for his craft, as well as its favorable reception, gives rise to an important question concerning the role of 'how-to' texts in practices of learning. What role did the *Guidebook* play in the acquisition of practical skills in the

⁴ Pamela H. Smith and Tonny Beentjes, "Nature and art, making and knowing: Reconstructing sixteenth-century life casting techniques," *Renaissance Quarterly*, 2010, 63:128-179. Pamela H. Smith and Tonny Beentjes, "Sixteenth-Century Life-casting Techniques, a reconstruction," in *The Renaissance workshop*, edited by M. Spring and A. Meek (London: Archetype, 2013), pp. 144-151.

⁵ Van Laer, *Weg-wyzer* (cit. note 2), p. 1.

⁶ The first edition of the *Guidebook* was published in Amsterdam (1721). Exact reprints appeared in Middelburg (1730) and Amsterdam (1768). A slightly altered edition was published in Mechelen (cit. note 8).

⁷ *Middelburgse Courant*, July 5, 1759.

⁸ Willem van Laer, *Weg-wyzer voor aankomende goud en zilversmeden. Verhandelende veele wetenschappen, die Konsten raakende, zeer nut voor alle Jonge Goud en Zilversmeden* (Mechelen, [1750?]): p. i.

⁹ *Amsterdamse Courant*, May 3, 1731.

¹⁰ *Amsterdamse Courant*, July 1, 1721.

¹¹ K. Davids, "Craft Secrecy in Europe in the Early Modern Period: A Comparative View," *Early science and medicine* 2005, 10:341-348.

¹² Willem van Laer, *Weg-wyzer voor Aankoomende Goud en Zilversmeden: Verhandelende veele wetenschappen, die Konsten raakende, zeer nut voor alle Jonge Goud en Zilver-Smeden* (Amsterdam, 1768), Othmer Library, Philadelphia, Pennsylvania. For W. van Calker, see: http://www.geheugenvanzeist.nl/wiki/Zilverindustrie_in_Zeist (accessed 22 June 2017).

eighteenth century? Unfortunately, annotated copies and archival material that could answer this question are scarce. To assess the historical role of the *Guidebook* in education processes, this study employs a multi-angle approach, including re-enactments. I argue that effective use of the *Guidebook* depended on complementary hands-on teaching by craftsmen who could make up for knowledge not provided by Van Laer. Yet its dependence on complementary hands-on education does not mean that the book was useless. The *Guidebook* brought benefits to the workshop as well, specifically because it helped to overcome some of the limits and challenges posed by hands-on education.

2. Text and practice

The early modern period witnessed an explosion of artisanal ‘how-to’ treatises, both in print and manuscript, that dealt with a variety of practices, ranging from smithing to mining, and from glassmaking to painting.¹³ While it might be tempting to read these sources as unequivocal accounts of early modern artisanal cultures of making, recent scholarship has pointed out that the relationship between these texts and actual artisanal practices was in fact more complex. Over the past few years, many scholars have therefore stressed the need to study these texts with particular attention to historical usage and their embeddedness in contemporaneous artisanal or craft practices.¹⁴ There are at least two reasons to re-address the interplay between text and practice. First, early modern artisanal writing constitutes a very complicated and versatile body of texts. Authors had different motives for writing, and readers engaged with these texts for various reasons. Historians have identified several of these motives, arguing that artisanal treatises were used to show off skill and know-how in writing, to elevate the status of craft work, to convey didactics of making, to instruct in the ‘ability to improvise’, as *aide memoires*, to codify errors, and to preserve knowledge that was going out of practice.¹⁵ Although limited, this list shows that the interaction between text and

¹³ William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton: Princeton University Press, 1994). Elaine Leong and Alisha Rankin (eds.), *Secrets and Knowledge in Medicine and Science, 1500-1800* (Farnham: Ashgate, 2011). Pamela H. Smith, “Why Write a Book? From Lived Experience to the Written Word in Early Modern Europe,” *Bulletin of the German Historical Institute*, 2010, 47:25-50. Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: The Johns Hopkins University Press, 2001): pp. 102-104.

¹⁴ Pamela O. Long, “Trading Zones in Early Modern Europe,” *Isis*, 2015, 106:840-847, p. 846. Marcos Martínón-Torres, review of *Laboratories of Art: Alchemy and Art Technology from Antiquity to the 18th Century*, edited by Sven Dupré, *Ambix*, 2015, 62:386-387, p. 387. William Eamon, “How to Read a Book of Secrets,” in Leong, *Secrets and Knowledge* (cit. note 13), p. 41.

¹⁵ Pamela H. Smith, “Why Write a Book?” (cit. note 13), pp. 25-50. Pamela O. Long, *Openness, Secrecy, Authorship* (cit. note 13), pp. 102-104. Jack Goody, *The Domestication of the Savage Mind* (Cambridge: Cambridge University Press, 1978), pp. 140-142. Richard Sennett, *The Craftsman* (London: Penguin, 2009): pp. 179-193. Sara Pennell and Michelle Dimeo, “Introduction,” in *Reading and Writing Recipe Books, 1550-1800*, edited by Michelle DiMeo and Sara Pennell (Manchester: Manchester University Press, 2013): p. 7. Richard Yeo, *Notebooks, English Virtuosi, and Early Modern Science* (Chicago: Chicago University Press, 2014). Sven Dupré, “Doing it Wrong: The Translation of Artisanal Knowledge and the Codification of Error,” in *The Structures of Practical Knowledge*, edited by Matteo Valleriani (Cham: Springer International Publishing), pp. 167-188. Marieke M.A. Hendriksen, “Necessary, Not Sufficient: The Circulation of Knowledge about Stained Glass in the Northern Netherlands, 1650–1821,” *Nuncius*, 2016 31:332-360.

artisanal practices differed from case to case and illustrates the need to study artisanal texts on an individual basis.

A second complicating factor in the relation between text and practice is the fact that text, as a medium for the transmission of artisanal knowledge, is often constrained. Willem van Laer wrote, for instance, that "it is not possible to put everything on paper with such clarity, that one would be able to understand it fully without hands-on instruction."¹⁶ Other early modern authors wrestled with similar issues.¹⁷ For example, the sixteenth-century mining official Lazarus Ercker (ca. 1530 – ca.1594), who wrote a book on metallurgy, stated that "these things refuse to be depicted on paper, such that one can grasp it by reading alone. Instead, reading provides the direction, and the work of the hand provides the experience."¹⁸ Likewise, the alchemist and glassworker Antonio Neri (1576-1614) remarked in his famous treatise on *L'arte vetraria* that "experience teaches much more than long studying."¹⁹

Scholars have often pointed to tacit knowledge to explain why texts are suboptimal vehicles for the transmission of craft knowledge.²⁰ Indeed, craft knowledge is best transmitted, taught and learned through apprenticeships, in which there is plenty of room for intimate observation, imitation, trial-and-error and repeated exercise. Text on the other hand, requires the articulation of craft knowledge, which, due to its sensory and physical character, is easier shown than explained. Tacit knowledge, in this respect, accounts for the fact that "we can know more than we can tell."²¹ Even though there is little reason to doubt this line of reasoning, this study regards tacit knowledge as conspicuous and in need of questioning in relation to artisanal texts, rather than as an analytical category. First of all, the term "tacit knowledge" is semantically obscure. For example, it remains difficult to find a clear-cut definition of what tacit knowledge precisely entails, whereas "the term 'tacit' has many shades of meaning, ranging from the silent through the unspoken to the implicit."²² More importantly however, parallel to tacit knowledge, other concepts have been developed and

¹⁶ Van Laer, *Weg-wyzer* (cit. note 2), p. *3 recto.

¹⁷ Pamela H Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: Chicago University Press, 2004), pp. 80-82. See also: Pamela H. Smith and The Making and Knowing Project, "Historians in the Laboratory: Reconstruction of Renaissance Art and Technology in the Making and Knowing Project," *Art History*, 2016, 39:210-233, pp. 211-212.

¹⁸ Lazarus Ercker, *Beschreibung der allerfürnemsten Mineralischen Erzt und Bergwerksarten* (Frankfurt am Mayn, 1573), 91.

¹⁹ Antonio Neri, *L'arte vetraria* (Firenze, 1612), p. 8.

²⁰ Richard Sennett, *The Craftsman* (cit. note 15), p. 94. Pamela H. Smith, "What is a Secret? Secrets and Craft Knowledge in Early Modern Europe," in Leong, *Secrets and Knowledge* (cit. note 13), p. 50. S.R. Epstein, "Craft Guilds in the Pre-Modern Economy: A Discussion," *The Economic History Review*, 2008, 61:155-174. Trevor H.J. Marchand, "Muscles, Morals and Mind: Craft Apprenticeship and the Formation of Person," *British Journal of Educational Studies*, 2008, 56:245-271. Steven R. Smith, "The London Apprentices as Seventeenth-Century Adolescents," *Past & Present* 61 (1973): 149-161. Patrick Wallis, "Between Apprenticeship and Skill: Acquiring Knowledge outside the Academy in Early Modern England." Paper presented at the Conference on Knowledgeable Youngsters: Youth, Media and Early Modern Knowledge Societies, Utrecht University, Utrecht, the Netherlands, June 26, 2015.

