

Schooling the Eye and Hand: Performative Methods of Research and Pedagogy in the Making and Knowing Project**

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Summary: What are historians doing in the laboratory? Looking back over six years of collaborative work, researchers of the Making and Knowing Project at Columbia University discuss their experience with hands-on reconstruction as a historical method. This work engages practical forms of knowledge—from pigment-making to metal casting—recorded in the BnF Ms. Fr. 640, an anonymous French manuscript compiled in the later sixteenth century. Bodily encounters with materials and processes of the past offer insights into the material and mental worlds of early modern artists and artisans, and train the eye in the interpretation of historical objects. At the same time, reconstruction contributes to the interpretation of the text: it is only by attempting to implement the instructions of practical or recipe literature that these texts can be understood as vehicles of emergent knowledge that only fully manifests itself in the doing. Overall, our approach to reconstruction mirrors that of the anonymous author-practitioner, who explored a wide range of techniques through experimenting and writing.

Keywords: Historische Rekonstruktion, Kunstgeschichte, Handwerkswissen, Praktisches Wissen, Fachprosa, Frühe Neuzeit, Forschung und Lehre, Hochschulpädagogik, Performative historical methods, Historical reconstruction, History of Art, Artisanal/practical Knowledge, Practical/technical literature, Early modern, Research and pedagogy, University pedagogy

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** The authors gratefully acknowledge the contributions of the Making and Knowing Project's Assistant Director Naomi Rosenkranz and Postdoctoral Scholars Donna Bilak, Jenny Boulboulé, Joel Klein, and Sophie Pitman to the development of the Project's reconstruction methodologies. Crucially, the authors' insights rely on collaborative work with over 70 student participants in the Laboratory Seminar "Craft and Science: Making Objects in the Early Modern World," offered through the History Department at Columbia University, 2014–2018. The development of the Edition was partially funded by National Science Foundation Grants Nos. 1430843, 1734596, 1656227, the National Endowment for the Humanities Grant No. RQ-249842-16, the Luce Foundation, the Gerda Henkel Foundation, and Columbia University.

1. Introduction

For a number of years, the Making and Knowing Project has pioneered its own version of performative methodology in the history of science. The manuscript at the Project's core, BnF Ms. Fr. 640,¹ is an eclectic collection of technical instructions, from medical recipes to metal casting techniques, compiled by an anonymous "author-practitioner" in 1580s Toulouse. It is overwhelmingly suited to and demanding of performative as well as textual engagement—first, because of its wealth of unique and detailed technical information, in particular on lifecasting and weapon-making, and second, because of its miscellaneous and iterative composition which deflects traditional textual analysis (the instructions range from terse recipes to meandering accounts of unfamiliar techniques and materials, replete with additions and experiential insights crammed into the margins). Initially informing reconstruction-based research into lifecasting techniques conducted by Pamela Smith and Tonny Beentjes, the manuscript became the focus of the Making and Knowing Project's mission to introduce hands-on approaches into university pedagogy as well as research.² While much of the textual work of transcribing, translating, and encoding the manuscript text, leading towards its first release of a recently-published digital critical edition,³ was "grad-sourced" in a series of summer workshops, the regularly-scheduled laboratory class "Craft and Science" at Columbia University incorporates hands-on reconstruction of the manuscript's instructions into its research-driven pedagogy.

We chose "reconstruction" as the most apt characterisation of our project from the several descriptors that have come to dominate in the growing field of performative methodologies, increasingly referred to collectively as "RRR"—reconstruction, replication, and re-enactment.⁴ For our project, which involves hands-on explorations by students within the bounds of a semester-long course, "replication" implies too much in the way of an exact reproduction of past practices, and similarly, "re-enactment" does not seem to sufficiently problematise our key questions about embodied skill, and the caveats of deploying untrained twenty-first-century bodies in encounters with materials and techniques. "Reconstruction," on the other hand, has appropriate connotations of exploring, of piecing together materials and processes of the past, and re-assembling the author-practitioner's worldview of matter and skill—his "material imaginary."

The distinct connotations of RRR terminology speak to questions of historical accuracy that are at the centre of what characterises different projects using performative methods. In a recent overview of methodologies, Hjalmar Fors, Lawrence Principe, and Heinz Otto Sibum have outlined a range of approaches with different stakes of accuracy. Reproductions of historical experimental phenomena relying on complex and sensitive experimental apparatus, such as Joule's paddle wheel investigated by Sibum, require "high-fidelity" replicas of the material setup in order to function at all. In other cases, starting out with such a high stan-

¹ *Recueil de recettes et secrets concernant l'art du mouleur, de l'artificier et du peintre*, Bibliothèque nationale de France, Département des Manuscrits, Français 640.

² Smith and Beentjes 2010.

³ Making and Knowing Project et al. 2020.

