WHY WRITE A BOOK?
FROM LIVED EXPERIENCE TO THE WRITTEN WORD
IN EARLY MODERN EUROPE

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For who could be taught the knowledge of experience from paper? since paper has the property to produce lazy and sleepy people, who are haughty and learn to persuade themselves and to fly without wings .... Therefore the most fundamental thing is to hasten to experience.¹

—Theophrastus von Hohenheim, called Paracelsus (1493–1541)

I.

A book can be many things: it can be a collection of medical recipes on papyrus, like a Papyrus Ebers from 1600 BCE, or it can be a computing device, like the *Theorice novella* from the 1400s, used to calculate planetary position (see Figure 1), or it can be a platform for taking notes, like a 1492 edition of Aristotle’s *De Caelo et Mundo*, filled with a university master’s notes, or it can be a laboratory where experiments are carried out in the precise replication of nature, such as in an early sixteenth-century book of nature prints by an unknown artist (see Figure 2), or it can be a repository of memory, as the eighth-century Bedouin poet Dhu’l Rumma’s words indicate: “Write down my poems, because I favour the book over memory. ... [T]he book does not forget and does not exchange any word for another.”² His view of the book as a valuable aid to memory and knowledge was not universal. In Plato’s dialogue *Phaedrus*, Socrates condemns the discovery of writing by the god Theuth:

And so it is that you, by reason of your tender regard for the writing that is your offspring, have declared the very opposite of its true effect. If men learn this, it will implant forgetfulness in their souls; they will cease to exercise memory because they rely on that which is written, calling things to remembrance no longer from within themselves, but by means of external marks. What you have discovered is a recipe not for memory, but for reminder. And it is no true


² Quoted in the exhibition catalog, Ulrich Johannes Schneider, ed., *In Pursuit of Knowledge: 600 Years of Leipzig University* (Leipzig, 2009), 124.
wisdom that you offer your disciples, but only its semblance, for by telling them of many things without teaching them you will make them seem to know much, while for the most part they know nothing, and as men filled, not with wisdom, but with the conceit of wisdom.3

A recent exhibition of books from the library of the University of Leipzig held at the Grolier Club in New York City demonstrated that books can function in a multiplicity of ways; they might even incorporate objects within themselves, such as the wood samples included in Johann Bartholomäus Bellerman’s 1788 work on different types of woods (Abbildungen zum Kabinet der vorzüglichsten in- und ausländischen Holzarten nebst deren Beschreibung). This exhibition emphasized the material nature of the book like that of a 1307 Mongol Qur’an, a holy object as well as a sacred text, which “none toucheth save the purified.”4

The exhibition was exemplary in demonstrating how diverse the purposes, formats, and sheer materiality of books could be, and its point that books are much more than the sum of their textual contents is worthy of reinforcing. In the following essay, I consider a moment in European history at which writing began to be employed in fields and by individuals who did not usually record their activities in texts. This is a moment at which movement occurred from lived experience to the written word, from the orality and the tacit knowledge of artisans to the written word of books. The years around 1400 represent a pivotal “practical moment” at which, with remarkable suddenness,
a wave—a virtual tsunami—of writing overtook many European craftspeople and practitioners. These individuals, who previously had been happy to live out their lives without recording their experiences and knowledge, and creating and producing in relative obscurity, suddenly began to write. It is a moment I shall call the “Sophists’ Revenge.”

Such a provocative rubric deserves explanation. As we all know, Plato, Xenophon, and Aristotle dismissed many of their contemporaries and teachers of rhetoric as “mere sophists.” According to Plato, the sophists’ bad qualities included a wandering life not tied to a single polis or even to Greece, a focus on practice rather than theory, that is, on the “technique” of “rhetoric” rather than the “knowledge” of “philosophy,” thereby teaching an appearance of wisdom rather than “real” wisdom. Sophists taught “how to do” rather than “how to think,” and, worst of all, they were paid for this teaching—a practice akin to prostitution for Xenophon. Although many ancient philosophers called each other by the name of sophist, Plato was the first to give the sophists a persona, and he did so not because sophists actually existed as an identifiable school, but because they were a convenient foil against which to establish a genealogy of his own “true philosophy.” Plato made the sophists the counterfeit background to the emergence of true wisdom in the teachings of Socrates. As historians of philosophy have shown, Plato’s project was not uncontested in the ancient world, but because Plato wrote (and his writings so remarkably survived), his genealogy has become our dominant narrative of the development of human thought.

Historians of ancient philosophy, most recently Hakan Tell, have attempted to piece together a clearer picture of this ancient sophia tradition from the scattered and meager documents that have come
down to us. Ancient *sophia* seems above all to have been oriented toward the *practice* of wisdom and to have included expertise of a practical kind—the performance of religious ritual, architecture, city planning, water catchment, medicine, poetry—which was often oriented to community life in the *polis* and an active life in politics. Movement from place to place was central to this ancient knowledge; indeed, some fragmentary ancient histories of philosophy located the origins of philosophy in India and Egypt, rather than giving primacy to the Greek city states, thus representing a more pluralistic ideal of knowledge. Sometimes this ancient tradition was referred to as a kind of cunning wisdom, a *metis*, celebrated, for example, in the fables of Aesop, sometimes as wise counsel, akin to prudence, but most often oriented to doing and practice.

This ancient wisdom tradition was overshadowed, if not completely suppressed, by the success of Plato, Aristotle, and Xenophon’s founding figure of Socrates and his philosophical tradition, which emphasized one kind of knowledge—that is, the universalized and disembodied *episteme* (or *scientia*)—at the expense of another—*technē*—and which placed practical pursuits lower on the epistemic hierarchy than true philosophy. As a result, “doing” came to be seen as separate from “knowing.” Doing was knowledge of “how to” rather than of “why” and was seen as goal-oriented “know-how” involving specific and particular practices, while “knowing” was regarded as generalizable, abstract knowledge expressed in propositions, general theories, and proofs. Plato and Aristotle regarded “knowing” as a more powerful type of understanding. It was obvious to them that “doing” could be employed in important ways for survival, but because animals exhibit this kind of knowledge (birds build nests and bees make hives), it was not an activity which could distinguish humans from brutes. “Doing” was thus a way of being in the world which was not worth theorizing about and did not need much written attention. Moreover, Aristotle was scathing about the unsuitability of the manual worker for citizenship in the republic, and this prejudice would be carried forward with the rest of the Aristotelian corpus and reinforced as the medieval university system in Europe grew.

