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Making and Knowing: Reconstructing an Author-Practitioner's Epistemic World and Material Imaginary

Introduction

The aim of the Making and Knowing Project is to explore the relationships between craft making in the workshops of early modern Europe and the level of knowing that we associate with scientific laboratories today. Since 2014, the Project has focused this investigation on an intriguing sixteenth-century manuscript, BnF Ms. Fr. 640, and has created a digital critical edition of this anonymous compilation of technical recipes, publicly released in 2020 as *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640*.¹ The goal of the Edition is to make this unique manuscript and the Project's research findings and methodologies freely available to students, scholars, and the general public through open access publication. The critical commentary and essays produced for the edition contribute to scholarship on craft practices and illuminate the development of science in early modern Europe. The research process employed novel methodologies for the humanities, such as large-scale collaboration in cross-disciplinary research groups, historical reconstructions of past techniques, integration of pedagogy in active research, and new digital tools. The Project's development of the digital critical edition provides a unique model for the preservation and communication of, and interaction with practice-based experiential knowledge by allowing readers to experience the process of historical techniques through text, image, audio, and video.

Fr. 640, like other historical technical manuals (also known as how-to texts, books of secrets, and artists' treatises), presents a unique challenge for investigation. Its wide range of topics, from metalworking and cannon-making to painting and medicine, requires expertise from numerous domains. Its structure and format—consisting of brief instructions, first-hand accounts of experiments, and observational notes in titled entries—elude traditional methods of textual and historical analysis. Fr. 640 gives an invaluable view into the continuous experimentation through which art objects were created by skilled labor and how the process of artistic creation yielded insights into the workings of nature in the period before the Scientific Revolution. Just reading the manuscript is insufficient to gain these insights, however, as the text is a

¹ Making and Knowing Project, Pamela H. Smith, Naomi Rosenkranz, Tianna Helena Uchacz, Tillmann Taape, Clément Godborge, Sophie Pitman, Jenny Boulboulé, Joel Klein, Donna Bilak, Marc Smith, and Terry Catapano, eds., *Secrets of Craft and Nature in Renaissance France: A Digital Critical Edition and English Translation of BnF Ms. Fr. 640* (New York: The Making and Knowing Project, 2020), <https://edition640.makingandknowing.org/>. DOI: <https://doi.org/10.7916/78yt-2v41>.

disorganized and often-confusing record of procedures observed or undertaken by a maker in a physical space, and the entries contain much shorthand and elision of difficult-to-describe embodied knowledge. How-to texts such as this one that codify procedures and materials therefore invite their readers to explore and investigate not just through the words of the text, but also through hands-on reconstruction of its contents.

In studying Fr. 640 and creating *Secrets of Craft and Nature*, the Making and Knowing Project employed such reconstructions of its entries in the Project's chemical laboratory, largely in graduate level, semester-long "Lab Seminars." Students worked together in groups and with the Project team, focusing on a selected entry (or entries) in the manuscript, with a larger goal of forming a historical argument and gaining insight into the manuscript's historical and material context. Historical reconstruction has gained momentum as another tool in the historian's toolbox, particularly in the histories of science and art, borrowing methodologies from archaeology, art conservation, and the natural sciences.² The Making and Knowing Project uses historical reconstruction as one of the key methods to understand making processes of the past.³

This approach to studying texts about making is a combination of primary source text analysis (in this case, Fr. 640), historical documents research, object-based study, and information from active engagement with materials and hands-on procedures. Reconstruction requires inquiry not only into making practices, materials, tools, and environments, but also into social, economic, and cultural systems. This historical research can shed light on the contexts in which the objects were made, traded, used, and valued. The reconstruction process begins, however, with thorough examination of the entry/recipe to be reconstructed. What is the final product or intended result of the entry? Does the entry itself provide information about all necessary materials and equipment? What is missing? What kinds of processes are used and are there comparable modern making practices? Consultation of other how-to texts for similar entries (if they can be found) provides valuable insight, supplementing the entry with additional details or descriptions of alternative methods. Further illumination may come from searching

² See Hjalmar Fors, Lawrence M. Principe, and H. Otto Sibum, "From the Library to the Laboratory and Back Again: Experiment as a Tool for Historians of Science," *Ambix* 63 (2016): 85-97; Maartje Stols-Witlox, "6. Imperfect Copies. Reconstructions in Conservation Research and Practice," in *Reconstruction, Replication and Re-enactment in the Humanities and Social Sciences*, ed. Sven Dupré et al. (Amsterdam: Amsterdam University Press, 2021), 169-198, <https://doi.org/10.1515/9789048543854-008>; and Hasok Chang, "How Historical Experiments can Improve Scientific Knowledge and Science Education: The Cases of Boiling Water and Electrochemistry," *Science & Education* 20 (2011): 317-41.