²¹ Michael Polanyi, *The Tacit Dimension* (Chicago: Chicago University Press, 2009), p. 4. See also Michael Polanyi, *Personal Knowledge: Towards a Post-Critical Philosophy* (London: Routledge, 1962).

²² Tim Ingold, *Making. Anthropology, archaeology, art and architecture* (London: Routledge, 2013): p. 109.

used, which despite semantical differences seem to serve similar goals. For instance, to denote the "tacit dimensions" of historical experimental practices, historian H. Otto Sibum uses the term "gestural knowledge" to refer to the "complex of skills and mastery".²³ In a similar manner, the term "embodied knowledge" is frequently used by others but is often left undefined.²⁴

Second, the fact that knowledge is not always articulated is not necessarily the result of the impossibility to put it into words. For example, it could deliberately be kept a secret, or it could be presupposed by the author. Moreover, certain knowledge did not surpass the domain of common understanding and was therefore not deemed worthy of putting into words.²⁵ Knowledge could also be obtained by working with materials and tools, either through trial-and-error or by exploring their affordances.²⁶ Furthermore, even though some knowledge might indeed appear to be impossible to express, to understand tacit knowledge as being opposed to articulated or explicit knowledge can be misleading as well. Tacit knowledge can be "unpacked" using narratives, metaphors or sympathetic illustrations.²⁷ Through these means, tacit knowledge can still find expression and evoke an understanding. Rather than being opposed to explicit or articulated knowledge, tacit knowledge appears to be consonant with it, which makes it more fluid and difficult to grasp.²⁸ Finally, the importance of tacit knowledge for craft knowledge can also be downplayed, as was done by Melvyn Usselman *et al.*; after replicating a nineteenth-century chemical experiment of Justus von Liebig based on the latter's publications, they indeed recognized the important role played by tacit or gestural knowledge and the difficulties it posed through its ineffability. Nonetheless, in their opinion the absence of certain tacit knowledge in Liebig's text only made replicating more complex but did not prevent them from succeeding.²⁹

In short, the versatility of the early-modern body of artisanal writing, as well as the problematic articulation of craft knowledge in text, has led to the awareness that the relation between text and practice should not be understood in a "hierarchical" or "binary" way.³⁰ By taking this premise as a point of departure, this study investigates the relation between textual

²³ Heinz Otto Sibum, "Reworking the Mechanical Value of Heat: Instruments of Precision and Gestures of Accuracy in Early Victorian England," *Studies in History and Philosophy of Science*, 1995, 26:73-106, p. 76.

²⁴ Erin O'Connor, "Embodied Knowledge: The experience of meaning and the struggle towards proficiency in glassblowing" *Ethnography*, 2005, 6:183-204.

²⁵ Harry Collins, *Tacit and Explicit Knowledge* (Chicago: University of Chicago Press, 2010), pp. 91-98.

Michelle DiMeo, "Openness vs. Secrecy in the Hartlib Circle: Revisiting 'Democratic Baconianism' in Interregnum England," in Leong, *Secrets and Knowledge* (cit. note 13), pp. 105-121.

²⁶ James J. Gibson, *The Ecological Approach to Visual Perception* (Boston: Houghton Mifflin Company, 1979), pp. 127-143.

²⁷ Sennett, *The Craftsman* (cit. note 15), pp. 179-193. Ingold, *Making* (cit. note 22), p. 109.

²⁸ Ikujiro Nonaka and Georg von Krogh, "Tacit Knowledge and Knowledge Conversion: Controversy and Advancement in Organizational Knowledge Creation Theory," *Organization Science*, 2009, 20:635-652.

Michael Polanyi, "The Logic of Tacit Interference," *Philosophy*, 1966, 41:1-18, p. 7.

²⁹ Melvyn Usselman et al., "Restaging Liebig: A study in the Replication of Experiments," *Annals of Science*, 2005, 62:1-55. Hasok Chang, "How Historical Experiments Can Improve Scientific Knowledge and Science Education: The Cases of Boiling Water and Elektrochemistry," *Science and Education*, 2011, 20:317-341, p. 321.

³⁰ Smith, "Why Write a Book?" (cit. note 13), p. 48.

and artisanal practices closely by looking at how early-modern people used texts to learn how to do things.³¹ In this context, the *Guidebook* provides a valuable case study, primarily because Van Laer unambiguously stated that he wrote this book while having in mind the education of young and upcoming gold- and silversmiths. This study takes this claim seriously and investigates the ways in which novices and apprentices could have been effectively using this book. In addition, the *Guidebook* marks, as a craft manual, the early beginnings of a development in which texts gradually played a more visible role in vocational training of gold- and silversmiths.³² Although beyond the scope of this article, the interplay between textual and artisanal practices can thus be historicized and followed through time.

3. The *Guidebook* in context

Willem van Laer was born in 1674, the son of the silversmith Pieter van Laer. His father had an established reputation in Zwolle, a Dutch provincial town, and trained his son in his profession. Willem appears to have been quite unfortunate in financial matters. He was troubled by debt and after a forced auction of his home in 1718, he suddenly turned up in Amsterdam. In the preface to the *Guidebook* he explained his situation: "The Vicissitude of this World has put me in an unfortunate position regarding my temporary goods, such that I have retained nothing more (due to certain people), than my Wife, and Child, and the use of my limbs, as long as the almighty will please."³³ To make things worse, Willem van Laer was not admitted to the Amsterdam guild for gold- and silversmiths, meaning that he had no access to its professional and educational infrastructure. Consequently, he was unable to practice his craft and therefore decided to write down his twenty-five years of experience, which eventually resulted in the *Guidebook*.³⁴ From the preface, it becomes clear that Van Laer hoped that by writing this book he could turn things around and generate more income. He offered his services at a "decent price" to those who want to receive the complementary and necessary manual education needed to understand everything that is explained in the book. Van Laer also claimed that he "has not found anyone yet, who has sketched the essence of a good Gold or Silversmith with letters on paper."³⁵ He was convinced that through his writing many people would start to see the complexities of his craft. Even though these reasons resonate with those typical for technical authorship from the fifteenth century onwards, i.e. to fish for patrons or commissions, or to elevate the status of the craft, Van Laer

³¹ Natasha Glaisyer and Sara Pennell, "Introduction," in *Didactic Literature in England 1500-1800*, edited by Natasha Glaisyer and Sara Pennell (London: Ashgate, 2003): pp. 1-18.

³² The Dutch vocational school for gold- and silversmiths (Vakschool Schoonhoven) had developed its own textual resources and workbooks.

³³ Van Laer, *Weg-wyzer* (cit. note 2), p. *2 recto.

³⁴ B. Dubbe, "Introduction," in Willem van Laer, *Weg-wyzer voor Aankoomende Goud en Zilvermeeden*, edited by B. Dubbe (Lochem: De Tijdstroom, 1967), p. xxix. Van Laer, *Weg-wyzer* (cit. note 2), p. 1.

³⁵ Van Laer, *Weg-wyzer* (cit. note 2), p. 1.

also genuinely believed that his book would actually enable people to “do” the “Mechanical Arts” themselves:³⁶

The reason I call it a Guidebook is that there will be few young Gold- and Silversmiths who, while reading, will not be able to find anything to their use and taste, and taken by the hand, will be lead to knowledge of many things.³⁷

The *Guidebook* is unmistakably endowed with an educational purpose. Furthermore, Van Laer frequently referred to “young” and “upcoming gold- and silversmiths” as his target audience, which likely encompassed future professionals such as apprentices and novices. Apart from these youngsters however, the book might also have been of appreciable interest to a specific class of non-professionals, such as art lovers, amateurs, connoisseurs and virtuosi.³⁸ Indeed, Van Laer mentioned them too. Interestingly, in his view the lovers are anything but passive consumers, collectors and appreciators of art. Rather, it is the lover who produces the actual objects. Moreover, the late seventeenth-century, and rather negative, identification of lovers as people who held inferior knowledge of art, does not seem to have applied to gold- and silversmithing.³⁹

How neatly the Figures and tiny Amsterdam Landscapes were shaped by a Lover is sufficiently witnessed by the Golden watchcases, snuffboxes and other Gold and Silver Works.⁴⁰

Nonetheless, to ask whether both non-professionals and young gold- and silversmiths alike might have bought and read the *Guidebook* seems beside the point. When it comes to actual and effective usage, I will argue that understanding the book often required prior knowledge and basic acquaintance with techniques and tools, which is more likely to be found in professional circles.

The *Guidebook* can be divided into two parts. After some general remarks about the importance of the art of drawing, “which cannot be praised enough,” Van Laer introduced the first half of the book, which dealt with quality assays, methods for separating metals and ways of purification. He explained that a “Gold- or Silversmith, and all negotiators in these beloved

³⁶ Van Laer, *Weg-wyzer* (cit. note 2), p. 1. For reasons for writing, see Smith, “Why write a book” (cit. note 13) and Pamela O. Long, “Power, Patronage, and the Authorship of Ars: From Mechanical Know-How to Mechanical Knowledge in the Last Scribal Age,” *Isis*, 1997, 88:1-41.