This essay suggests that the *scientia* tradition of philosophy in Europe came under siege with the explosion of practical and technical writing in the 1400s. We can see the advance party of this siege in the expressions of self-consciousness, expressed not in words,
but, to take just a few examples, in the 1392 self-portrait in stone of Peter Parler, proudly placed on the Prague Cathedral where he acted as master mason, and in the sculpture of Adam Kraft, who carved himself in 1485 life-sized and dressed in his mason’s working garb, holding his stoneworking tools at the base of his astonishing sacrament house, which reaches into the vaults of the St. Lorenz Church in Nuremberg. Lorenzo Ghiberti cast his own portrait in bronze on the doors adorning the Florentine baptistery in the first quarter of the *quattrocento*, and Jan van Eyck referred to himself prominently and powerfully in his 1434 oil portrait of Giovanni Arnolfini and His Wife, where he placed his maker’s signature, “Johannes de Eyck fuit hic,” in the very center of the painting. These artisan-artists all seem to be saying, “Here I am; here is my proof; here is what I can do.” These men all expressed ambitions to record themselves in some medium, sometimes in writing as well as in representation.

This sudden appearance of self-consciousness and self-assertion took place in the context of increasingly powerful territorial rulers and their need of artisans for war technologies and for the representation of power. At the same time, society in Europe had become increasingly urbanized, with concentrations of artisans experimenting with different media and engaging in an intense exchange of skills and ideas with their fellow craftspeople and other social groups. The wave of technical writing that followed on this beginning around 1400 rippled out still further with the invention of printing in the 1460s: recipe collections and technical treatises (still titled, as they had been since the Middle Ages, “books of secrets”) were some of the earliest works off the presses and some of the biggest best-sellers, growing larger and larger with each reprinting as material was added and the pseudonyms of the authors changed. Early works in the vernacular appeared in astounding numbers and include Distillir-Bücher in the 1490s, Kunstbüchlein in the 1500s, and assaying and metalworking treatises (known as Probir-Büchlein) in the 1530s. Then Alessio Piemontese’s *Book of Secrets* burst onto the scene in the mid-sixteenth century, first in Italian and then quickly translated into Latin and many other European languages, going through ninety editions by the seventeenth century. This boom in “how-to” books continued throughout the seventeenth century and into the eighteenth, and these two centuries saw the publication of many more books on every conceivable subject, from fencing to composting, and from embroidery to cannon casting.

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6 For further examples of such artisanal self-consciousness, see Pamela H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago, 2004).

Vivid evidence of this siege on the *scientia* tradition can be found in a coat of arms a Venetian galley oarsman gave to himself in the 1400s (see Figure 3). It certainly seems to portray a kind of revenge, a world turned upside down, in which a giant mouse holds a bloodied cat in its paws, blood dripping from the cat’s already stiffening sides. This striking image is flanked by oversized turnips, known as peasant food, in place of the usual noble fleur-de-lis. This is clearly a work of some self-consciousness and no little irony on the part of its low-born vernacular creator, Michalli da Rhuodo (Michael of Rhodes). Michael joined the Venetian navy as a lowly galley oarsman in 1401, taking part in over forty voyages in as many years across the Mediterranean and to Flanders, rising to a high position. He documented his life in a remarkable manuscript begun in the 1430s, only published in its entirety for the first time in 2009, which records his voyages and provides a remarkable glimpse into his life.8 It reveals his interest in mathematical and algebraic calculation for commerce, calendar computation, navigation, and apparently just for

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the sheer delight of working with numbers, as well as his deep piety (see Figure 4), his concern with astrology (see Figure 5), and his interest in the technical details of ship-building, for which he provided many striking illustrations, filled with precise measurements (see Figures 6 and 7). All these components of his book convey a vivid but enigmatic glimpse into the concerns and ambitions of a low-born, informally educated handworker who was part of neither an intellectual nor a social elite.

In Michael’s book, a working man who has been engaged in “doing” all his life suddenly comes to light through his foray into the written word, and he looks like we hoped he would: no doubt embedded in his religious and cultural context which included deep piety and astrology, but also self-conscious and mathematically clever, and, from the look of his remarkable coat of arms, apparently dreaming of overturning the social order.

It would thus appear that Michael’s book must be a treasure trove for understanding this moment of “sophists’ revenge” and the practical sophia tradition lost in antiquity. What do we find in Michael’s book? How does he express his vernacular “knowledge”? As text-centered scholars ourselves, concerned with our own authorship, we must admit to disappointment
in Michael’s book—it is a bit of a jumble, the math is mostly problem solving, rather than setting out rules or axioms; the problems are a compilation from abacus school textbooks; the portolans (descriptions of sailing routes) are so inaccurate that anyone using them would have shipwrecked themselves; the images are not all original; the recipes often seem dry lists; the magical incantations brief; and the shipbuilding instructions not actually useful to shipbuilders. What do we make of this? So much practical writing is like this—compiled from other texts with little conceivable order: bare-bones recipes, magic tricks, undigested, out-of-date, and inaccurate information that could not possibly be employed by the readers. What is such useless information doing in a how-to book? So many of the ways in which we think today about knowledge as powerful—innovative, oriented to formulating general rules, precise, accurate, and useful—seem to be absent from many of these books. Perhaps Michael’s book really gives little insight into this working person’s life, or, even more regretfully, perhaps it is the work of a second-rate mind, simply imitating rather than innovating, not something upon which we might hopefully found an alternative intellectual genealogy of knowledge-making. Can we thus conclude, after all, that Michael

9 For these assessments, see the scholarly essays in vol. 3 of The Book of Michael of Rhodes.
was just a striver, trying to imitate an intellectual elite tradition of *scientia* in his book without really understanding it? Is the movement from lived experience to the written word around 1400 not revenge but merely a moment of imitation, a case of practical people emulating the higher status activity of writing books, and printers capitalizing on their desire? Perhaps these how-to books appealed to readers because they appeared to promise a means to obtaining the social status of an artisan without actually having to make oneself subservient in the way that an apprentice is subject to a master; thus they might be a manifestation of the social mobility of this period, which is also evidenced by the popularity of conduct manuals at the same time.