⁴ Dupré et al. (2020).

dard of historical authenticity can get in the way. Chemical processes, for example, may rely on a multitude of reagents, impurities, temperatures, apparatus, and other unfathomable variables which would be impossible to get right from the start. Here, more can be learned by starting with a workable, “streamlined” version of the historical process, making compromises such as using modern-day chemicals and heat sources. Historical variables can then be re-introduced one by one in a controlled manner.⁵

Other performative research approaches can be characterised by their location on this spectrum. Reflecting on experiments in culinary history, Ken Albala emphasises the historical contingencies of ingredients, equipment, and techniques. Although faced with similar challenges to those involved in reproducing historical chemical processes, Albala rejects any suggestion of compromise regarding historical accuracy, insisting that “adapting recipes in any way whatsoever tells us absolutely nothing about the past.” In addition to the process and the equipment, “the ingredients must be replicated exactly or the experiment is meaningless”—including obscure herbs, heirloom pork breeds, and such unfamiliar pieces of crockery as a pipkin, a round-bottomed clay vessel nestling directly on the hot coals.⁶ While his insistence on absolute historical accuracy may seem unrealistic or unnecessarily limiting, Albala’s experiments with roasting and stewing techniques do yield important insights into the effects of specific techniques and equipment, and reinforce the point that it is worth taking recipes seriously, word for word, even if the instructions seem counter-intuitive to modern-day reconstructors.

Another approach to the question of historical accuracy comes from Technical Art History. The HART Project (Historically Accurate Reconstruction Techniques), led by Leslie Carlyle and Maartje Stols-Witlox, addresses head-on the tension between the need for accurate materials and techniques and problems of feasibility, caused by such issues as the toxicity of historical pigments. Their design of a workable process, including the necessary compromises with respect to historical accuracy, is informed by the requirements of specific research questions and by extensive comparative text work. A large database of technical writing allows researchers to identify a recipe that is representative of its kind, or to devise a hybrid model process from a range of sources. Through careful documentation of process, materials, and potential caveats regarding their similarity to historical ones, the project produces a material archive of “highly characterised reconstructions” (HCRs) which can serve as points of reference for scientific analysis of historical paint samples or to calibrate analytical equipment.⁷ This approach does not shy away from making compromises necessary to perform historical processes, but makes a virtue of problematising the historical accuracy of reconstructions and the limits of the conclusions we can draw from it.

The Making and Knowing Project overlaps in content with the approaches outlined above—our focus text, Ms. Fr. 640, contains culinary recipes, chemical processes, and artists’ techniques, raising many of the same questions and chal-

⁵ Fors et al. 2016.

⁶ Albala 2010, on 76. An article making a similar point from an entirely different field is Fachhochschule Köln 2001.

⁷ Carlyle and Witlox 2007. See also Carlyle (2020).

lenges. The question of historical accuracy and the need for compromise is compounded by the pedagogical nature of the Project. Most of our reconstructions are undertaken by graduate students as part of the course “Craft and Science” at Columbia University. Thus, they have to fit within the confines of a semester and of a repurposed 1940s chemistry laboratory which is well-equipped but ultimately limited in space and budget. This means that we have to devise reconstructions that can be safely realised by a student with minimal training, using materials that are already available in the lab or can be sourced within the timeframe and budget. This entails, for example, forgoing the use of toxic substances containing arsenic or mercury, settling for commercially-available pure chemicals, and using propane torches and a fume hood rather than a charcoal-fired forge. It also means that there is often no time to conduct many iterations of the same experiment. Such compromises necessarily determine the kinds of conclusions we can draw. While our reconstructions are as “highly characterised” as possible through detailed field notes and reflection on the compromises we make, we would hardly claim that the majority of objects filling the shelves and drawers of the laboratory are “historically accurate” specimens in any strict sense.

But, as we aim to show in this article, this is neither our ambition, nor, in our case, the chief value of reconstruction. Instead of focusing on the material object as the outcome, we emphasise the value of paying attention to the process, and rather than expecting our hands-on work to yield definitive answers, we conceive of it as generating questions and suggestive insights that can serve as building blocks for reconstructing the material and mental world of past practitioners. In particular, we show how reconstruction at the Making and Knowing Project can provide a framework for developing and recognising material and cultural literacy, how it helps us to read the manuscript as a repository of knowledge that only emerges during practice, and how it brings us closer to the author-practitioner’s own mode of collecting and reconstructing expertise.

2. Reconstructing Material, Technical, and Cultural Literacy

A particularly powerful outcome of historical reconstruction is its recalibration of the eye to be able to see, recognise, and interpret features of historical objects that might otherwise be overlooked. Often, these features are traces of making processes, poorly understood and thus little discussed in the literature. Once recognised, such features can inform historical inquiry as well as contemporary conservation practice. Take, for instance, the small knob-like protrusions on the feet of some lizards cast from life (Figure 1). When examining cast lizards, these slight bumps are easily missed or, if noticed, they might be ascribed to flaws in the moulding or casting process. In fact, our experience of reconstructing the techniques described in Ms. Fr. 640 shows that these protrusions are the material traces of the pins used to pose the lizard and affix it to the clay slab used as a base for mould-making.⁸ Once the eye is attuned to this aspect of process—a necessary aspect that only becomes obvious with first-hand making experi-

⁸ Smith and Beentjes 2010, on 153–155.