³⁷ Van Laer, *Weg-wyzer* (cit. note 2), p. *2 verso.

³⁸ “The Varied Role of the Amateur in Early Modern Europe.” Special issue, *Nuncius*, 2016, 31:485-675. Charlotte Guichard, “Taste Communities: The Rise of the *Amateur* in Eigenteenth-Century Paris,” *Eighteenth-Century Studies*, 2012, 45:519-547. Elizabeth A. Honig, *Jan Brueghel and the Senses of Scale* (University Park: Pennsylvania State University Press, 2016).

³⁹ Paul Taylor, “The Birth of the Amateur,” in “The Varied Role of the Amateur in Early Modern Europe.” Special issue, *Nuncius*, 2016, 31:499-522.

⁴⁰ Van Laer, *Weg-wyzer* (cit. note 2), pp. 147, 148. See also pp. 38, 84, 176.

metals, need to know well their inner grade, or value. If not, it will cause (the buyer, or seller) great damage”.⁴¹ This knowledge was already widely available through several treatises published prior to the *Guidebook*. One of these treatises was the aforementioned *Beschreibung allerfürnemisten Mineralischen Ertzt, unnd Bergwercks arten*, first published in 1574 by the Bohemian-Saxon mining official Lazarus Ercker. This treatise likely served as an example for Van Laer, specifically because several of the processes described in the *Guidebook* can be found in here as well, such as a closely related description of the cupellation process.⁴² More compelling evidence of Van Laer’s interest in Ercker is found in an engraving that displays a composition of distilling furnaces and retorts. Interestingly, the inverse composition is identical to one found in Ercker’s *Beschreibung*, which makes it likely that it was traced and copied by Van Laer. Even though it is clear that Van Laer’s descriptions of quality assays and procedures are far from original, the *Guidebook* is nonetheless the first known published book on this topic in Dutch. The only predating Dutch source is a manuscript from 1639 that was written by Peter Geerts, a Dutch goldsmith from the city of Groningen. Called *Assays on gold and silver coins*, this manuscript specifically contains knowledge for mint masters, but whether it was actually published is unknown.⁴³

The second part of the *Guidebook* is devoted to techniques, processes, and knowledge immediately concerned with the fashioning of silver and/or gold objects. Unlike the first half of the book, this part cannot be traced back to previous artisanal writings and presents a near complete and structured account of the craft of gold- and silversmithing. Almost every chapter is concerned with a different “art”, such as soldering, casting, chasing, gilding and polishing. In many cases, Van Laer explained why these arts are of importance to the reader. For example, he introduced soldering by stating that “many have learned, through harmful experience, that a master Silver- or Goldsmith is in great need to know how to solder well. That is why I want to share with the student all I know, hoping it will safeguard him from disasters in due course.”⁴⁴ In almost each of his chapters, Van Laer led with his personal experience. He explained what worked best in his opinion, and yet, he left no stone unturned when it came to alternative procedures used by his colleagues. Throughout his chapters, he alternated between extreme detail and summarizing descriptions. For instance, in his discussion of chasing, he explained in great detail how to transfer a design to silver but provided almost no guidance on how to perform the actual chasing.⁴⁵ This selective eye for detail suggests that Van Laer addressed an audience that was already acquainted with some of the craft tools and procedures, which is why he could skip these parts in his explanations.

⁴¹ Van Laer, *Weg-wyzer* (cit. note 2), p. 4.

⁴² Compare Van Laer, “Om goede klaar te maaken,” in *Weg-wyzer* (cit. note 2), pp. 50-52, with Lazarus Ercker, “Wie man gute Clär machen soll,” in *Beschreibung* (cit. note 18), p. 11.

⁴³ Janneke Tump, *Ambachtelijk geschoold: Haarlemse en Rotterdamse ambachtslieden en de circulatie van technische kennis, ca. 1400-1720* (PhD Diss., Vrije Universiteit Amsterdam, 2012), pp. 208-209.

⁴⁴ Van Laer, *Weg-wyzer* (cit. note 2), pp. 117-8.

⁴⁵ Van Laer, *Weg-wyzer* (cit. note 2), pp. 147-151.

Because Van Laer singled out future professionals as his audience, and because he presupposed familiarity with some of the craft procedures, the *Guidebook* could most effectively be employed when incorporated in apprenticeship learning. Indeed, high percentages of book possession amongst Dutch gold- and silversmiths, i.e. up to 79% between 1672-1720, illustrate their literacy and secure them as a potential audience.⁴⁶ In the early modern period, apprenticeship was a compulsory step for those wanting to become masters.⁴⁷ Craft guilds were the main institutions through which this educational system was organized, although in the Northern Netherlands apprenticeships could also be organized independent from guilds. Before entering an apprenticeship, a contract was signed in which finances and expected outcomes were negotiated. Even though minimal information about the actual learning process has survived, it is unlikely that a formalized educational program was in place. Instead, learning was often more spontaneous than structured. This idea is also supported by Joan Lane in her study of apprenticeships in England. Even though she draws on early nineteenth-century accounts, she argues that in general the apprentice would move through different stages. The first stage concerned unskilled and routine tasks, such as tidying the shop and running errands. Subsequently, apprentices would move onto low-level tasks, which would provide them with practical experience and knowledge of materials. Gradually, the apprentice would take on more complex and responsible tasks.⁴⁸ Even though not much is known about the course of the apprenticeship, it is clear that preferably no material or time was wasted for practice and educational purposes only; learning happened on the job.

In the Dutch Republic, the duration of the apprenticeship for gold- and silversmiths varied widely, but seemed to have fluctuated around four years.⁴⁹ Frequently, apprentices switched masters because they wished to expand their knowledge and skill. Master craftsmen were often specialized in a selection of products or areas, meaning that they were not able to provide a complete overview of the craft. The most obvious case of specialization was that of gold- or silversmithing. Van Laer too, differentiated between these two areas and described them as "two Arts, each of which require a complete human being."⁵⁰ There are however examples of more specialized areas of expertise. Some apprenticeship contracts from the seventeenth and eighteenth century stipulated a selection of different areas in which the

⁴⁶ Tump, *Ambachtelijk geschoold* (cit. note 43), p. 202.

⁴⁷ Karel Davids, "Apprenticeship and Guild Control in the Netherlands, c.1450-1800", in *Learning on the Shop Floor: Historical Perspectives on Apprenticeship*, edited by Bert de Munck, Steven L. Kaplan and Hugo Soly (New York: Berghahn Books, 2007), pp. 66-84. Bert de Munck, *Technologies of Learning: Apprenticeships in Antwerp Guilds from the 15th Century to the End of the Ancien Régime* (Turnhout: Brepols, 2007). Bert de Munck, "Corpses, Live Models, and Nature: Assessing Skills and Knowledge before the Industrial Revolution (Case: Antwerp)," *Technology and Culture*, 2010, 51:332-356. Smith, "The London Apprentices" (cit. note 20), p. 151. Wallis, "Between Apprenticeship and Skill" (cit. note 20). Patrick Wallis, "Apprenticeship and Training in Premodern England," *The Journal of Economic History*, 2008, 68:832-861, p. 848.

⁴⁸ Joan Lane, *Apprenticeship in England* (London: University College London Press, 1996): pp. 57-69.

⁴⁹ Peter Schoen, *Tussen hamer en aambeeld. Edelsmeden in Friesland tijdens de Gouden Eeuw* (Hilversum: Uitgeverij Verloren, 2016): p. 182. Lidewij Hesselink, "Goud- en zilversmeden en hun gilde in Amsterdam in de 17^e en 18^e eeuw," *Holland Historisch Tijdschrift*, 1999, 31:127-147, p. 130. Tump, *Ambachtelijk geschoold* (cit. note 43), p. 89.

⁵⁰ Van Laer, *Weg-wyzer* (cit. note 2), p. 3.

apprentice had to be trained, such as gold- or silverplating, gold- or silverbeating, embossing or wiredrawing. Other contracts merely mentioned the objects, such as the fashioning of gold- or silver buttons or thimbles, for which the apprentice would receive training. In addition to selective expertise of the craftsmen, specialization could also occur in the course of the apprenticeship, due to a lack of talent or particular skillfulness exhibited by the apprentice.⁵¹ Finally, it needs to be emphasized that transmission and education of craft knowledge was not the sole purpose of the apprenticeship. Apprentices usually enrolled as adolescents and were consequently trained and raised by the master, not only professionally, but also to prepare them for adulthood. Several scholars have pointed out that the apprenticeship was, and in fact still is, important for character formation of young people.⁵²

All in all, there was no such thing as a standardized apprenticeship, even though some attempts were made to complement or streamline apprenticeship learning.⁵³ For example, from the sixteenth century onwards, schools were founded for drawing, which freed masters from the often mandatory drawing lessons during the apprenticeship. Van Laer too emphasized the indispensability of drawing for gold- and silversmiths, but did not explain this skill in his book.⁵⁴ Additionally, in England attempts were made to introduce textual resources to apprenticeships, such as Richard Dafforne's *The Apprentices Time-Entertainer Accomptantly* (1640). Similar examples have however not been found in the Low Countries.