**II.**

To answer these questions, let us return to Michael’s book to consider what writing could do for him. Michael earned his livelihood by being signed on every year in some capacity to the Venetian navy or to the trading fleet. From 1401 to 1422, he worked his way up from oarsman to *armiraio*, the highest position he could attain as a non-noble. In order to be hired at the rank of non-noble officer, Michael had to compete with dozens of other mariners. Such officer positions not only put one into a position of command, but also paid better and gave more space to the individual to ship his own commodities for private sale. Due to changes in the rules of the competitions in 1418, the applicants for non-noble officer positions were judged by Venetian patricians who had negligible maritime experience themselves. As Alan Stahl’s careful reconstruction of Michael’s service in the Venetian fleets has shown, the competitions from 1433 to 1436—the years during which Michael substantially completed his book—were particularly fraught by conflict between the noble patrons of the ships of the fleet and the non-noble officers, as well as by various charges of influence and corruption. In these difficult years when Michael composed his text, it appears a book could assist in the competitions. There is no getting around the social and intellectual status of a book, especially one that had the “look” of expertise, including a list of his voyages, portolans (inaccuracy was not at issue since no one actually used them for navigating), lots of numbers, and many impressive images of ships. Michael’s book from this vantage point was a “proof” of his expertise, although it was a much less powerful proof than his actually navigating a ship safely across the Mediterranean, or his being able to garner a profit by his ability to calculate—to take an example from
Michael’s book—the correct price of a load of silk worth 11-3/11 soldi per pound being exchanged for cloth worth 60 soldi in cash and 66 soldi by barter, in which one third of the silk must be paid for in cash.\(^{10}\) But his book did constitute a proof that conformed to the textual world and expectations of the competition’s judges, many of whom had never been to sea. It appears that Michael’s book may have worked, for he was elected as *armiraio* of the Flanders galley in 1436.\(^{11}\)

But what about the pictures devoted to shipbuilding? On the strength of its images (see Figures 6 and 7) and its precise measurements for ships, Michael’s text has until recently been viewed as a how-to work for shipbuilders. But it mysteriously begins with sail-making, not ship construction. This is especially mysterious because Michael did not work on sailing ships, only on galleys with banks of oars. It seems that Michael intended this portion of his book not for instruction in building ships but for “completing them for the sea,” that is, arranging the masts, fitting them out with rigging, hanging the rudders, and providing the stores and equipment, all of which also required precise measurements. The audience for Michael’s pictures (with verbal explanation to be provided

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\(^{11}\) Alan M. Stahl, “Michael of Rhodes: Mariner in Service to”

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**Figure 6. A completed Flanders galley under sail.** *The Book of Michael of Rhodes*, vol. 1, fol. 145b.
by Michael was probably made up of patrician youths whose merchant families sent them to sea at their own expense to learn the trade, boys who then went on to serve not on galleys, but on merchant sailing ships. It appears, indeed, that almost all how-to manuscripts on shipbuilding written at this time by practitioners were not intended to furnish instructions for other craftsmen, but instead were employed by practical men explaining the tools and expertise of their trade to the social group above them, administrators or patrons, who needed the illustrations and the book both to understand the spoken presentation and to take it seriously as “knowledge.” Thus, Michael’s pictures were probably employed for the instruction of non-experts.\textsuperscript{12}

Pictures are especially effective in organizing technical knowledge into an abbreviated form, because the processes being described are extremely tedious and confusing to follow in writing, especially for the uninitiated. His pictures, supplemented with verbal elaboration, were undoubtedly even better than the pictures alone at transmitting complicated procedures. Michael’s book thus tells us about one of the aims of a how-to book—for use with patrons and officials as

\textsuperscript{12} David McGee, “The Shipbuilding Text of Michael of Rhodes,” The Book of Michael of Rhodes, 3:211–41; this discussion, 238–241.

Figure 7. Drawing for the bow of the Flanders galley. The Book of Michael of Rhodes, vol. 1, fol. 138b.
talking points. Yet, for actually doing and producing things, embodied non-textual knowledge was still best, as demonstrated when the Venetian Council of Forty specified in 1403 that on every ship construction over a certain size an elderly carpenter be hired “for the benefit and improvement of the craft of ship carpenters,” in order that he could “give to the others the means to learn this craft.”

Administrators well into the eighteenth century would continue to call upon such knowledge embodied in craftspeople whenever they aimed to have things actually produced.

Michael’s foray into making a book shows us something else that writing made possible. One of the largest sections of the book is taken up with calculations, most of them eminently practical problems familiar from abacus school textbooks for calculating partnership shares, bartering, freightage, as well as the rule of three, a very ancient commercial technique already employed before the common era in Egypt and Mesopotamia, but first written down in Sanskrit in the seventh century. We might lament Michael’s lack of originality, but the historian Raffaella Franci has shown that the long sections on mathematics actually are a kind of experimentation with the problems—for Michael solves each of them in three ways: first by using the rule of three, then the rule of double false position (another ancient technique first written down in India), and, finally, by means of algebra (what Michael called the “rules of the unknown”).