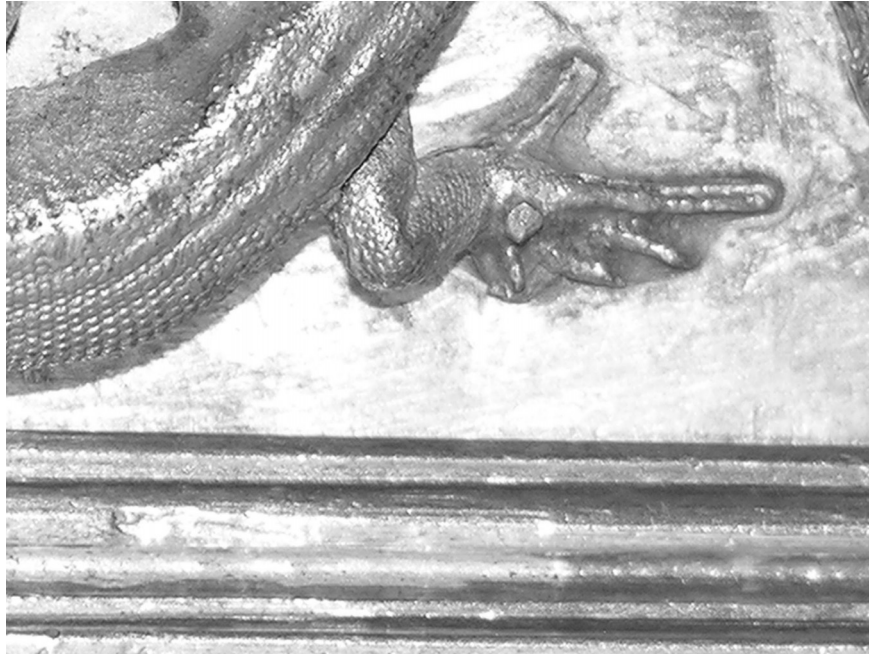


Figure 1: Foot of a life-cast lizard showing traces of the pin used to fix the animal in place during moulding (detail). Wenzel Jamnitzer, Writing box, *c.*1560, silver, 22.7 x 10.2 cm x 6 cm. Kunsthistorisches Museum, Vienna, Kunstkammer 1155–1164. Photo: Pamela H. Smith and Tonny Beentjes.

ence—these trace remnants of process call out to the viewer with each new object examined.

We can begin to think of our refocused eye as a tool for object literacy. Just as the ability to recognise the letter “T” or an ampersand is fundamental to the ability to read, the historian’s eye that looks for and sees features of making processes is fundamental to the ability to “read” objects as artefacts of the human hand. Even the most cursory hands-on experience can help generate new modes and habits of looking, and reconstruction is a revelatory activity for researchers, for students, and for those engaged in public history.

As powerful as the experience of reconstruction can be, we must be careful in the estimation of our skill and understanding of historical process. Reconstruction and the recalibrated eye are tools for object literacy and must not be confused with literacy itself. They do, however, make participants aware that there are spheres of knowledge that exist outside the textual and the theoretical—outside the ken and comfort zone of many historians. In short, historical reconstruction exposes gaps in our understanding that, in turn, engender new questions. These gaps also engender an awareness of the body as a tool for knowing, problematising the historicity of bodily experience.

If the recalibrated eye is a tool of object literacy, then the entire body of the reconstructor becomes a tool for material and technical literacy. This is particularly

potent in pedagogical contexts.⁹ Few twenty-first-century students of the humanities, or scholars for that matter, have had extensive hands-on experience with the manipulation and transformation of (natural) materials into new substances and configurations. The seemingly menial opportunity to grind brick in the Making and Knowing Lab and to refine it into a powder impalpably fine enough to be an effective additive for plaster moulding—that is, to feel its coarse grate beneath the pestle and to discern its eventual powdery stick between the fingertips—is one that affords surprisingly rich insights for individuals who are increasingly accustomed to typing, swiping, and relying on specialised services that distance them from producers, access to unfinished materials, and the opportunity to develop hand-skills. Consider, first, that thorough grinding takes time—a lot of time; much more, in fact, than students imagine or often have the desire or stamina to invest. Second, the body develops a rhythm and choreography for the task that varies depending on how far along the grinding has come. Third, terms like “fine” and “impalpable” emerge as technical descriptors, meant to signal consistency in an era of non-standard units—terms just as useful in the craft context as modern microns in the scientific laboratory. Fourth, repetitive work is both meditative and mindful, allowing the mind to rest and the body to think on the one hand, and, on the other, providing a baseline of constancy against which changes in smell, sound, and other sensory indicators might be measured. Lastly, the further transformation of the impalpably powdered brick into a wet plaster and a fired mould, to say nothing of its eventual destruction to free the final object cast in metal or of its eventual return to powder under the pestle to become an additive to new plaster mixes for new moulds, reveals thrifty workshop practice, but also illustrates early modern conceptions of cycles of material transformation.

These insights, of course, are not exclusive to historical reconstruction—they are available and well-known to anyone engaged in practices of making. Nevertheless, they are lessons that are better intuited through the body than through text, and they should be integrated into modern curricula in order to give students the experience to develop a first-hand sense of embodied cognition as well as a vocabulary that can help characterise, transmit, and validate experiential knowledge.