³ For more detailed information, see Pamela H. Smith, "Making the Edition of Ms. Fr. 640," in *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640*, ed. Making and Knowing Project et al. (New York: Making and Knowing Project, 2020), https://edition640.makingandknowing.org/#/essays/ann_329_ie_19. DOI: <https://www.doi.org/10.7916/zdaf-cv31>; Joel Klein, "Methodologies for Making and Knowing: Reconstructions for Historical Research," in *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640*, ed. Making and Knowing Project et al. (New York: Making and Knowing Project, 2020), https://edition640.makingandknowing.org/#/essays/ann_322_ie_19. DOI: <https://www.doi.org/10.7916/s7f5-5h76>; and Donna Bilak, Jenny Boulboulé, Joel A. Klein, Pamela H. Smith, "The Making and Knowing Project: Reflections, Methods, and New Directions," *West 86th, Volume 21, No. 1* (2016), 35-55.

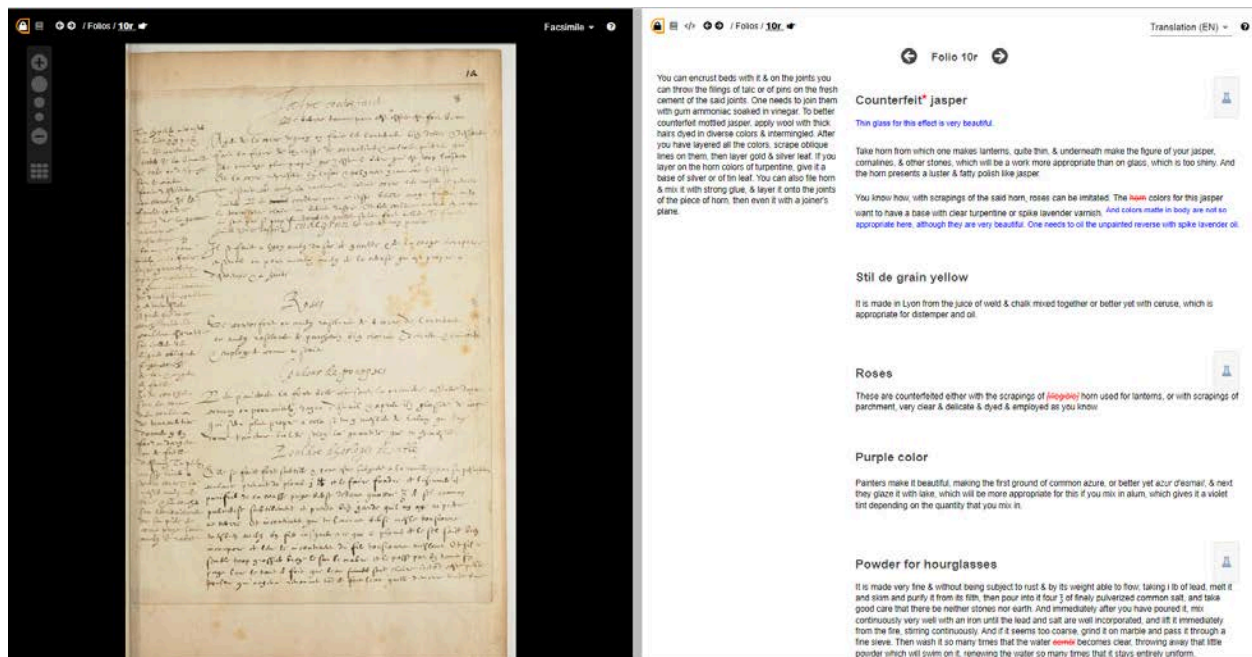
museum collections and archives for existing objects described by the manuscript's entry or that incorporate elements of the entry.