Writing makes the ordering of information in a variety of ways possible and allows for its comparison, thus leading to a kind of experimentation. Putting something into writing might have the effect of formalizing a dynamic oral tradition, but it can also allow for experimentation in a way that oral presentation cannot. Indeed the recipe-like nature of many how-to books—listing various different methods and combinations as “another way” and yet “another way”—positively encourages the comparison of techniques.

Perhaps, as Jack Goody has claimed, writing develops abstract thought and may even bring forth changes in cognition by fostering an internal monologue. This seems plausible, but what can we see it doing for Michael? In 1431, after a battle against the Genoese, a violent storm arose and the ships in the Venetian fleet were separated. Then again, in 1437 and 1439, Michael voyaged in one of the four ships of a convoy escorting the Byzantine emperor and his party of 700 from Constantinople to Venice and back, and, as violent storms separated the ships of the convoy, all on board

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15 Franci, “Mathematics in the Manuscript of Michael of Rhodes.”
feared shipwreck. How could they determine where they were? And how could they reach the other ships of the fleet? Michael used a technique to mentally calculate how far a vessel had been blown off course, using a table of numbers (“raxon del marteloio”) and a computational practice called dead reckoning by English mariners and “mental navigation” (“navichar a mente”) by Michael. By these means, internalized through his endless practice in computation, Michael could master the storms and contingencies of sea travel. He also devoted much computational practice to calculating the lunar and solar years and the date of Easter, and this clearly represented to him a means, as Faith Wallis has put it, to control “the flow of time, as one might master the flow of money, or the flow of the ocean currents, to secure human safety and advantage. Mathematics was the key to that mastery.” Mastery of this technique, like others, was attained by constant practice, by doing all the problems in three different ways.

The fact that the mathematics in Michael’s book—as was the case in most other practical mathematics texts—was organized around problems rather than theorems or proofs could be taken as a sure sign that we are dealing with “how-to” practical knowledge rather than the “why” of science. But we can see in Michael’s case that such problems were a way to gain practice in thinking through the forces of nature and the value of materials until the practice was internalized. This practiced “thinking and working through” allowed a higher-order, intuitive response to tides and winds or the fluctuations in commodity prices. The carefully computed problems, done three ways and then copied into his book, are thus a demonstration of how to learn to improvise and intuit. Much of Michael’s how-to book, then, is a demonstration of the training of intuition and improvisation, an extremely powerful combination of practice and thought that I think we might consider an embodied equivalent to the functioning of generalization in logical induction. Michael was not only “doing,” he was also thinking about cognition. In the late sixteenth century, scholars would indeed turn to algebra, to use their phrase, as an “art of thinking about thinking.” As Michael put it: “These are the points of the stars, by which are made the fortunes of the sea and the wind and the rain, and in the same way of great calm and great heat, and in addition you must always watch out not for the appropriate things but for the contrary things that can arise, so that if you want to navigate, always be prepared for every contrary thing.” It was the hours of practice that made Michael able to respond to the unknown—the

contrary things—and this ability to respond at a more general level constitutes a form of generalizing or universalizing analogous to Aristotle’s conception of *scientia* or *theoria*.

A similar statement by a master mason in a compilation of design rules repeatedly emphasized that his written rules were not to be relied upon exclusively, but that a mason must be able to exercise judgment based on his accumulated experience: “Give to this writing careful attention, just as I have written it for you. However, it is not written in such a way that you should follow it in all things. For [in] whatever seems to you that it can be better, then it is better, according to your own good thinking.”23 Because how-to books were often written as lists of design rules and specific problems, they have been seen as prescriptive for particular cases rather than describing general methods. If we see these books of practice as intended to replicate the ways in which general methods were taught in apprenticeship, however, they come to have new significance. Take, for example, *Das Büchlein von der Fialen Gerechtigkeit* of 1486 by master mason Matthäus Roriczer, which appears to set out instructions on how to draw a pinnacle for a spire. In actuality, this piece of technical writing provides an exercise in deriving the elevation of a pinnacle from a ground plan, the most important “secret” of masons’ lodges throughout Europe.24 Such exercises, taught by example and imitation in apprenticeship, led to an ability to apply specific instances more generally and can therefore be understood as instances of higher-order knowledge.

In 1444, Michael wrote a second book, an abbreviation and compilation of his 1434 book with some new material. At his death in 1445, both books passed into the possession of another mariner, who apparently carried the books with him on his voyages. This man carefully erased Michael’s name on the second book, substituting his own.25 A work of plagiarism and thievery, perhaps? Not really. Rather, Michael’s book had, in fact, become the book of its inheritor. It was never a book by Michael of Rhodes in our sense; it was, as Michael called it, the book of Michael of Rhodes.26 It contained a collectively gained, shared resource of maritime knowledge, shaped to Michael’s own needs and laid out according to Michael’s best efforts at demonstrating his techniques as well as the knowledge that resulted from them. A book was, of course, not an optimal means of transmitting embodied knowledge. That was done better by the collective working conditions of the workshop and the course of “doing” of apprenticeship and imitation.


Let us then question the idea of individual authorship (with which we scholars are all so self-absorbedly enamored) and not just for such how-to books. Even Shakespeare, whose authorship and personality are so important to our own self-understanding and identity, was a master compiler—he hardly invented a plot. I would argue that all writing was viewed as wholly or partially an act of compilation and incorporation for some centuries after 1400. Roger Chartier and other historians of the book have shown how the idea of the author as the most important component in the production of a book emerged very gradually in the eighteenth century out of a system that viewed the author as one of several cogs in a mechanism that included the work’s dedicatee, copyist, printer, and seller.\(^27\)

Long after 1400, authoring a text could mean a variety of things, of which compilation continued to be central.\(^28\) Consequently, we should expect from a how-to book neither a proof, for the proof lay elsewhere—in the practitioner’s humble body and the objects produced—nor insight into an individual author, for how-to books did not emerge from single authors, but from knowledge made, held, and shared collectively.

III.