One way the Project’s reconstructions help students to develop an appreciation for experiential knowledge is by giving them a point of access to another material imaginary—an experience that engenders greater awareness of the conceptual underpinnings of our twentieth-century worldview that we routinely take for granted. That is, by reconstructing the recipes of the “author-practitioner” of Ms. Fr. 640, students recognise the cultural and historical contingency of conceptual taxonomies and the work that the senses can do to mediate our encounters with the world around us. For instance, by trying to find hands-on ways of understanding statements such as “*azur d’esmail* [smalt] hates more than any other to be ground, especially with water, for it dies & loses all its color,” students ask

⁹ For the utility of reconstruction in pedagogy, see Chang 2011; Heering and Wittje 2011; Stauber-mann 2011; O’Connor 2007; Klein 2020. See also Uchacz 2020.

what it means for a substance to experience “hate” or to “die” in grinding (seeing for themselves how the pigment turns a dull greyish hue when ground too finely), and they come to see that materials were understood to have agency in the early modern period, a notion that has all but disappeared from modern sensibility.¹⁰ Our contemporary understanding of materials as inanimate thus emerges as a cultural convention rather than a given.

Moreover, if materials can be seen to have agency, then our interactions with them become necessarily more intimate, and bodily ways of knowing become more intuitive approaches to understanding material properties. Take, for instance, the author-practitioner’s advice that sand for making moulds for metal casting be moistened with a binder “in such a fashion that it gives a good hold, nevertheless coming apart easily.”¹¹ This indication of consistency is not one that demands a given volume of liquid for a given weight of sand—a process of mixing mediated by the tools of standardised measure. Rather, it is an invitation to use the hand to understand the point at which one can squeeze the wetted sand in the palm of the hand so that it holds its shape but can still crumble easily under gentle prodding with a finger. This “squeeze test” underscores the role that the body played—and can play—in assessing materials, qualifying properties, and monitoring processes.¹²

Through reconstruction, it becomes clearer how the author-practitioner came to understand his materials not via the received wisdom of authoritative text but through the actions of making, interacting, manipulating, and transforming. The author-practitioner’s textual project of writing down his practice comes after the fact, and his words are prompts, however frustratingly approximate and incomplete, to follow in his footsteps and to know by doing. And the more we and our students accept this invitation, the sharper our toolkit for material, technical, and cultural literacy will become.

As revelatory as hands-on learning can be, these nascent forms of literacy are often means rather than ends. In the Making and Knowing model, the reconstruction itself seldom offers definitive answers. The Project is structured on a semesterly cycle such that our students must aim for “proof of concept” rather than reliably reproducible results from iterated and single-variable-controlled experiments. What reconstruction mostly does for us is to raise questions—good questions, which would be easy to miss except when challenged to understand the textual through the material. The answers to these questions more often than not emerge from more traditional textual research into areas of inquiry that it would not have occurred to us to pursue otherwise. For instance, a recipe for “Powder for hourglasses” calls for a mixture of lead and rock salt to be ground coarsely and repeatedly washed with water until no impurities come out in the water.¹³ Our students worried that the washing step would affect the salt in the salt-lead mix-

¹⁰ BnF Ms. Fr. 640, fol. 58v, transcription and English translation in Making and Knowing Project et al. 2020, online: <https://edition640.makingandknowing.org/#/folios/58v/tcn/58v/tl>.

¹¹ BnF Ms. Fr. 640, fol. 118v, transcription and English translation in Making and Knowing Project et al. 2020, <https://edition640.makingandknowing.org/#/folios/118v/tcn/118v/tl>.

¹² Cataldo and van Visco 2020; Taape 2020.

¹³ BnF Ms. Fr. 640, fol. 10r, transcription and English translation in Making and Knowing Project et al. 2020, <https://edition640.makingandknowing.org/#/folios/10r/tcn/10r/tl>.

ture; this led them to questions about the interaction of hourglass powder with water, and to the insight that early hourglass powder had to be non-hygroscopic because up until the mid-eighteenth century it was impossible to blow an hourglass in one piece, and moisture could enter through an improperly sealed joint. Research into other recipes for hourglass powder suggested that its production was a domestic activity that drew on materials found in a given environment. This led to an even larger set of questions related to production: who made hourglass bulbs and how were they sold in towns and villages? Who calibrated hourglasses? The local clockmaker? Was there an actual template for the size of the hole for 3-minute, 8-minute, or hour-long hourglasses? And how could there be if the materials from which the sand was made were so diverse?¹⁴ It seems as though very few scholars—if any—had previously thought about these questions, which stemmed directly from an engagement with reconstruction in a pedagogic setting.

There are instances, however, where reconstruction itself yielded answers and insights, albeit conjectural ones, especially regarding cultural and religious resonances in the author-practitioner's "material imaginary." A recipe for a burn salve, for example, describes washing the mixture with holy water in clearly-prescribed intervals timed by the recitation of paternosters (the Lord's Prayer in Latin), starting with nine recitations and gradually decreasing to an interval of only one prayer (fol. 103r). While the religious and ritual aspects were conspicuous at first read, it is only through reconstruction of the recipe that we were able to appreciate them fully. During the addition of holy water to "wash" the salve, complete with recitation of the paternoster, the transparent yellowish mixture of wax and linseed oil gradually expanded and thickened into an opaque and voluminous white substance (Figure 2). This dramatic transformation from an oily liquid to a fluffy white salve provided a vivid material instantiation of the purification implicit in the instruction to wash with holy water, and suggested an inspiring of the substance through holy water and prayer.¹⁵

This experience allowed us to read the text anew in the light of the highly suggestive correspondences between the use of holy water for purification, prayers for timekeeping, and the visually striking material change to produce a healing salve. As historical method, much of this is more akin to the evocative and sometimes speculative insights of textual study than the hard material facts we habitually expect of experimental work. But this, too, can be a virtue of reconstruction, especially in a pedagogic setting. Upon sober reflection, this exciting experiment invites us to think critically about the caveats of trying to obtain historical insights from the experience. For one thing, our experience is far removed from those of early moderns, for whom daily prayers as timekeeping and the use of holy water were much more commonplace than they are for us. For another, we must be aware of the implications of coming to the experience as historians with particular preconceptions and questions in mind, primed to read cultural meaning into material practices. Thus, reconstruction can afford glimpses of the mental and mate-

¹⁴ Pope 2020.