4. Re-enactment as a method to assess historical usage

Even though it is known that the *Guidebook* was read and used, no historical sources have been found that adequately describe its specific role in the historical workshop and in practices of learning. To better understand how exactly the *Guidebook* may have been embedded in these practices, I used the method of historical re-enactment. Well-known in the fields of archaeology and conservation and restoration, experimental methods have become part of the historian's toolkit too.⁵⁵ Specifically in cases where the interpretation of texts, the primary source material for historians, is difficult, experimental history can significantly enhance more traditional humanistic methods such as close-reading and archival research. Many terms have been employed to describe the act of historical experimenting. Historians

⁵¹ De Munck, *Technologies of Learning* (cit. note 47), pp. 47-8. Schoen, *Tussen hamer en aambeeld* (cit. note 49), pp. 188-189.

⁵² Marchand, "Muscles, Morals and Mind" (cit. note 20), pp. 245-271. Smith, "The London Apprentices" (cit. note 20), pp. 149-161.

⁵³ Patrick Wallis, "Between Apprenticeship and Skill" (cit. note 20). Bert de Munck and Hugo Soly, "'Learning on the Shop Floor' in Historical Perspective," in De Munck, *Learning on the Shop Floor*" (cit. note 47), pp. 3-31. De Munck, "Corpses, Live Models" (cit. note 47), pp. 332-356. De Munck, *Technologies of Learning* (cit. note 47), p. 53. Smith, "The London Apprentices" (cit. note 20), p. 151.

⁵⁴ Van Laer, *Weg-wyzer* (cit. note 2), 2.

⁵⁵ For reconstructions in archeology, see: Daniel Ingersoll, John E. Yellen, and William Macdonald, eds., *Experimental Archeology* (New York: Columbia University Press, 1977). For reconstructions in conservation and restoration see: Leslie Carlyle and Maartje Witlox, "Historically accurate reconstructions of artists' oil painting materials," in *Arts of the Past: Sources and Reconstructions. Proceedings of the First Symposium of the Art Technological Source Research Study Group*, edited by Mark Clarke, Joyce H. Townsend and Ad Stijnman (London: Archetype, 2005): pp. 53-59.

have written about their experimental research as replication, restaging, reconstruction, and re-enactment, with each term denoting slight methodological differences.⁵⁶ Indeed, terminology, methodology, and application of experimental historical research differ from case to case. For example, historical experimentation can be used to lay bare the experiences, skills and tacit knowledge underlying a historical text. Along this line, H. Otto Sibum demonstrated that the success of the canonical heat-experiment of the nineteenth-century scientist James Joule depended on the latter's artisanal experience as a brewer.⁵⁷ Alternatively, experimental history can be used as a tool to significantly enhance understanding of a text. As such, Lawrence Principe found that the reproduction of alchemical recipes can be a valuable tool in falsifying prevailing interpretations, which resulted in a drastic re-evaluation of alchemical knowledge and the awareness that alchemical texts, although allegorically, were based on actual experimental practices in alchemy.⁵⁸ Similarly, historical reconstructions have recently been explored in the Making and Knowing project as a method for close-reading and as a heuristic device in translating artisanal texts.⁵⁹

Closest perhaps, to the envisioned approach of this article, are a series of reconstructions the Making and Knowing project made of life-casting techniques described in BnF. Ms. Fr. 640, a sixteenth-century French manuscript. Together with an expert-maker, Tonny Beentjes, who is a practicing silversmith and Amsterdam-based conservator and who returns later in this article, they reconstructed this fashionable Renaissance technique and found that it enhanced a better understanding of the materials and techniques mentioned in the manuscript.⁶⁰ Reconstruction taught them, for example, that metal casting is not so much about the metals, but rather about "experimentation on *mold* materials." It also helped them identify details on museum objects that would have otherwise escaped their attention, such as the little holes left by the pins that kept the dead animals in place while building the mold.⁶¹ Above all, they found that reconstructions had the potential to reveal "systems of belief and knowledge, as well as testify to the material, physical, and philosophical engagement of craft with the generative and transformative power of nature."⁶²

This study shares some important characteristics with the aforementioned approaches. It recognizes the importance of historical experimentation as a way to access and understand the material and tacit dimensions that lay behind an artisanal text such as the *Guidebook*. Indeed, as the Making and Knowing project found, only after carefully following Van Laer's

⁵⁶ Hjalmar Fors, Lawrence M. Principe and H. Otto Sibum, "From the Library to the Laboratory and Back Again: Experiment as a Tool for Historians of Science," *Ambix*, 2016, 3:85-97. Chang, "How Historical Experiments" (cit. note 29), pp. 317-341.

⁵⁷ Sibum, "Reworking the Mechanical Value of Heat" (cit. note 23), pp. 73-106.

⁵⁸ Lawrence M. Principe, *The Secrets of Alchemy* (Chicago: University of Chicago Press, 2013), pp. 137-171.

⁵⁹ Donna Bilak et al., "The Making and Knowing Project: Reflections, Methods, and New Directions," *West 86th*, 2016, 23:35-55, p. 46. See also: Sébastien Moureau and Nicolas Thomas, "Understanding Texts with the Help of Experimentation: The example of Cupellation in Arabic Scientific Literature," *Ambix*, 2016, 63:98-117.

⁶⁰ Smith, "Historians in the Laboratory" (cit. note 17), p. 215.

⁶¹ Pamela H. Smith, "In the Workshop of History: Making, Writing, and Meaning," *West 86th*, 2012, 19:4-31, pp. 21, 23.

⁶² Smith, "Historians in the Laboratory" (cit. note 17), p. 228.

instructions on casting, did the value of good quality casting sand became apparent, as well as its relative importance compared to other variables in the casting procedure. However, although a thorough understanding of early modern materials and techniques remains indispensable, re-enactment based on the *Guidebook* was not primarily aimed at the elucidation of materials, techniques and worldviews behind it, but rather at exploring the processes of learning and the role of books therein.

For this study, I chose to re-enact the educational context for which the *Guidebook* was initially designed. Consequently, drawing from my field notes and ethnographies of the re-enactments, I could enhance my understanding of the specific role and contributions of the *Guidebook* in the educational process as a whole. This method was not only inspired by the aforementioned historical approaches, but also indebted to the fields of anthropology and sociology in which the "apprentice-style method of inquiry" has become a much-appreciated method to study craft knowledge and craft education. By becoming corporeally and sensually involved in learning a craft, the ethnographer gets a better grip on what precisely is going on, especially because "most on-site communication is non-propositional, and relies more immediately on an intercourse of visual, auditory and somatic information."⁶³ The apprentice-style method thus allowed me to keep track of the non-propositional communication and knowledge involved in learning the craft of silversmithing.

The *Guidebook* provides two basic conditions for the re-enactments. First, Van Laer explicitly addressed novices who want to pursue a career as a gold- or silversmith. More specifically, his target audience consisted of "upcoming gold and silversmiths," whereas the book was supposedly of "great use to all young gold- and silversmiths".⁶⁴ Having no prior gold- and silversmithing experience, I took up the role of the learning novice. Second, Van Laer reminds his readers that the textual instructions had to be complemented with hands-on education and that is why Tonny Beentjes joined the project. Although learning would initially happen through the *Guidebook*, Beentjes would oversee the education process as a master craftsman and complement the *Guidebook* with hands-on instruction where necessary. This collaboration proved rather fruitful in the end, not only for me, but for Beentjes too. Although Beentjes' expertise and familiarity with historical gold- and silversmithing practices proved indispensable in interpreting the *Guidebook*, his role was not solely advisory. Teaching me as a silversmith enabled him to reflect on his own pedagogy.⁶⁵ Additionally, my unexperienced position forced us to keep an open mind and to question procedures that otherwise would have been taken for granted.

⁶³ Marchand, "Muscles, Morals and Mind" (cit. note 20), p. 249. See also: Erin O'Connor, "Embodied knowledge" (cit. note 24), pp. 183-204. Paul Atkinson, "Blowing Hot: The Ethnography of Craft and the Craft of Ethnography," *Qualitative Inquiry*, 2013, 19:397-404. Cristina Grasseni, "Skilled vision: An apprenticeship in breeding aesthetics," *Social Anthropology*, 2004, 12:41-55. Sarah Pink, *Doing Sensory Ethnography* (London: Sage Publications, 2009). Tim Ingold, *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill* (London: Routledge, 2000).

⁶⁴ Van Laer, *Weg-wyzer* (cit. note 2), title page.

⁶⁵ Sven Dupré, "Re-working with Makers (Part 2)," *ARTECHNE* (blog), <http://artechne.wp.hum.uu.nl/re-working-with-makers-part-2> (accessed 29 Jan. 2018).