Michael’s precise contemporary, Cennino d’Andrea Cennini, a painter not far away in Padua, also wrote down his knowledge—in *Il Libro della Arte* at the very end of the fourteenth century. Cennino’s book set out a complete course of an apprenticeship for a painter, from picking up the chicken bones under the table and charring them for charcoal through pigment-making, panel painting, gilding, frescoing, and casting. His book records painters’ techniques current in the fourteenth and fifteenth centuries. At first glance, Cennino’s book appears, as Michael’s did at first evaluation, as an attempt to attain a higher intellectual and social position. Cennino sought, as he tells us, to establish that the art of painting requires both “scienza” (science) and “operazione del mano” (work of the hand). Cennino nowhere defines *scienza* very clearly, but for him it has two important characteristics: first, it is a superior form of activity and it lends this superior status to whomever articulates it and, second, it involves the work of imagination and intellect.

Cennino and Michael were both making claims for their expertise within a hierarchy of knowledge that placed the written word and *scientia* higher than practice and embodied knowledge. Their movement

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\(^{28}\) In some genres, print even prolonged the tradition of the composite collection: Chartier, *The Order of Books*. For an example of this, see Ann Blair, “Authorship in the Popular ‘Problemata Aristotelis,’” *Early Science and Medicine* 4, no. 3 (1999): 189–227, who shows that the many editions of this compilation of questions on natural subjects called upon a composite and collective authority (despite its attribution to Aristotle) right up until the last editions in the eighteenth century.
from practicing to writing, like that of other how-to compiler-authors, was partly about asserting their identity, their modes of cognition, their skills, and their own particular kinds of knowledge. As with the artists who began to include self-portraits in the body of their works, these individuals began to take the measure of themselves and sought to make their practical knowledge known, respectable, or, in other words, recognizable as “knowledge” within their culture. Yet just as Michael’s book can be read as an epistemological tool of experimentation and a text that both teaches and demonstrates how to learn to improvise and intuit, Cennino’s book is also more than simply an attempt to move up the intellectual and social hierarchy.

Cennino’s lived experience comes across vividly in the opening lines of his book, in which he declares his work one of religious piety and common good. Cennino begins and ends his book with a prayer to “God All-Highest, Our Lady, Saint John, Saint Luke, the Evangelist and painter, Saint Eustace, Saint Francis, and Saint Anthony of Padua,” that the students of his book will “study well and … retain … well, so that by their labors they may live in peace and keep their families in this world, through grace, and at the end, on high, through glory, per infinita secula seculorum.”

Cennino’s piety pervades the manuscript, lauding those who become painters out of enthusiasm and desire to praise God, stressing the costume of “Enthusiasm, Reverence, Obedience, and Constancy” that the painter must don when he begins his apprenticeship. Cennino advocates the use of fine gold and good colors, because they will make the painter’s reputation, but even if he is not paid well, “God and Our Lady will reward you for it, body and soul.” On beginning every panel, a painter should invoke “the name of the Most Holy Trinity ... and that of the Glorious Virgin Mary.” And when the painter begins the extremely delicate task of drawing with a sharp-pointed needle on gilded glass, being careful not to make a single mistake, he must begin “with the name of God.” It is worth noting that Michael also quite literally framed his text with his piety, heading each page with the sign of Christ.”

Cennino’s book progresses from the prayer to an abbreviated recounting of Genesis, moving immediately to the Fall. As he says, “Inasmuch as you have disobeyed the command which God gave you; by your struggles and exertions you shall carry on your
lives...” The Fall of Humankind imposed a necessity of laboring for salvation, and Cennino’s painting and his text should be understood as works of redemption through labor. This expresses more than formulaic piety: Cennino’s work functions as an act of religious devotion and redemption, as did an altarpiece in Wurzach, on which Hans Multscher signed the work: “Intercede with God for Hans Multscher von Reichenofen, citizen of Ulm, who made this work in the year numbered 1437.” Numerous works of art reveal that the artist viewed the bodily labor of producing as an act of devotion and a work of individual salvation, as well as working to redeem humanity through the act of redeeming matter.

This spiritual understanding of his craft is also expressed in Cennino’s straightforward technical instructions. For example, he describes precisely how one is to lay in the flesh tones of living individuals and specifies that this flesh tone should never be used in representing faces of the dead. He called this color incarnazione and clearly regarded its use as akin to the incarnation of life in a body. This giving life to (or “incarnating”) an image for Cennino constituted a perfectly mundane artisanal technique by which the abstract principle and profound miracle of the incarnation of God and the Word in human flesh could be imitated. Cennino thus proclaimed, through a nuts-and-bolts recipe, the transformative power of art and artisan. His simultaneously material and spiritual understanding of the production of pigments, expressed in this recipe, illustrates the “theory” that underlay artisanal practices, although it was a lived and practiced “theory,” rather than a written and abstracted one. Cennino and Michael’s piety was a commonplace component of their culture, but we may also understand it as one piece of an underlying set of principles that gave meaning and order to the world; it was knowledge that explained “why,” yet it was contained in a “how-to” book largely made up of recipes.

It turns out that another explanatory theory of sorts underlies additional straightforwardly didactic recipes in Cennino’s book. In “How to Paint Wounds,” Cennino instructs a painter, “take straight vermilion; get it laid in wherever you want to do blood.” The pigment vermilion was an artificially manufactured substitute for naturally occurring cinnabar (mercury sulphide), which painters had employed as a deep red pigment in Europe and Asia from ancient times. To manufacture vermilion, mercury and sulfur were heated together until they became a black paste. On constant heating and...

36 Cennini, Il libro, 1.
40 Cennini, Il libro, 95.
stirring, this paste turned dark blue on the outside and silver on the inside, and eventually formed a vapor that condensed as a bright red cake on the walls of the crucible. This powder was then scraped off to be used as a painting pigment. The red of vermilion was associated naturally with blood and in particular with the blood of Christ. Evidence for this can be found in the practice of scribes and illuminators, who marked the places where vermilion was to be used in their manuscripts with a cross. Perhaps their use of the cross even referred to the making of vermilion in the crucible; the root of “crucible” in Latin is, of course, “crucis” (cross), and it was in the crucible that sulfur and mercury underwent their own passion and transformation to produce the blood red pigment.