¹⁵ Liu 2020.

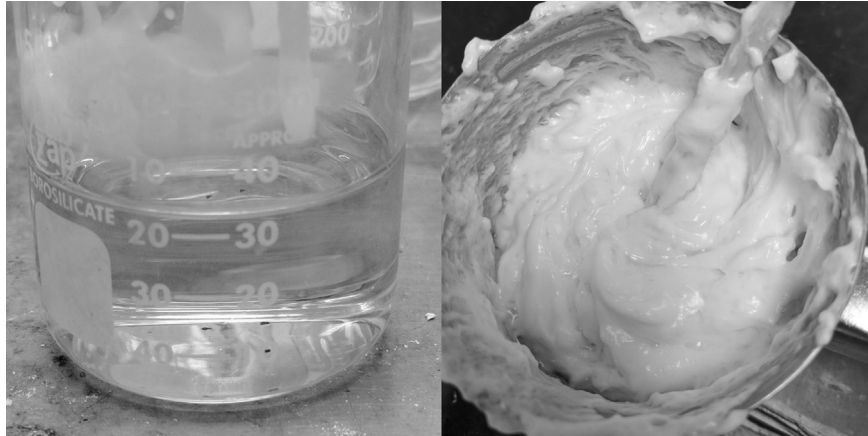


Figure 2: Burn salve made according to the recipe in Ms. Fr. 640 (fol. 103r). The transparent yellow mixture of melted wax and linseed oil (left) transformed into a thick white salve (right). (c) The Making and Knowing Project (CC BY-NC-SA).

rial lived experience of the past, while also raising important questions about the historicity of experience.

While reconstruction starts as a pedagogic strategy that encourages exploration and methodological reflection, our teaching has also significantly shaped our own and our students' research agendas. Several of our graduate students changed the focus and analytical framework of their doctoral dissertations using their insights into material culture and pursuing questions raised by reconstruction in the Making and Knowing Laboratory. Clio Nisse, for example, provides a new perspective in art history by exploring the materiality of canvas as a substrate for painting, and Julianna van Visco explores new questions in literary history by investigating what Dante and Boccaccio knew about making textiles and how this shaped their literary production. Others have co-authored publications based on their laboratory research.¹⁶ As we discuss below, Making and Knowing researchers collaborated on an essay reassessing the category of "ephemeral art" based on insights that emerged from a semester's teaching on the topic.¹⁷

3. Reconstructing Text: Recipes and Emergent Knowledge

Reconstruction most often (although not always) starts from recipes. We all know what a recipe is—a straightforward set of instructions. These expectations of straightforwardness and transparency have, until recently, generally deflected traditional scholarly analysis. In line with recent trends in the historiography of science and knowledge, such as increased attention to the place of women and practitioners in knowledge-making and an emphasis on practices and how-to texts in the history of science more generally,¹⁸ recipes and recipe collections have moved

¹⁶ Kremnitzer et al. 2018; Smith et al. 2019; Smith and Lores-Chavez (forthcoming).

¹⁷ Smith et al. 2020.

to the center of the field.¹⁹ Scholars have provided insights into the multidimensionality of recipes, their place in sociality, gift-giving, and economic exchange,²⁰ as well as their role in creating an imaginary of (gendered) household culture and hierarchy of taste.²¹ Now that recipes are accepted as a particular genre of writing and as important in knowledge-making,²² it is not surprising that scholars have now started reconstructing or remaking them. Food historians began this early, finding that re-making the recipes shed light on types of cooking vessels, produce, spices, cuts of meat, and many other recipe components of the past, but also on tastes and conceptions of humoral health, and, of course, on the aesthetics and look of food.²³ Much the same can be said for the artisanal recipes in Ms. Fr. 640 that the Making and Knowing Project has been studying since 2014—reconstructing them (in conjunction with text- and object-based historical research) has allowed the Project to decipher and interpret the text. Many of its recipes, products, materials, and techniques would otherwise remain obscure. In some cases, the Ms. Fr. 640 is the only known written source for certain techniques, but the recipes are anything but straightforward, containing much repetition, many contradictory statements, unfinished thoughts, and gaps in necessary information and practical steps. Nevertheless, our reconstructions have alerted us to hitherto unsuspected techniques and/or uses of materials. As discussed above, reconstruction has assisted in coming to understand the author-practitioner's view of material properties, such as in the “squeeze test.”