The reconstruction of Fr. 640's entries has served as a form of close reading, engaging both textually and materially with the contents of the manuscript. It opens fertile avenues of inquiry that cannot be accessed by considering texts or objects on their own; only through the trial (and many failures) of trying to replicate the techniques in some fashion can we gain new insights into historical practices and attitudes towards materials, processes, and the natural world. Careful deciphering of historical terminology and materials is elicited, and questions are raised that would otherwise go unasked.

Case study: Jasper and the Imitation of Visual Effects

A discussion of the Project's multi-year reconstruction of a recipe for the imitation of jasper stone from Fr. 640 shows how the Project's study of this entry through hands-on engagement resulted not only in better understanding of the manuscript text and the artisanal process employed, but also insights into the views and understandings of the natural world in the sixteenth century.

The Recipe: "Counterfeit Jasper"



The first entry on fol. 10r of Fr. 640 is titled "Counterfeit jasper" and reads as follows:

Take horn from which one makes lanterns, quite thin, & underneath make the figure of your jasper, cornalines, & other stones, which will be a work more appropriate than on glass, which is too shiny. And the horn presents a luster & fatty polish like jasper.

You know how, with scrapings of the said horn, roses can be imitated. The ~~hærr~~ colors for this jasper want to have a base with clear turpentine or spike lavender varnish.

And colors matte in body are not so appropriate here, although they are very beautiful. One needs to oil the unpainted reverse with spike lavender oil.⁴

The last two sentences are in a slightly smaller script and seem to be squished above and around the heading of the next entry, “Stil de grain yellow,” suggesting it was written after that entry was already present on the page. Another note is added right at the top of the entry text, below the heading of “Counterfeit jasper:”

Thin glass for this effect is very beautiful.

Finally, a further extension of the process is found in the left margin:

You can encrust beds with it & on the joints you can throw the filings of talc or of pins on the fresh cement of the said joints. One needs to join them with gum ammoniac soaked in vinegar. To better counterfeit mottled jasper, apply wool with thick hairs dyed in diverse colors & intermingled. After you have layered all the colors, scrape oblique lines on them, then layer gold & silver leaf. If you layer on the horn colors of turpentine, give it a base of silver or of tin leaf. You can also file horn & mix it with strong glue, & layer it onto the joints of the piece of horn, then even it with a joiner's plane.

The recipe is disjointed, sometimes contradictory, and seems to describe more than one process. Apart from detailing counterfeit jasper, the author-practitioner notes that scrapings of horn—presumably produced while thinning and planing the horn—can be used to create an imitation rose. This topic is discussed again on fol. 10r in the third entry, “Roses:”

These are counterfeited either with the scrapings of [illegible] horn used for lanterns, or with scrapings of parchment, very clear & delicate & dyed & employed as you know.

The preparation of the horn and the transformation of extraneous scrapings into a rose were explored in the Project's first reconstruction in 2015 by Ana Estrades and Wenrui Zhao.⁵ Estrades and Zhao thinned and cut the horn and painted the horn with different colors and types of varnish mentioned in the entry in order to emulate the visual effect of jasper stone. The following year in 2016, Isabella Lores-Chavez and Charles Kang completed the next recommended steps: attaching colored wool to the painted varnish and incising oblique lines to create a more variegated look before applying gold or silver leaf to the back to brighten the colors and create an illusion of depth.⁶ In the Project's third reconstruction of this entry in 2018,

⁴ Fol. 10r, Making and Knowing Project, et al., eds., *Secrets of Craft and Nature in Renaissance France: A Digital Critical Edition and English Translation of BnF Ms. Fr. 640* (New York: The Making and Knowing Project, 2020), <https://edition640.makingandknowing.org/#/folios/10r/f/10r/tl>.

⁵ Ana Estrades, “Jasper Imitation in Horn,” in *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640*, ed. Making and Knowing Project et al. (New York: Making and Knowing Project, 2020), https://edition640.makingandknowing.org/#/essays/ann_028_fa_15. DOI: <https://www.doi.org/10.7916/jv1e-zr84>.

⁶ Isabella Lores-Chavez, “Imitating Raw Nature,” in *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640*, ed. Making and Knowing Project et al. (New York: Making and Knowing Project, 2020), https://edition640.makingandknowing.org/#/essays/ann_045_fa_16. DOI: <https://www.doi.org/10.7916/a9xc-m996>.

each of these elements was revisited, building upon the exploratory work of the previous two trials and our own growing expertise/experience, to enable creation of the most convincing samples of imitation jasper, particularly in the setting recommended by the author-practitioner: decorated furniture.