In vernacular practices and high theology, blood brimmed with overlapping and contradictory meanings. It signified vitality, fertility, the material of conception, and the spirit of life, but at the same time, blood poured out could signify death, and, of course, that shed by Jesus signified death, life, and redemption all at the same time.

Blood was regarded as an extremely powerful agent: it was often listed in recipes as the only means to soften or cut hard gemstones such as diamonds. In medieval and early modern Europe, red substances were viewed as possessing the powerful properties of blood. Red coral, for example, had a variety of valuable qualities:

And it has been found by experience that it is good against any sort of bleeding. It is even said that, worn around the neck, it is good against epilepsy and the problems of menstruation, and against storms, lightning, and hail. And if it is powdered and sprinkled with water on herbs and trees, it is reported to multiply their fruits. They also say that it speeds the beginning and end of any business.

Michael of Rhodes includes a recipe “To staunch the flow of blood,” which intones, “Blood is in you as Christ was in himself. Blood is fixed as Christ was crucified. Blood is strong in your vein as Christ was in his pain. And break one stone and immediately put it on your nose and take the breath of the stone deeply into yourself.”

Blood was the carrier of life heat, and gold was viewed as possessing analogous properties, heating up the body and stimulating rejuvenation when prepared as the medicinal “potable gold” or even when worn on the body as jewelry. Red components, such as the
pigment vermilion, were often ingredients in recipes to produce gold pigment, even when they could have no practical effect on the actual chemical reaction. Red seems to have been considered an essential ingredient in processes that sought to generate and transform, especially related to the noble metal gold. The materials of vermilion (i.e., sulfur and mercury) also often appear in recipes for gold pigments, such as for mosaic gold (tin or stannic sulfide, SnS\(_2\)), a sparkling golden pigment that imitated pure gold. Cennino lists one such recipe, which calls for “sal ammoniac [ammonium chloride], tin, sulfur, quicksilver, in equal parts; except less of the quicksilver.” Art conservators have determined that the mercury (quicksilver) in this recipe is not necessary to produce the gold pigment, and instead appears to refer back to the homologies between red and gold. But through their ability to produce red color, sulfur and mercury seem to have been viewed by artisans as necessary to bring forth gold or, in other words, regenerate, transform, and ennoble materials.

Cennino’s recipes are thus deceptively simple. They both provide a set of instructions to be followed by an aspiring painter, and, at the same time, they reveal the explanatory framework in which this practice took place. They reveal what we might call a “vernacular science” of matter and transformation, a relational web of interlinked homologies among red, blood, and gold that underlay artisanal practices and techniques and that generated meaning in their world. This knowledge system was not formulated as a set of propositions, but rather as a set of particular instances or instructions. Yet it was intended as a generalizing statement. Moreover, it was not always expressed in writing, but was instead sometimes just practiced and lived. It related practices of making to knowing nature, and it gave access to the powers of nature, transformation, and generation. Productive practices in early modern Europe did not just involve the handling and transformation of inert materials, but rather allowed the artisan to investigate and engage in life forces and in the relationship of matter to spirit, and even to imitate the most profound mysteries such as the Incarnation. On the one hand, their practices were mundane and oriented to the production

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48 Just one example comes from H. G., “Goldsmith’s Storehouse,” c. 1604, Folger Shakespeare Library, Washington DC, ms. Va 179, f. 55r.


of goods, but, on the other, artisanal techniques gave access to the greater powers of the universe.

Pigment-making and metalworking texts also often included another unusual component related to this red-gold-vermilion complex: lizards. In instructions perhaps for making mosaic gold, which appear in a 1531 collection of recipes for pigment-making and metalworking, a process of producing gold by catching, feeding, and burning lizards is described in naturalistic detail. The recipe opens with precise instructions on how to catch the lizards, then directs the reader to force-feed the lizards on goat’s milk and brass, preventing them from suffocating, however, by making holes in the vessel in which they are buried in the earth. The recipe instructs the reader to burn and mash the lizards to eventually produce a powdered gold. In this and other lizard recipes in this compiled volume, lizards are associated repeatedly with generation and transformation, in part apparently through their connection with mercury and sulfur, the generators of gold and blood-like vermilion. More evidence for the association of lizards and transformation comes from a book of secrets ascribed to Albertus Magnus (but probably a compilation of material from various sources written no later than the fourteenth century) which contains many “secrets” for lighting a house. One of these calls for cutting off the tail of a lizard and collecting the liquid that bleeds from it, “for it is like Quicksilver [i.e., mercury],” and, when it is put on a wick in a new lamp, “the house shall seem bright and white, or gilded with silver.”

Lizards were associated with processes of putrefaction and generation more generally, as can be observed in the natural world: lizards appear seemingly spontaneously from putrefying matter, lending support to the commonsense principle that generation involved a process of decay. Furthermore, lizards emerge fully grown from their places of hibernation after freezing winters, and they can regenerate their tails when severed. In other words, lizards, too, were bound up with the mysterious processes of putrefaction, generation, and regeneration. An ambivalent attitude to lizards as impure and associated with putrefaction, yet as crucial in processes of transformation and generation, seems to have been very long-lived, appearing relatively recently, for example, in the birth amulets—adorned with naturalistic lizards and salamanders—of Jewish silversmiths in early twentieth-century Morocco.
Such recipes to transform lizards probably were not intended to provide straightforward instructions, but rather they reveal another node, along with blood, red and gold, in the theoretical framework by which metalworkers explained processes of generation and transformation. It should be emphasized, however, that these two different functions of a how-to book might be combined comfortably, as Cennino did in his book of recipes which could be followed by an apprentice, while simultaneously making clear the explanatory or “theoretical” framework of his practice.