These insights can be likened to those that might emerge from a very close and detailed reading of a text, but in the case of recipes, this is occasioned in part because carrying out the processes described in the manuscript necessitates clear working interpretations of the text—doing becomes an essential part of reading, and vice versa. In the Project, the reconstructors keep detailed field/lab notes on their ongoing thoughts and actions in deciphering and interpreting the text as they engage in hands-on work. As they plan an experimental protocol for the topic they seek to research through their reconstruction, they must consider closely the aim of the recipe, as well as the materials and their properties used in the reconstruction. They shift constantly between reading, writing, and doing. In this iterative movement between text and bench, unexpected material processes occur, new interpretations of the text arise, and, above all, multiple questions are raised. Reconstruction, then, can be seen as a new mode of critically engaging with a practical text or even with an object—neither reading nor doing alone, but an integrated mode of analysis that demands not only the recalibrated eye and a habit of attention, discussed above, but also careful recording and planning

¹⁸ This literature is now enormous. Central works on how-to texts include Vérin 1993; Dubourg Glagny and Vérin 2008; Eamon 1994; many works by Pamela O. Long, including Long 1997 and Long 2001; Córdoba 2013; Cardinal et al. 2016.

¹⁹ Pennell 2004; Krohn 2015; Neven 2016. See also *The Recipes Blog*, online: <https://recipes.hypotheses.org/>.

²⁰ DiMeo and Pennell 2013; Leong and Pennell 2007, on 133–134; Leong 2008; Leong 2018; Rankin 2007; Rankin 2013; Spiller 2008; Spiller 2009.

²¹ Wall 2016.

²² Alonso-Almeida 2013; Telle 2003.

²³ Albala 2010; Ivan Day, *Historic Food* (website), online: <https://www.historicfood.com/portal.htm>.

practices and protocols as well as an openness to alternative readings and new questions.

This integrated mode of analysis is essential for understanding recipe texts because, although not all recipes are meant to be used, all contain practical knowledge which can never be entirely delimited by a text. Practical knowledge involves embodied techniques and productive outcomes: it is constituted in the course of practice. Like other written forms of practical knowledge, recipes can point to bodily action, but obviously cannot accomplish that action. Practical knowledge is very different from propositional knowledge, which can be captured in a written proof. The proof of practical texts can only be brought into being in real time. Thus, the meanings of a practical text emerge fully only through practice. In this regard, the research the Project has carried out over the past six years on the collection of practical recipes that make up Ms. Fr. 640 has given insight into the nature of practical knowledge: written recipes can never provide for every circumstance which might bring about necessary variations in procedure—they are not precision instruments, but approximating and flexible tools. Nowhere is this more true than in Ms. Fr. 640, a manuscript apparently in the midst of being composed. For this reason, its recipes formed an invitation to action, and, in part because of their abbreviated form, necessitated repeated hands-on testing and trying, as well as returning to the puzzle of the text. The meaning and process of the recipes emerged only slowly and piecemeal as we worked through them. This underscored for the students the particularity, variability, and the emergent quality of practical knowledge. We realised that the recipes in Ms. Fr. 640, like all recipes, captured in written form—to the extent this is possible in writing—this characteristic of emergence, as well as setting out a pathway for the acquisition of skill, by means of which emergent phenomena can be channelled and harnessed. While our students could not become skilled in a semester, they could at least glimpse this path and its goal. Only by engaging in the practice of reconstruction—itself a form of emergent knowledge—would we have recognised this dimension of the form and function of recipes.²⁴

The history of science has dealt with practical texts—such as Boyle’s experimental “essay”—in the mode of history of philosophy, studying them as texts *qua* texts, and as one of the factors in the development of an empirical method. Reconstruction goes further by placing texts of practice back in conversation with actual practice and the context of action.²⁵ This allows us to reflect on our own writing about these practices. Our reconstructions have been bookended by text: they begin with historical text, which leads to action, which is then documented in field notes and written into historical questions or arguments. Generally, these actions must be repeated many times—failure, repetition, and extension are a necessary part of any hands-on work of this sort, and we have come to see that this is simply the nature of learning through experience, an insight that sheds much light on the activities of any workshop of the past, especially at a time when materials were not standardised: experimentation was a necessary part of workshop practice. This act of translation among texts and actions is thus so long and repe-

²⁴ Smith (forthcoming).

²⁵ Keller 2020.

titious that it is easy to recognise why a recipe collection like Ms. Fr. 640 might be so messy, repetitious, and circuitous—it is simply the nature of experiential knowledge, which, in turn, helps us appreciate how fraught can be the original act of translating actions into text and codifying practical expertise in writing. In our view, reconstruction as a method of investigating this translation has the distinction of not only getting closer to the materials and techniques at hand, but also to the mode of acquiring expertise that configured the author-practitioner's movements between practice and text.