The recipe thus describes two main processes: first, the creation of imitation jasper with thin pieces of horn, painted with various colored varnishes and further decorated with incised lines and colored wool, which is then covered by gold or silver leaf to enhance the look of the imitated stone. Second, using scrapings of horn, the waste from thinning the horn, to produce an imitation rose blossom by coloring and arranging the pieces.

The three trials are detailed below with the insights gained from each that were then employed in each following iteration. This is followed by a discussion of aspects of this entry that have yet to be tested fully, invitations for future reconstruction trials. Finally, we discuss larger insights gained from the reconstruction process.

Reconstruction 1: Transforming Horn

The first investigation of the “Counterfeit jasper” entry on fol. 10r was undertaken by Ana Estrades with assistance from Wenrui Zhao, students in the Fall 2015 Lab Seminar. It became clear, as with many of the author-practitioner’s entries and the contents of how-to texts more generally, that crucial steps were omitted, certain background or experience was assumed, and critical contextual information was missing. Much of Estrades’ work focused on making sense of the author-practitioner’s notes, determining what was being described, how it should be made, and how it could be used as a finished object.

Their first insight came from disambiguating the instructions for jasper from those about creating roses: the entry describes two related yet distinct processes. They next turned to the main ingredient of this recipe, horn, “from which one makes lanterns.” No further information about the type of horn is discussed, only that it should be “quite thin” and that it is more suitable than glass because it “presents a luster & fatty polish like jasper.”

Horn as an ingredient is mentioned in Fr. 640 in two contexts. First, there are a number of entries with horn as an element of decorative art objects such as “Fanciful tables” (fol. 68r), which calls for “very clear lantern horn.” The horn can be degreased by soaking in quicklime (fol. 73r) and “softened” with hot water (fol. 15v) to be cut into pieces for small boxes, as well as dyed and colored (fols. 73r, 75v, and 78v). Second, the author-practitioner uses ground/crushed horn for its “fatty” properties in mixtures to create molds for casting metal. “Burned marrow of ox horn” can give “bond” to molding sand (fol. 41r) and, in a marginal note on fol. 53r, the author-practitioner speculates that adding “marrow from the horns of oxen or sheep” to molding sand will produce better casts. These entries on casting are the only ones to detail a type of horn—either sheep or ox. The jasper entry specifies horn that is used to make lanterns, but this designation does not seem to be associated with a particular animal. Other treatises from this

time period are similarly vague, only occasionally specifying goat, cow, stag, or hartshorn,⁷ though some secondary sources suggest that ox or steer horn were chosen for lantern-making due to its thinness.⁸ This may suggest that horn selection was so ubiquitous that it did not merit mentioning, or, conversely, that the secret was too precious to share in writing. Most likely, however, is that horn choice was site-specific: artisans used whatever horn was locally available, with some horn-working workshops strategically positioned near cattle markets.⁹

As Estrades notes, the pliability of horn made it a versatile material, shaped into combs, buttons, tool handles, “horn books,” and a variety of other everyday as well as luxury items. The ability to render horn translucent made it particularly suitable for applications that mediate light, such as window panes and lanterns.¹⁰ The term “lantern” was also found as “lanthorn,” as noted by the Oxford English Dictionary, “probably due to popular etymology, lanterns having formerly been almost always made of horn.”¹¹ The reference in Fr. 640’s jasper entry on fol. 10r to horn’s use as an inlay in beds evokes a fifteenth-century Venetian inlay technique used to decorate objects such as boxes and cabinets with a veneer of colored horn, bone, and wood in geometric patterns. Another connection is the Florentine *pietre dure* inlay technique where a variety of colored semi-precious and precious stones, including marble, lapis lazuli, amethyst, and jasper, are cut to shape and carefully fit together to create decorated tabletops, boxes, and chests, among many other items.