The naturalistic details of these lizard recipes, such as approaching the lizards carefully and keeping them from suffocating by perforating their vessels, remain puzzling, however. Why the precise instructions for an action probably not meant to actually occur? Perhaps these should be understood as inculcating certain habits necessary to craft practice. For example, the concentration of the lizard hunt proclaims “stay alert!” One of the most important components of successful handwork is the training of attention, and many recipes make reference to this important habit of being wide awake to the changes in the state of the material and the task at hand. Michael of Rhodes repeatedly admonishes his reader to “watch out.” The injunction not to suffocate the lizards seems to tell the practitioner to put himself in the position of the material, and enjoins the artisan to know the materials with the whole body, to come to “feel,” to “sense,” and to “know” matter. Such injunctions resemble Cennino’s deceptively homely discussion of materials when he speaks about the wooden panel on which he is going to paint as being hungry, and having to give it an appetizer of size (a thin gesso mixture) before laying on the following coats which constituted its meal. Matter was like a living being one had to come to know through intimate and bodily acquaintance. The artisan had to sound out his materials, be attuned to them, taste them through the bodily senses, or “overhear” matter, as the medical and intellectual reformer Paracelsus, quoted in the epigraph to this essay, expressed it in trying to capture this element of artisanal practice. Artisanal manuals are full of directives about this type of discernment by listening, tasting, and smelling, which is very hard to describe in words, but instead is known in the body.

Jack Goody defines a recipe as “a written formula for mixing ingredients for culinary, medical or magical purposes; it lists the items required for making preparations.” While this is certainly a good
definition of one function of some recipes, how-to texts and recipe collections can also form a meditation on the material; they develop a habit of regarding matter and its manipulation. By their very repetition, often listing different variations of ingredients or different methods of doing something, they can encourage trial-and-error testing. The need for repeated trial is emphasized by the Venetian metalworker, Vannocchio Biringuccio in his 1540 book on metalworking, the *Pirotechnia*: “those things that have such inner powers [implanted by God], like herbs, fruits, roots, animals, precious stones, metals, or other stones, can be understood only through oft-repeated experience.”

Such trial-and-error procedures teach that matter is something to work through, something in which to explore resistances, in which to seek out the characteristics of a material in different situations. Such grounding in the behavior of matter led, like Michael’s computational practice, to an ability to intuit, improvise, and innovate. The judgment required by such intuition could only come through practice, not through the words or texts of simple instructions.

Hours of practice enabled the practitioner to respond to the unknown. Indeed, cognitive psychologists now believe that expertise in a craft comes after 10,000 hours of practice. This was the training that made intuition possible, and it involved a repetition of particular instances and experiences until they became generalized as “second nature,” like Michael’s calculations. Improvisation based on thorough knowledge was the stock-in-trade of the practitioner. In the smoke and heat of the workshop, with dangerous and molten materials all around him, the metal caster must make the split-second determination at which exact moment the metal is ready to pour. Technical writing and how-to books sought to convey the necessity of educating the attention, of overhearing or thinking with matter, and of repetitive “doing” in order to respond to the contingencies of the workshop. As a modern Japanese silversmith trained in traditional methods put it:

Remember, our work is not done by measuring and talking. The hammering, the forging, all the processes are performed by intuition. It’s the split-second intuitive decision to remove the iron from the fire, when and how to bring up the flame, to immerse the blade in the water now—it is these acts of intuition that produce.

And, as the assay master of the 1604 manuscript, “The Goldsmith’s Storehouse,” phrased it: “a pfitt Assay Master, whose perfection...
[is] grounded upon Artificiall Exercise, for these things doe rather consiste in doing then in referringe, for they are not easelye reduced to matter of Argument ... the trade asketh a good Judgment, gotten rather by years & experience, then by speculation & dispute.” The assay master must possess “grounded experience in this Science or mysterie, should have a perfect Eye to vewe, & a stedye hand to waye for other mens senses cannot serve him.”\footnote{“The Goldsmith’s Storehouse,” fols. 5v–6v.}

IV.

The foregoing survey of the books of Michael and Cennino indicates that, contrary to first impressions, their desire to move from lived experience to the written word was not merely a striving towards the higher intellectual and social status of authorship. Rather, they sought to convey and to teach the foundations of their techniques, the system of knowledge that underpinned their practices, and the attitudes and actions that fostered them: “watch out,” “pay attention,” “practice over and over again.” But this was not all: the ultimate goal of these books was to instruct in the ability to improvise, that is, to respond to new situations intuitively. We can see intuition as the certain scientia—the science or theory—of this practical writing, while improvisation is the generalizing action, and proof was the success in producing the right result or making things work. As such, these practical how-to books included thinking about doing and how to train for it, but they also included thinking about thinking, if that encompasses such elements of cognition as attentive action and intuition. The title of “Sophists’ revenge” consequently seems more fitting for the avalanche of how-to texts during the practical moment around 1400 than viewing it simply as mass imitation of higher-status intellectual practices.

We seem to be entering another such practical moment ourselves. In clear contrast to previous scholarship on guilds, economic historians have recently come to see the embodied knowledge of the crafts and the guild structure of early modern Europe as providing an effective means of transmitting knowledge and fostering innovation.\footnote{See, for example, S. R. Epstein and Maarten Prak, Guilds, Innovation, and the European Economy, 1400–1800 (Cambridge, UK, 2008).} Economists are studying cooperation in place of competition, while law theorists are emphasizing practice and norms over principles of law, and cognitive philosophers and psychologists are studying skill and collaborative knowledge-making—none of which even touches on the phenomenon of Wikipedia and open source software as examples of collective knowledge-making. Of course, this interest in practice is not entirely new to the last ten years: phenomenology and
pragmatism also argued for the importance of embodiment and collective intelligence. These contemporary concerns with practice and skill no doubt possess important ramifications for policy-makers and educators in technology, industry, and science, but let us conclude on a scholarly note by going back to the issues of knowledge-making.