4. Reconstructing Reconstruction: A Rapprochement of Modes of Inquiry

Reconstructing expertise across epistemic distances is not the invention or exclusive purview of historians, but an approach that is shared by some of the historical actors we study. For example, Lawrence Principe has pointed out parallels between his own experimental work in reproducing the legendary phosphorescent properties of the “Bologna stone” and the efforts of the seventeenth-century chymical expert and collector Wilhelm Homberg (1652–1715), on whose writings Principe's study is largely based.²⁶ At the Making and Knowing Project, we see a similar synergy between our approach and the author-practitioner's own way of gaining knowledge. Of course, we are using reconstruction to try to bridge historical distance, while the author-practitioner had the benefit of learning from his contemporaries. However, the sheer scope and variety of techniques he was interested in suggests that he cannot have had true inside knowledge of all of them. He certainly could not have been traditionally trained in the various professions he alludes to, from painters to gunners. In fact, it is not clear that he learned and practised any one particular trade. Although his knowledge is clearly most detailed in the area of metalwork, especially casting, and he mentions owning a “goldsmith's forge,”²⁷ he leaves out techniques such as the raising of vessels that would have been the bread and butter of contemporary goldsmiths, while he includes others (notably gilding and counterfeit gems) that were forbidden by local guild regulations.²⁸ Whatever his professional identity, the author-practitioner must have approached at least some of the practices and areas of expertise he wrote about as something of an outsider.

An entry on oil painting with the blue pigment *azur d'esmail* (probably what we would now call smalt, see above) gives insight into the way the author-practitioner explored such pockets of specialist expertise. This azure pigment was readily available, but tricky to handle: as the author-practitioner notes throughout the manuscript, the most beautiful azure colour is achieved by grinding the pigment to not too fine a particle size, but the resulting gritty consistency could be difficult to paint out evenly. He begins his instructions for dealing with this somewhat temperamental pigment by noting “this is a secret that is hardly known to common painters,” going on to outline different approaches: “some” prick the

²⁶ Principe 2016.

²⁷ BnF Ms. Fr. 640, fol. 12v, transcript and English translation in Making and Knowing Project et al. 2020, online: <https://edition640.makingandknowing.org/-/folios/58v>.

²⁸ Muñoz 2020.

ground with an awl to make the paint seep in, whereas “others lay the panel flat & put down the azure on it;” “some grind it thoroughly with an egg yolk & then wash it in five or six waters,” and so forth. He also includes practices from further afield, noting that “those who make it in Germany compound it like enamel, in large pieces which they pestle, & pass through several sieves & wash.” In addition to this short survey of the tricks of the painters’ trade (or at least of those who knew the “secret”), the author-practitioner describes trying his own hand at these techniques (“I have experienced that grinding *azur d’esmail* with egg yolk & next washing it in several waters is good”), and his own modifications and exploration involving serial washing and decanting—the author-practitioner’s take on a process known as levigation.²⁹ To explore the question of how to get the most out of *azur d’esmail*, he locates expertise in specialist milieus, and reproduces it through his own experimentation.

The author-practitioner reconstructs not only the processes of craft milieus to which he perhaps had limited access, but also processes from nature. The imitation of natural processes and materials by human artifice was of major interest to contemporary artists, artisans, and patrons, as is attested by many *Kunstammer* objects which combine the natural and the artificial, often challenging the boundary between the two. Ms. Fr. 640 is replete with these kinds of ideas and practices. The *azur d’esmail* entry, for example, describes a “rock water” used for washing azure pigments, which is “a water distilled from mines where azure or *vert d’azur* is found, which distils naturally through the veins of the mountain or is distilled through an alembic from mineral stones of azure or copper.”³⁰ The natural “distillation” of the water through mineral-bearing mines can be replicated by artificial distillation through an alembic. Similarly, one of our students found that the author-practitioner’s many moulding techniques with different sands and plasters speak to an underlying ontology of stone, informed by the Aristotelian concept of mineral generation in which rock forms through the aggregation of loose mineral composites.³¹ In creating solid moulds from powdered earth and mineral ingredients, the author-practitioner created artificial stone, mirroring its much slower natural formation underground.

One of the dominant modes of reconstructing nature in the manuscript is epitomised by the term *contrefaire*. It is one of two terms the author-practitioner uses to refer to instances of imitating natural materials through the crafty use of different materials, usually less valuable ones. The other term, *imiter*, refers to the three-dimensional representation of natural things, such as a rose made from dyed horn shavings.³² *Contrefaire*, on the other hand, denotes the making of a simulacrum of a natural material, such as “counterfeit jasper” made from slices of buffalo horn, rendered translucent with spike lavender oil, and painted on the re-

²⁹ BnF Ms. Fr. 640, fol. 11r, transcription and English translation in Making and Knowing Project et al. 2020, online: <https://edition640.makingandknowing.org/-/folios/58v>.

³⁰ BnF Ms. Fr. 640, fol. 11r, transcription and English translation in Making and Knowing Project et al. 2020, online: <https://edition640.makingandknowing.org/-/folios/58v>. On this, see Garriss 2020.

³¹ Jiang 2020.

³² BnF Ms. Fr. 640, fol. 10r, transcription and English translation in Making and Knowing Project et al. 2020, online: <https://edition640.makingandknowing.org/-/folios/58v>.

verse side with coloured varnish and wool fibres to imitate the veined and mottled appearance of jasper.³³ Our research, detailed elsewhere, suggests that the author-practitioner conceives of *contrefaire* as reproducing not only a superficial visual resemblance (of the kind signalled by *imiter*), but a genuine correspondence in material properties which made the product a viable substitute—a process that Marjolijn Bol has termed “material mimesis.”³⁴ Thus, producing “counterfeit” jasper (or coral, or a number of other substances), was a way of investigating the properties and possible generation of the natural material.