It is important to note that even though the re-enactments were aimed at a better understanding of historical practices, they were themselves an *ahistorical* staging of an educational context.⁶⁶ This means that historical research took place before and after the re-enactment was performed. Preceding the re-enactment, the experimenting historian needs to make choices, deciding what features of historical practices are essential or irrelevant with respect to the topic and question under investigation.⁶⁷ These choices vary from materials, persons and expertise involved, through the physical space of the workshop, to the scope of the re-enactment. Based on these historically informed decisions, a scenario is drawn up and the stage is set. It is only then that the historian enters the scene as a participant-observer and starts to perform ethnographical research. Subsequently, the ethnographies, insights, and questions that arise during the re-enactment serve to further inform and interpret the historical topic under investigation. Historical research and re-enactments thus complement each other. As a methodological consequence, one should keep in mind that next to informing new historical insights, re-enactments can as easily function as a gimmick that reinforces existing interpretations while obscuring the alternatives. It is therefore imperative to continuously keep going back and forth between historical decision-making and re-enactment, while reflecting on the double role of historian and participant-observer.⁶⁸

5. Historical conditions and limits of re-enacting

In the summer of 2016, re-enactments started in the Atelier Building in Amsterdam, a state-of-the-art facility for conservation and restoration practices of the Rijksmuseum, the Cultural Heritage Agency of the Netherlands and the University of Amsterdam. It is important to note that the re-enactments took place in a workshop that was distinctly different from what a historical workshop would have looked like. In an engraving from 1576, goldsmith Étienne Delaune (1518/1519-1583) offers a great impression of the set-up of a historical goldsmith's workshop. (Fig. 3) (Fig. 3. here) Immediately striking is the central place of fire. The forge would be employed to melt metals and was fueled by a charcoal fire. Even though the Atelier Building has a fire place, melting would be done by hand using gas-fueled torches, with the smoke immediately carried off by a sophisticated ventilation system for practical, health, and safety reasons.

Another difference concerned the people in and around the workshop. A historical workshop would have ordinarily harbored multiple individuals, such as apprentices, journeymen and the master himself. Although the average size of gold- and silversmithing

⁶⁶ Anna M. Mann et al., "Mixing Methods, Tasting Fingers: Notes on an Ethnographic Experiment," *HAU: Journal of Ethnographic Theory*, 2011, 1:221-243. See also: Dupré, "Re-working" (cit. note 65).

⁶⁷ Ad Stijnman, "Style and technique are inseparable: art technological sources and reconstructions", in *Arts of the Past: Sources and Reconstructions. Proceedings of the First Symposium of the Art Technological Source Research Study Group*, edited by Mark Clarke, Joyce H. Townsend and Ad Stijnman (London: Archetype, 2005): p. 6. Fors, "From the Library" (cit. note 56), p. 94.

⁶⁸ Dietmar Höttecke, "How and What Can We Learn From Replicating Historical Experiments? A Case Study," *Science & Education*, 2000, 9:345-346.

workshops was found to be small in the Low Countries, and in some cases limits had to be imposed on the number of employees.⁶⁹ Likewise, Delaune's engraving depicts several people at work. This meant that the apprentice had ample opportunity to observe, watch and learn how others worked, moved and behaved around the workshop. According to sociologist Paul Atkinson, the workshop could be thought of as a "site of choreography". In his ethnography of glassblowing, Atkinson argues that understanding the workshop, also means to understand "posture, the angles of the body, the rhythms of the body, the co-ordination of different workers' bodies in the confined space of the studio".⁷⁰ Similarly, the gold- and silversmiths' workshop was a site of choreography. In Delaune's engraving, the forge clearly effects co-ordination and collaboration between two people. One of the figures, likely the apprentice, is working the bellows, while the other, presumably the master, is minding the silver in the crucible. Meanwhile, other workers are busy chasing a large basin or hammering out, 'raising', a bowl against the anvil. At the Atelier Building however, similar choreographies rarely occurred. Learning simply by absorbing the dynamics of the workshop and by witnessing peers was impossible.

But maybe one of the largest differences was that the re-enactments, compared to historical practices, were not restricted by time, money or commissions, nor influenced by a need to shape a young person's life. Whereas from a historical perspective, learning came virtually down to working, we took a different approach and explored the *Guidebook* topic by topic, not hindered by any deadlines or the need to secure income.⁷¹ Topics were selected based on their feasibility and potential interest for the research question. Consequently, procedures like mercury-gilding were off-limits due to safety concerns. While our selective approach allowed for much freedom, as a downside, we never finished an entire object. Normally, a craftsman foresees the trajectory of an object from beginning to end and is trained to think ahead accordingly.⁷² For example, when making a mold, a silversmith efficiently positions the runners towards the replica as to minimize the loss of detail during finishing, which prevents a half day's work of compensatory chasing in the end. Similar anticipatory decisions keep a lid on expenses and make processes more efficient. As Beentjes explained during one of the re-enactments, "sometimes a silversmith needs to think even up to ten steps ahead." The re-enactments however, due to their selective nature, did not leave much room to experience how different stages of work affected one another as an object comes into being. As a result,

⁶⁹ Tump, *Ambachtelijk geschoold* (cit. note 43), pp. 92-93. Schoen, *Tussen hamer en aambeeld* (cit. note 49), p. 183. De Munck, *Technologies of Learning* (cit. note 47), pp. 131-153.

⁷⁰ Atkinson, "Ethnography and Craft Knowledge," *Qualitative Sociology Review*, 2013, 9:56-63, p. 59. Atkinson, "Blowing Hot" (cit. note 63), pp. 397-404. For a historical perspective on movement and rhythm, see: Janina Wellman, "Hand und Leib, Arbeiten und Üben: Instruktionsgraphiken der Bewegung im 17. und 18. Jahrhundert," in *Bewegtes Leben. Körpertechniken in der Frühen Neuzeit*, edited by R. von Mallinckrodt (Wiesbaden: Harrassowitz, 2008), pp. 15-38.

⁷¹ De Munck, *Technologies of Learning* (cit. note 47), p. 56.

⁷² Tim Ingold deliberately employs the term "foreseeing" instead of "overseeing" to account for the "inclinations of alternatively pliable and recalcitrant materials." Ingold, *Making* (cit. note 22): p. 70.

the urgency of certain techniques and the 'why' of certain procedures did not always become apparent because they were never performed in full connection to each other.

6. "On the casting of both silver and gold"

Re-enactment began with a ten-page chapter on casting silver. This decision was grounded in Beentjes' experience that casting serves as an accessible introduction to the craft.

Interestingly, Van Laer does not distinguish between entry-level and advanced techniques in the *Guidebook*, nor does he stipulate a curriculum. So already at this stage, Beentjes became immediately didactically involved by deciding what chapter to start with, a decision that seemed random to me at best, since the chapter is positioned in the middle of the book between soldering and chasing. In brief, casting as described by Van Laer concerns a procedure that today is understood as founding. Founding comprises both mold-making and the subsequent casting of the mold with molten metal. Although historical and current practices overlap in many respects, terminology differed in two important ways: Van Laer did not speak of founding, nor did he speak of molds.

To optimally prepare for the re-enactment, I started close-reading Van Laer's instructions and tried to reconstruct the casting process on paper. Van Laer introduced the chapter on casting by saying that "every Gold and Silversmith knows the great convenience and advantage of learning to master the Art of casting in Gold and Silver from their Master craftsman. Doing it well depends on a lot of things."⁷³ He discussed a wide array of materials and tools, ranging from silver alloys to crucibles, fluxes, and casting flasks. Subsequently, he provided a detailed account on the type of sand needed for casting. The instructions continue with remarks on dusting sand, the preparation of casting flasks, and finally the cutting of sprues and runners.

Initial close-reading of the chapter emphasized two important things. First, as an inexperienced layman, I was able to follow the casting procedure as explained in the *Guidebook* and make some sense of it. Yet many of the terms and tools were new to me and many of the instructions seemed less comprehensible at second glance than they initially appeared to be. For example, I did not understand why certain parts of the process received more attention from Van Laer than others. Why would he bother so much with different types of casting sand while the actual casting process was virtually neglected? Reading the instructions with the intention of carrying them out made me aware of problems that would have otherwise escaped my attention.

Second, I hoped to find an explanation that would eventually lead me to cast an object from scratch. I nevertheless searched in vain. A step-by-step explanation, such as in twenty-first-century cookbooks, manuals for remote controls and IKEA-instructions, was not presented in the *Guidebook*. On the contrary, I had to gather information from a selection of rather randomly distributed remarks. The procedure had to be reconstructed by piecing

⁷³ Van Laer, *Weg-wyzer* (cit. note 2), p. 130.

together seemingly casual references for which I had to browse back and forth through the chapter.⁷⁴ (Table 1 here)

How hard it is to get a complete picture of the casting procedure just by reading the *Guidebook* became clear when I tried to understand the role and function of one very specific tool: the casting flask. Not having seen or handled this tool before, a combination of reading and deductive reasoning taught me the following things. It has a mouth and consists of two halves which can be fixed onto each other. The flask itself is filled with moist sand and somewhere in the middle sits the so-called pattern or model which is being cast. Moreover, Van Laer prescribed the use of special dusting sand to ensure that the pattern and both halves of the flask come loose easily. After the flask has been filled with sand, runners are cut out through which the molten silver or gold will eventually flow, but casting can only happen once the flask has properly dried.