This essay has assumed a linear movement in the work of Michael of Rhodes and Cennino Cennini from experience to writing. Perhaps this itself is too simplistic. Let us attempt an inverted view—appropriate to the inverted world of Michael’s frontispiece—by considering three examples. First, in 1530, maize was already growing in Avila, Spain. Historians have argued that it took about a century for the New World to be assimilated into the world picture of the Old. They have relied upon texts to make this argument. That maize was already growing in Spain within forty years of first contact indicates that exchange and assimilation of information, materials, and practices were already much livelier at an early stage than the texts would lead us to believe. Practices, practitioners, and experience moved ahead of the written word. This indicates the importance of attending to practices and to lived experience as well as books.

In recent work on the construction of the Canal du Midi in the seventeenth century, which ran 150 miles north of the Pyrenees from Toulouse to the Mediterranean, Chandra Mukerji documents the use of hydraulic mortar on the canal, that is, mortar capable of being used underwater. At the time of the canal’s building, waterproof mortar was a rural French masons’ practice (perhaps dating from Roman times), unknown to the scholarly tradition. In fact, hydraulic mortar had been discussed by the Roman architect Vitruvius, but the textual knowledge of the technique had fallen out of historical memory, while the practice itself survived. In the eighteenth century, the technique was rediscovered in Vitruvius, which then came to be regarded as the source of the use of waterproof mortar in the building of the canal. In fact, what had happened was that a practice had moved in and out of written tradition. As a practice it had survived, but it was lost and then found again in the written tradition. This example indicates the complexity of the relationship between practice and text and alerts us to the pitfalls of thinking about them in a hierarchical or binary way.

It turns out that the deeply associative red pigment vermilion constitutes a similar caution: the practice of manufacturing vermilion spread westward, probably from China to the Islamic world and thence to Europe in the early Middle Ages. The first written recipe

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67 The classic statement of this is J. H. Elliott’s The Old World and the New (Cambridge, UK, 1970).


for vermilion-making appeared in Europe in the eighth century. Vermilion production interested medieval European scholars, such as Albertus Magnus, because it was made by the combination of what he believed to be the two principles of all metals, sulfur and mercury, a theory he had discovered in the texts of the Arabic (al)chemical scholars whose works were translated from Arabic into Latin in the twelfth century. The philosopher’s stone, the substance that alchemists believed to be capable of instantly transforming a mass of base metal into shining gold through a dramatic series of color changes, was often described as a red powder, like vermilion. Thus, pigment-making and alchemical theory seem to have been intimately related; not only were the two principles of metals in (al)chemical theory—sulfur and mercury—also the ingredients of actual vermilion production, but they both involved spectacular transformations that bore a strong resemblance. When alchemical theory arrived in Europe in the twelfth century in textual form, craftspeople had already been combining mercury and sulfur to produce a red powder for at least four centuries. Indeed, the practice of vermilion production always seems to have predated the articulation in texts of a theory of metals. It appears likely that the sulfur-mercury theory of metals actually emerged from the practice of making vermilion, in other words, from the work of craftspeople and their techniques. Thus, one of the most pervasive and enduring metallurgical theories of matter and its transformation—the sulfur-mercury theory—probably emerged from the making of a valuable trade good that resulted from the worldwide circulation of craft techniques and texts.

As I laid out above, vermilion was one of the nodes—along with blood, gold, and lizards—of a “vernacular science” of matter and the transformation of natural materials. Oddly enough, in the early twentieth century, anthropologists working on the oral culture of illiterate South Asian villagers recorded recipes using reptiles to produce light similar to the lizard-tail recipe from the medieval book of secrets. In China, too, lizards were deeply implicated in transformation, indicated even by the characters which made them up. The Bo wu zhi (Comprehensive Record of Things) by Zhang Hua (232–300 CE), illustrates this, while also drawing a direct connection between lizards and red pigment, when it instructs the reader to keep lizards in a vessel and feed them cinnabar. When the lizards turned red, they were to be pounded into a pulp and then applied to a woman’s body, where the red color would glow brightly as long as she remained chaste.

71 Edgar Thurston, Omens and Superstitions of Southern India (New York, 1915). My thanks to Robert Goulding for this reference and for allowing me to read his lecture, “Snakes in a Flame,” in manuscript.
72 “Xi yi are also called yan yan. If you keep it in a vessel and feed it cinnabar (zhu sha), its body will turn all red. After it has ingested seven jin of cinnabar, pound it into a pulp by ten thousand smashes with a pestle. Dot it on a woman’s limbs and body and it will glow without extinguishing. If she has sexual intercourse, then it would extinguish. Therefore, it is called shou gong (guard chamber).” According to the third-century dictionary Shiming (Explanation of Names), xi yi is so-called because its tail could detach (xi) from the body and its color could change (yi). Yi is the word for change or transformation, as in the Yijing/ I Ching. The word yi that made up the compound lizard is made up by adding the “insect” radical to . The former radical indicates that it is in the insect family and the latter gives it its sound, yi. Lizard is thus related to yi-transformation. My deep thanks to Professor Dorothy Ko, Barnard College, for this communication.
The potent combination of lizards, vermilion, metals, and generation that formed a cornerstone of Arabic alchemical theory and European metalworkers’ vernacular beliefs apparently journeyed far across the globe, conveyed by craftspersons, commodities, books, and technologies (with practices, as was the case with maize, apparently traveling in advance of the texts), and taken up both by learned scholars and manual workers. The resulting amalgam of written and tacit knowledge and of theories and practices that formed the knowledge of vermilion can be viewed as characteristic of the relationship between lived experience and the written word of books: that is, experience and the written word, theory and practice, were never really opposed, but existed in a more complex and dynamic relationship. Indeed, “doing” and embodied knowledge were always a part of “knowing.” Even Plato, as he attempted to explain the final step toward the highest stage of intellectual knowledge—apprehending the Forms—could do so only by employing an analogy to sexual intercourse and reproduction.73

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