It is only through our own reconstruction that we were able to appreciate the author-practitioner’s approach to investigating and reconstituting jasper in the workshop. Following the instructions focused our attention on the sequence of steps, and on the likely genesis of the recorded entry. Nearly two-thirds of the text appear to be later additions, squeezed in above and below the original text block, and in a long marginal note. They likely represent experiential insights from the author-practitioner’s returning to the same process and refining his technique, including the instructions to “scrape oblique lines” into layers of different colour varnishes and to apply wool fibres “to better counterfeit mottled jasper,” as well as backing the varnished horn with silver or tin leaf, which renders it more luminous, especially when used for inlay work, “to encrust beds with it.” Starting with questions about how human artifice could mimic nature in producing a material that could stand in for its natural counterpart, the author-practitioner reconstructs jasper’s “fatty polish” and its mottled appearance, refining the process to match its natural properties.³⁵ Our own iterative reconstructions of these instructions eventually resulted in objects that plausibly suggested how horn and varnish could be transformed into a jasper-like material through material mimesis, and, more importantly, helped decode the author-practitioner’s thinking, writing, and making.

In mirroring the author-practitioner’s method of acquiring material expertise as well as his actual techniques and processes, our method of reconstruction moves closer to the original project of Ms. Fr. 640. Like us, the author-practitioner explored repertoires of expertise to which he did not always have the immediate, embodied access that comes with years of guild-regulated training, and he approached such practical, emergent knowledge in what is ultimately the only way: by doing things for himself, by experimenting many times over to reproduce what he had observed. This is in many ways the same approach he and his contemporary artisans and artists used to understand the hidden workings of nature—an active, embodied “artisanal epistemology”—applied to human artifice.³⁶ While we as historians are of course much further removed from the expertise we seek to understand than the author-practitioner was from contemporary expertise, reconstruction using a similar *mode* of inquiry (as well as similar tools and materials) productively collapses some of the historical distance between early

³³ BnF Ms. Fr. 640, fol. 10r, transcription and English translation in Making and Knowing Project et al. 2020, online: <https://edition640.makingandknowing.org/-/folios/58v>.

³⁴ Bol 2014; Smith and Lores-Chavez (forthcoming).

³⁵ BnF Ms. Fr. 640, fol. 10r, transcription and English translation in Making and Knowing Project et al. 2020, online: <https://edition640.makingandknowing.org/-/folios/58v>.

³⁶ Smith 2004, on 59–94.

modern and twenty-first-century projects of understanding and recovering artisanal expertise, if not in its specifics then at least in its methods.

5. Conclusion

Reviewing the Project's reconstruction work over the past few years, it has been an invaluable tool for asking new and incisive historical questions, both in pedagogy and research. While it is impossible for students in one semester to acquire the embodied expertise of an early modern craftsman, reconstruction allows them to gain a much clearer sense of what was at stake in acquiring and exercising material literacy, at least to the point of being able to better read historical objects, and to appreciate what kind of gestural knowledge their creators would have had to possess. Cumulatively, this research-driven pedagogy has amassed questions and insights about the author-practitioner's material imaginary, from the agency of pigments to the spiritual dimension of medical recipes, and more generally about humans' epistemic engagement with nature in the early modern period. Furthermore, the caveats and compromises involved in reconstruction can become a virtue, especially in a pedagogic context. First-hand experience makes for a powerful prompt for students to reflect on the historicity of materials, processes, and bodily experience—questions that are increasingly central to the history of science.

Far from being at odds with traditional scholarship, reconstruction has proved a truly complementary tool for the analysis of texts that, by their technical nature, elude even the closest reading. Recipes, technical instructions, and practical secrets are texts of action, and it is only by placing them back into a context of action that we begin to understand the nature of the knowledge they encode as contingent, emergent, and embodied.

Such knowledge is difficult to codify in writing, and reconstruction can help us understand the fraught translation from practice to text by adopting a mode of inquiry similar to the author-practitioner's own, a record of which we see before us on the page. Using both written words and iterative experimentation to access repositories of artisanal expertise brings us closer to the author-practitioner's project, although the gap bridged by those efforts in our case is compounded by historical as well as socio-professional and geographic distance.

Overall, we find that reconstruction achieves an important overarching goal in both pedagogy and scholarly research: it shifts the focus towards process rather than outcome. One telling example is our exploration of techniques and materials in the manuscript relating to "decorative" or "ephemeral" art—sculpted stucco, moulded papier-mâché, and painted banners for temporary triumphal arches for royal entries, sugar sculpture for banquets, and a variety of ways of producing lavish visual effects of jasper, marble, or gold through the crafty use of cheaper materials.³⁷ Reading these instructions alongside guild records and city accounts relating to royal entries into Toulouse, we argue that a focus on the materials and processes productively challenges categories such as "ephemeral," "high" or "low" art, suggesting instead a repository of making techniques shared by temporary,

³⁷ Smith et al. 2020.

permanent, public, and domestic endeavours of visual production and display. While our arguments ultimately rely mostly on traditional archival and published sources, it is clear to us that we would not have known to ask the right questions of them had we not spent hours experimenting with stucco made from chalk and rye flour, trying to produce halfway plausible “counterfeit jasper” from buffalo horn, or trying different sizing treatments to prevent the colours from running on a silk banner.

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