Unfortunately, for an inexperienced layman, this rather cryptic compilation of flask-related remarks is difficult to understand. This seems to suggest, once again, that Van Laer addressed those readers who already knew their way around the workshop. Young gold- and silversmiths, for example, would better understand the order and place of Van Laer's remarks in the entire casting process, because they would have frequently witnessed the casting process on the shop floor.

7. Choreographies, temporality and tools

Because I was interested in the practicability of Van Laer's instructions, I first tried to prepare a casting flask without Beentjes' supervision. On the workbench waited a small flask approximately ten centimeters high, together with a bucket of the required Brussels sand that had already been moistened according to Van Laer's instructions. Beentjes also provided me with the pattern: a replica of the object that I was about to reproduce. It was a four-centimeter brass disc, at the front of which a lion's face had been raised, while being flat at the back.

I quickly ran through the procedure in my head. It made sense to first take the flask apart and to fill both halves separately. Once one half had been filled with sand, I could insert the pattern and start filling the other half on top. This way, I reasoned, the pattern would always end up in the middle of the flask. Upon closer inspection, I saw that one half of the casting flask had four iron pins mounted on its frame that fitted into four related slots on the other half. Later I would learn that these halves are called *cope* and *drag* respectively, although Van Laer never spoke of them that way. Because the *Guidebook* did not prescribe with which half to start, I randomly decided to take the half with the slots, and placed it slots-down on the bench. (Fig. 4A) (Fig. 4. here)

A little uncomfortable, I filled the frame with some moistened sand and gently started to push the sand into the frame with my fingers. To my surprise, it was possible to significantly

⁷⁴ Pamela H. Smith observed a similar lack of linearity when reading and working with the sixteenth-century recipe collection BnF Ms. Fr. 640. Smith, “Historians in the Laboratory” (cit. note 17), p. 218.

compact the sand, just by pressing it a little. Although Van Laer did not mention how much pressure to apply, it followed quite naturally from the material itself. I kept adding sand little by little and continued pressing until it was pressed so tightly into the flask that it could be lifted from the bench without falling apart. (Fig. 4B)

I turned the flask upside-down, which revealed a smooth surface of tightly compacted sand. Now the pattern had to be placed on top of the first half of the casting flask. This could be done in two different ways, either with the lion facing downwards into the pressed sand, or with the lion facing upwards. Since the *Guidebook* did not explain how to proceed, I decided to position the pattern with the lion facing upwards, such that the newly pressed sand could be pushed into the cavities of its face. (Fig. 4C)

Next, I needed to apply dusting sand. Van Laer explained that “dusting sand is of great importance when pressing. The sand is scattered on one half of the pressed flask, before the other half is pressed upon it. For this reason: otherwise the sand that has been pressed together cannot be separated anymore.” Even though he presented a variety of materials that will do the job, he “uses finely ground pressing sand the most.”⁷⁵ Accordingly, I took some of the dry Brussels sand, similar to the sand I previously used to fill the flask. I judged it to be fine enough – its consistency reminded me of flour – and sprinkled it over the filled half of the casting flask together with the pattern. (Fig. 4D) Next, I mounted the casting flask together and gently started to fill the empty space with sand on top of the pattern, just like I had done before. (Fig. 4E, F) The flask was ready. I cautiously opened it and once Beentjes returned, we took a look at the result.

I was glad to recognize the lion's face in the imprint, even though the result proved to be generally disappointing. (Fig. 5) (Fig. 5. here) Beentjes saw immediately that too much dusting sand had been used. It came off in flakes, while two smooth surfaces should appear once the flask is opened. Next, he told me that many details of the imprint were lost, because at several points, sand remained in the cavities of the pattern. Moreover, the pattern could not be removed without losing detail due to undercuts. Finally, the pattern had not been positioned in a practical way. Preferably the runner should be connected to the thickest part of the imprint to minimize loss of detail, which in my case would be the lion's beard and not the top of its head. After we had reflected on the initial result, Beentjes prepared a second casting flask.

Beentjes took a brush and started to dust the pattern, using talcum powder as a separating agent.⁷⁶ (Fig. 6A) (Fig. 6. here) Next, Beentjes placed the pattern, face-up, on the table and took the half of the casting flask with the slots and positioned it slots-down over the pattern. The pattern was oriented with the lion's beard facing the flask's mouth. (Fig. 6B) Beentjes grabbed a handful of sand, threw it on the pattern and started pressing the sand, first along the edges of the flask while cautiously avoiding the area above the pattern. He explained that by

⁷⁵ Van Laer, *Weg-wyzer* (cit. note 2), pp. 135-136.

⁷⁶ This was an anachronistic choice, but later we would switch to pumice powder, which Van Laer offered as an alternative to the fine Brussels sand we used in the initial attempt.

starting with the edges, the sand would provisionally fasten the pattern to ensure no latitude was left before applying the remaining sand. After the edges were sufficiently compacted with his fingers, Beentjes pressed the sand on top of the pattern as well. Next, he grabbed another handful of sand and threw it into the flask. This time, after he had fastened it first by pressing it a little, he took a solid brass cylinder, a rammer, and started pounding on the sand to compact it even more. He repeated this step two or three times until the first half of the casting flask was completely filled with sand. Next, he took a squared metal sheet and used it to scrape off the surplus sand in order to meticulously level out the sand with the frame of the flask. He then turned the flask, flipped it and placed it back on the table, re-revealing the pattern. (Fig. 6C) I looked at the pattern's back, while the rest of it was already firmly buried in the sand. With his nail, Beentjes carefully removed the bits of sand that clasped around the pattern's edges. Next, he scattered some talcum powder on the prepared half of the flask, such that it covered the sand as well as the pattern. With his finger, he softly rubbed it over the flask, blowing any excess of dusting sand away. We were halfway through the process. Beentjes mounted the other half of the flask onto the half he had just prepared. As before, he alternately filled the flask with sand and compacted it using the brass cylinder, finally scraping off excess sand. Now, the flask could be opened. Using a small spatula, Beentjes loosened the pattern from the first half by lifting it a little. With a sudden movement, he quickly flipped the flask upside-down. The pattern fell out, leaving a satisfying imprint behind. (Fig. 6D)

Major differences between our approaches were apparent. First of all, there was a difference in what can best be described as manual choreography. By this term, I mean the orderly sequence of hand movements in which a procedure can be broken down and is performed. With no prior experience, I derived my choreography from Van Laer's description of the casting flask. This meant that I simply inserted the pattern halfway through the procedure, because it needed to end up in the middle of the two halves. Beentjes on the other hand, deliberately started with the pattern in anticipation of the final result. Later on, when I asked him about the reason behind this order, he explained to me that experienced craftsmen usually start by positioning the pattern on a flat surface, because it allows for the sand to be compacted even further into the cavities, which enhances the detail of the imprint in the end. While the novice does not yet fully understand how every step affects the end result, the master has learned to reason back from the desired outcome. This anticipation, this sense of temporality, could not be grasped from Van Laer's instructions and neither does he describe the flask-making choreography. Secondly, Beentjes introduced new tools to the process, which I would never have considered using. Indeed, the rammer to compact the sand, as well as the squared metal plate used to level out the sand were not mentioned by Van Laer. However, they were important means to achieve the best possible result. The simple pressing that I encountered in the book suddenly became a sophisticated technique in the hand of Beentjes. Similarly, the importance of levelling the sand – an irregular surface would deform

the imprint when the flask was flipped and pushed upon from the other side – escaped me as well.

Gradually, I began to understand what Van Laer meant when he emphasized the necessity of hands-on education in learning to cast well.⁷⁷ At first, I read this as an idle truism and obligatory remark mentioned with respect to all kinds of craft knowledge. Yet during the re-enactment, this remark took on a different meaning. I began to see the choreographies, the temporality and the tools that were not explicated in the *Guidebook* and which had to be passed on by Beentjes instead. Nonetheless, that these elements were not explicated, did not mean that they were simply absent in the text. The *Guidebook* proved fully compatible with Beentjes instructions. His extensions did not violate Van Laer’s instructions but laid bare knowledge and practices that had been silently present all along.

On a methodological level, the re-enactment forced us to rethink the purpose of our approach. Whereas I initially hoped to retrieve information on the mechanisms through which the *Guidebook* would inform my material practices and my education as a silversmith, I gradually began to see that our approach effected the opposite instead. Comparison between the *Guidebook* and Beentjes’ instruction helped to identify in particular those types of knowledge that remained unarticulated in text, but that simultaneously proved indispensable in learning the craft. Instead of immediately laying bare the interaction between text and practice, re-enactment thus proved first and foremost a valuable tool to investigate the explanatory gaps in text and helped us to sort out and narrow down what goes by the names of tacit, embodied and gestural knowledge. In other words, it has the potential to provide a typology of unarticulated knowledge.

8. Sensory indicators

Apart from knowledge concerning choreographies, temporality and tool-use, another category of largely unarticulated knowledge emerged during the re-enactments. This type of knowledge is best described as *sensory indicators*. By this term I mean knowledge that enables craftsmen to develop “skilled vision”, or rather a skilled sensory apparatus in general, and the ability to “read” the materials they work with. Sensory indicators guide both perception and action and help the craftsman to look for material signs or subtle cues that indicate progress or the necessity to take action.⁷⁸

A good example of a sensory indicator was found when Beentjes and I finished the aforementioned flask and continued by casting it. Once dry, the two halves of the flask were clamped together and conveniently positioned at the fire place. A few scraps of silver were placed in a crucible, we put on gloves and protective goggles, and together we started to heat the silver with a blowtorch. (Fig. 7) (Fig. 7. here) I was excited to see what would happen, as I

⁷⁷ Van Laer, *Weg-wyzer* (cit. note 2), p. 134.

⁷⁸ Grasseni, “Skilled vision” (cit. note 63), pp. 41-55. Tim Ingold, “From the Transmission of representations to the education of attention,” in *The debated mind*, edited by H. Whitehouse (Oxford: Berg, 2001), pp. 113-153. Ingold, *Making* (cit. note 22), p. 110.

had never melted metal before. It was an intriguing process. Within a few minutes, the silver had already gone through several stages. Some silver scraps were covered by a thick layer of corrosion, tarnish, which would break open under the local heat of the torch and reveal a reflecting surface of shiny silver. Other scraps exhibited colorful states of oxidation, much like the iridescence of an oil film on water, which were gone as quickly as they appeared. After a while however, the smallest scraps began to melt and the bigger pieces gradually followed like chunks of melting chocolate. At this stage, different patches of dirt floated on the surface and the molten silver moved rather stiffly. To get rid of the dirt, Beentjes threw in a small teaspoon of borax; a mineral that works as a flux and cleaning agent. Continued heating eventually caused the floating film of dirt to gradually break away towards the sides, and finally a red, gleaming surface was revealed that much reminded me of mercury. But then, all of a sudden, I wondered when the silver would actually be hot enough for casting. I had been so caught up in the heating process, that I completely forgot to think about the next step. Quickly, I tried to rethink all of Van Laer's instructions, only to realize that the *Guidebook* did not touch on this issue. When I asked Beentjes about it, he mentioned a very useful rule of thumb: As soon as the silver in the crucible starts to behave and ripple like water, it is ready to be poured into the flask. We did so accordingly and finally got ourselves a much-desired silver replica of the lion's head. (Fig. 8) (Fig. 8. here)

Later on, Beentjes told me that successful casting really depends on the silver having the right temperature. The water metaphor functions as a sensory indicator that tells the silversmith, quite accurately, what to look out for. Beentjes was not the first to resort to this metaphor. In fact, this sensory indicator is and was commonly shared among silversmiths and can even be traced back as far as the sixteenth-century Italian gold- and silversmith Benvenuto Cellini (1500-1571). In his treatises on goldsmithing and sculpture, he describes the process of melting silver and explains that "after a while you will see the silver beginning to float like water." This was his cue to throw in some flux and to start casting.⁷⁹ The commonality of this metaphor, as well as its long history, makes its absence in the *Guidebook* even more noticeable. Why would Van Laer leave out this type of information?

Even though the water metaphor is valuable knowledge cherished by every silversmith, this sensory indicator is no guarantee for perfect casts. It is not an unequivocal formula that can be readily transmitted and understood. Rather, it provides novices with a sense of direction and helps them by guiding their perception. This too, was the case when I eventually started to cast independently from Beentjes. Even though I knew what to look out for, once I found myself in the middle of the casting process, it proved very difficult to decide what behavior of the silver was actually water-like and what not. In other words, the water-metaphor did not signify a binary state. Instead, the silver rippled a little at first, which

⁷⁹ Benvenuto Cellini, *The Treatises of Benvenuto Cellini on goldsmithing and Sculpture*, translated by C.R. Ashbee (London: Arnold, 1898), p. 80.

gradually increased until it was suddenly too hot. So even if the sensory indicator is transmitted in text, it still needs to be rediscovered in practice by the novice.⁸⁰

9. Learning through trial and error

A few months later we confirmed that trial-and-error is a powerful way to, at least partially, overcome the difficulties posed by the gaps in the text. Beentjes and I set up a small workshop in which we offered participants the opportunity to try out Van Laer's instructions for themselves. The group consisted of participants of a workshop on Re-enactment, Replication, Reconstruction that took place in June 2017.⁸¹ No participant had prior gold- or silversmithing experience and the workshop was designed in a similar way to the re-enactment described above.⁸² At first, participants were handed a selection of casting-related remarks as found in *Table 1*. Tools and sand waited on the benches and with no further explanation, the participants were put to work. A few started by meticulously dusting an empty casting flask with dusting sand. Others first filled one half of the flask with sand and subsequently tried to firmly press the pattern with its detailed side into the already compacted sand. When they did not succeed because of the sand not giving in, they removed the pattern, carved out a pattern-sized cavity and tried again. Even though these actions would be illogical from a craftsman's point of view, the *Guidebook* nevertheless allowed for these different readings and procedures. However, after several trials, the participants began to approach procedures that indeed yielded recognizable imprints of the patterns. Without any textual or professional indications, they also started to introduce new tools to the process, using squared metal sheets to level off the sand and brass cylinders to compact the sand. One team, upon observing a loss of detail in the imprint, analyzed this problem and rightly decided to use more dusting sand next time. Even though none of the procedures figured out by the participants would yield a perfect cast in the end, it was impressive to witness the power of trial and error and the resourcefulness of the participants. In fact, several issues appeared to be self-resolving, simply by exploring the limits of materials and the affordances of tools.⁸³ The lack of certain steps and knowledge in the text did not hinder the participants from discovering them on their own. This indicates the necessity to rethink the importance of tacit knowledge in relation to crafts and indeed confirms the aforementioned argument of Melvyn Usselman *et. al.* that tacit, gestural or embodied knowledge makes the transmission of craft knowledge a complex, but not impossible affair. Materials and tools provide guidance too in situations where text remains silent.⁸⁴ For example, even though unarticulated in the *Guidebook*, it followed quite naturally from the sand how much pressure it needed for compacting. Furthermore, the

⁸⁰ Tim Ingold, *Being Alive: Essays on movement, knowledge and description* (London: Routledge, 2011), p. 162.

⁸¹ For more information, see: <http://www.rrr-network.com>.

⁸² I would like to thank the participants who enabled these observations: Ruth Benschop, John Hopkins, Annie Jamieson, Roeland Paardekooper, Peter Peters, Lawrence Principe, and Rebecca Wolf.

⁸³ Gibson, *The Ecological Approach* (cit. note 26), pp. 127-143.

⁸⁴ Usselman, "Restaging Liebig" (cit. note 29), pp. 1-55. Chang, "How Historical Experiments" (cit. note 29), p. 321. Tim Ingold, "The textility of making," *Cambridge Journal of Economics*, 2010, 34:91-102.

amount of dusting sand was easily determined and adjusted after a single failed attempt during the workshop. In brief, the existence of tacit, embodied or gestural knowledge does not necessarily arrest each and every non-verbal attempt to transmit craft knowledge.

Unarticulated knowledge is not necessarily lost in text but can be recovered in a material context.

Nonetheless, additional hands-on instruction by Beentjes was needed to significantly improve the quality of the prepared casting flasks. For example, none of the participants arrived at the idea to start preparing the mold with the pattern and instead introduced it only halfway through the process. Likewise, the patterns were not ideally positioned towards the mouth of the casting flask. When Beentjes walked them through the entire process, one participant exclaimed that, all of a sudden, he began to understand how Van Laer's instructions fit together; Reading and struggling with the text enabled him to understand the logic behind Beentjes' process, while it was only with this experience that he started to discern a similar logic that had been silently present in the *Guidebook* all along.

10. Learning a craft from books

The re-enactments resulted in a typology of unarticulated knowledge and, consequently, did not immediately reveal the mechanisms through which a craft could be learned from text. However, the explanatory gaps, such as choreographies and sensory indicators, relate something important too. This knowledge is essential in learning to master techniques and silversmithing practices, especially if someone wishes to do it well. Advanced apprentices and trained craftsman would have benefited the most from the *Guidebook*, because they could either rely on others to fill in the explanatory gaps or rely on their experience as an interpretive scheme. Learning to master the techniques and procedures without this experience would otherwise become a complicated affair very quickly. The *Guidebook* was thus far from a DIY crash course, which is also confirmed by Van Laer, who more than once pointed out the indispensability of complementary hands-on education. This raises a very important question however. Would it not be easier to just learn everything the old-fashioned way? If the *Guidebook* indeed depended on complementary training, or on prior experience, why bother with a book at all?

One might argue that the interdependence of text and hands-on instruction was above all a strategic attempt by Van Laer to carve out a livelihood. Since the *Guidebook* could not be used on its own, the principle purpose of this book was to force serious readers to become paying customers; the *Guidebook* indeed makes a clever invitation to his workshop. Van Laer explicitly reminded his readers that he could teach them how to make silverwork in the "old-fashioned" or "new-fashioned" way and how to create the associated models, patterns and drawings.⁸⁵ The idea of books needing aftercare for which readers could subsequently be charged in the workshop had more currency in the early modern period. With respect to so-

⁸⁵ Van Laer, *Weg-wyzer* (cit. note 2), pp. *3 recto - *3 verso.

called “*usus et fabrica*” books, i.e. books that explained to readers how to build and use mathematical instruments, historian of science Mario Biagioli made the suggestion that they could be seen as “cheap bait” to draw readers into the “labor-intensive economy of artisanal and pedagogical services.”⁸⁶ Still, to view the *Guidebook* from this perspective only would be somewhat one-sided. Certainly, the existence of gaps in the text might be interpreted as a strategic decision to carve out a livelihood, yet the better part of these gaps concern craft knowledge that, one way or another, remains rather difficult to put into words. Besides, Van Laer’s promotional remarks are much less explicit than would be expected on the basis of the “*usus et fabrica*” books; even directions to his workshop are missing. More importantly however, this line of argument addresses the *Guidebook* merely from a writer-perspective. Whether or not the *Guidebook* was intentionally written as advertising material still does not explain how the book could have been used by the people who ended up reading it. Put differently, the important question is not so much how the complementarity of text and hands-on instruction came about in the first place, but rather how the *Guidebook’s* end-users ultimately dealt with this issue. This leads to an alternative explanation.

To understand why people would indeed bother to use the *Guidebook* to learn the craft of gold- and silversmithing in spite of its dependence on hands-on instruction, it is helpful to look at a similar Dutch text that was published over two centuries later. In 1936, a new handbook for jewelers and gold- and silversmith came onto the market, which was specifically meant to educate upcoming craftsmen. This handbook was not very original in content and rested heavily on its eighteenth-century predecessor. In fact, it even presented an appendix in which significant parts of the *Guidebook* were summarized and reproduced, including Van Laer’s instructions on casting. However, apart from implicitly demonstrating the durability and comprehensiveness of Van Laer’s account, this handbook also provides some clues as to why functional reading in craft education might actually be helpful. In the introduction, the author explains that several colleagues asked him to write a handbook and subsequently recounts his own training.

For myself, I was indeed convinced of the need for Dutch professional literature for gold- and silversmiths. I often experienced the lack thereof during my own training. There had always been many technical questions that remained unanswered, because we neither could or ought bother the teaching assistants from whom we had to learn everything. Besides, many times they did not manage to formulate their answers well, however competent and skillful they were though.⁸⁷

The author’s plea for texts in vocational training is interesting because it redirects the attention from the limitations of the text to the limitations of the educator. Indeed, it can be

⁸⁶ Mario Biagioli, “From Print to Patents: Living on Instruments in Early Modern Europe,” *History of Science*, 2006, 44:139-186, p. 163.

⁸⁷ Jac. Hendriks, *Vakboek voor den Juwelier, Goud-, en Zilversmid* (Nijmegen: self-pub., 1936), p. 5.

very difficult to write craft knowledge down and to learn practical things from a text, but the oral transmission of knowledge is not perfect either. As in the twentieth century, apprenticeship learning in the early modern period was limited too. As argued earlier, many craftsmen were specialized in one or other area. What they could teach was often limited, meaning that apprentices had to switch masters to extend their knowledge. Historian De Munck, based on several examples of apprenticeship learning in early modern Antwerp, even argues that specializations were the “most serious impediments to the transfer of technical knowledge.”⁸⁸ Moreover, there are several known cases in which apprenticeships were not successful for less noble reasons than specializations. Some Dutch apprentices in gold- and silversmithing complained about mediocre education in the seventeenth century. They were busier running errands than learning or complained about the rather selective and one-sided education they received.⁸⁹ The limitations of text and the limitations of apprenticeship learning thus seem to start balancing the scale with respect to the transmission of craft knowledge. In this light, functional reading of Van Laer’s *Guidebook* as a way to support apprenticeship learning starts to make sense. Whereas the master craftsman was essential in complementing the explanatory gaps in the *Guidebook*, the gaps left open by the craftsman could be complemented by the *Guidebook* in return. The *Guidebook* thus seems to be a clever solution to overcoming the challenges posed by hands-on education, such as divided attention from the master and limitations brought about by specializations, prioritized work or plain didactic clumsiness. Of course, master craftsmen too could refer to the *Guidebook* as a way to free their hands of needy apprentices.

The re-enactments not only clarified what knowledge was missing from the *Guidebook*, but also proved that the *Guidebook* was particularly helpful when it came to advanced knowledge in terms of tips, tricks and best practices. For example, even though Van Laer did not describe how to assemble the casting flask, he did go to great lengths to explain how the casting sand should be prepared. He explained that “ordinary Brussels sand is used in this country, which is good by nature, but could be improved a lot through art.” Subsequently he gave the instructions. “I have considered it useful to moisten the sand and to form it into balls before it is used for casting. The balls should be glowed in a bright coal fire, so that all of the sand’s combustibles are taken away that would otherwise inflict porosity”.⁹⁰ Beentjes and I went with and against his advice and soon established that his instructions made a vital difference to the cast object. Untreated sand indeed amounted to extreme porosity, while the use of glowed sand resulted in a smooth surface. In addition, Van Laer discussed different types of material throughout the *Guidebook*, such as dusting sand and fluxes for melting, and explained their properties and preparation.⁹¹ He provided measurements and instructions to build forges, reminded the readers of the ratios in which the silver alloys should be prepared

⁸⁸ De Munck, *Technologies of Learning* (cit. note 47), p. 51.

⁸⁹ Schoen, *Tussen Hamer en Aambeeld* (cit. note 49), pp. 183-189.

⁹⁰ Van Laer, *Weg-wyzer* (cit. note 2), p. 133.

⁹¹ Van Laer, *Weg-wyzer* (cit. note 2), pp. 135-136, 141.

for soldering, listed several recipes to prepare wax for lost-wax casting and demonstrated how to produce charcoal to polish silver.⁹² Moreover, for most of these explanations, Van Laer not only disclosed his best practices, but those of his colleagues too, which enabled his readers to make their own informed decisions. To understand these instructions and to put them to good use, indeed required a basic level of experience and understanding of the craft. But once arrived at this level, the *Guidebook* could free the apprentice from the limitations of hands-on education and provide them with an opportunity to extend their knowledge independently from their masters.

My work shows that more research needs to be done to close the gap between the *Guidebook* and its twentieth-century successor, and more generally between early modern craft manuals and the current use of texts in vocational training. In other words, there is a need to historicize functional reading in craft education. The *Guidebook* is only an early example of this phenomenon and points at an emerging interest in the eighteenth century in introducing textbooks to craft learning. As others have already suggested, this development is in all probability connected to the waning influence of the guilds in the eighteenth century.⁹³ Yet evidence that convincingly demonstrates this connection is still meagre and not well established. However, with respect to textual and traditional methods of knowledge transmission, the *Guidebook* elucidates at least one important point: Guilds, the traditional organizers of craft education, and texts like the *Guidebook*, did not so much compete with each other, but rather benefited from each other in a symbiotic manner. To Van Laer however, this was already a foregone conclusion.

⁹² Van Laer, *Weg-wyzer* (cit. note 2), pp. 28-30, 127-130, 207-208, 173-175.

⁹³ Glaisyer, "Introduction" (cit. note 31), p. 9.

Figures and captions

Figure 1: Communion-beakers (1709) by Willem van Laer. Photo by Thijs Hagendijk.

Figure 2: Signed copy of Van Laer, *Weg-wyzer* (cit. note 12). Photo by Thijs Hagendijk.

Figure 3: Étienne Delaune, *A goldsmith's workshop*, engraving (1576). © Trustees of the British Museum.

Figure 4: First attempt to prepare the casting flask. A: Filling the first half of the flask with sand. B: Pressing the sand. C: Placing the pattern on top of the first half of the flask. D: Scattering dusting sand over the pattern and flask. E: Placing the second half of the flask on top of the first. F: Filling the second half of the flask with sand. Photos by Thijs Hagendijk.

Figure 5: The first but failed preparation of the casting flask. Photo by Thijs Hagendijk.

Figure 6: The second preparation of the casting flask with Tonny Beentjes. A: Dusting the pattern with talcum powder. B: The first half of the flask is placed slots-down on the table and the pattern is positioned towards its mouth. C: The first half of the flask is ready. D: Opening the flask revealed a satisfying imprint. Photos by Thijs Hagendijk.

Figure 7: Melting the silver with a blowtorch. Photo by Thijs Hagendijk.

Figure 8: Casting resulted in the much-desired silver replica of the lion's head. Photo by Thijs Hagendijk.

Table 1: Excerpts from the chapter "On the casting of both silver and gold." Van Laer, *Weg-wyzer* (cit. note 2).