⁷ See, for example, John Bate, *The Mysteryes of Nature and Art: Contained in Foure Seuerall Tretises, the First of Water Workes, the Second of Fyer Workes, the Third of Drawing, Colouring, Painting, and Engraving, the Fourth of Divers Experiments, as Wel Serviceable as Delightful* (Imprinted at London: For Ralph Mab and are to be sold by Iohn Iackson and Francis Church at the Kings armes in Cheapeside, 1634), 125 (hartshorn); Jean Le Begue, “Experimenta de Coloribus (1431),” in *Medieval and Renaissance Treatises on the Arts of Painting: Original Texts with English Translations*, ed. Mary P. Merrifield (New York: Dover, 2003), 58 (goat), 74 (goat, hartshorn), and 274 (stag’s horn); The Bolognese Manuscript (15th century) in *Medieval and Renaissance Treatises on the Arts of Painting*, 544 (“white horn of a cow”); and Pierre Lebrun, “Recueil Des Essais Des Merveilles De La Peinture (1635)” (The Brussels Manuscript), in *Medieval and Renaissance Treatises on the Arts of Painting*, 784 (stag horn).

⁸ As described in “Making a Lanthorn,” *Using and Working With Horn*, accessed November 8, 2015, <http://www.personal.utulsa.edu/~marc-carlson/horn/hlant.html>, cited by Ana Estrades, “Jasper Imitation in Horn,” https://edition640.makingandknowing.org/#/essays/ann_028_fa_15.

⁹ As noted by Arthur MacGregor, “the processes involved in horn working were such that it was necessarily a sedentary occupation. An organised long-distance trade in animals is not verified archaeologically or historically, so that all early horn working would have relied on comparatively locally bred beasts. It was not until the seventeenth century that this localised pattern began to break down under the development of large-scale cattle droving and the introduction of foreign horns, notably those of American bison and Indian water buffalo.” Arthur MacGregor, *Bone, Antler, Ivory and Horn: The Technology of Skeletal Materials Since the Roman Period* (London: Routledge, 2014), <https://doi.org/10.4324/9781315747668>, 42. See also “Horn, Antler and Bone Working,” Heritage Crafts, April 30, 2017, <https://heritagecrafts.org.uk/horn-working/>.

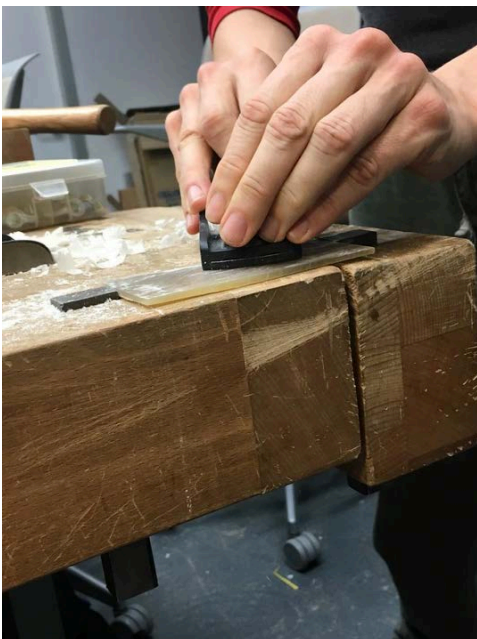
¹⁰ Ana Estrades, “Jasper Imitation in Horn,” https://edition640.makingandknowing.org/#/essays/ann_028_fa_15; Adele Schaverien, *Horn: Its History and its Uses* (Lexington, KY: Brécourt Academic, 2006), 52, 233; Nicolas Lémery, *Modern Curiosities of Art & Nature Extracted Out of the Cabinets of the Most Eminent Personages of the French Court* (London: Matthew Gilliflower and James Partridge, 1685), 118; and “Horn, Antler and Bone Working,” Heritage Crafts, April 30, 2017, <https://heritagecrafts.org.uk/horn-working/>.

¹¹ “lantern, n.” OED Online. September 2022. Oxford University Press. <https://www-oed-com.ezproxy.cul.columbia.edu/view/Entry/105662?rskey=8KxyEQ&result=1&isAdvanced=false>.

Horn continues to be used in the creation of decorative objects today, including in the making of artisanal razors, which is the context in which the horn was purchased for the reconstruction of “Counterfeit jasper.” The water buffalo horn from India was described as “honey” in color by the seller, a pale color that seemed most suitable to become translucent. The author-practitioner provides no detail about how to prepare or work the horn, only that it should be thin and that it is “from which one makes lanterns.” The pieces of horn could be cut into smaller rectangles with a jeweler’s saw, but to thin the pieces, a wood plane was employed to shave down the surface of the horn from its original 5-6mm to a thickness of about 3-5mm, thin enough to be translucent. Polishing the surface with sandpaper could thin the pieces slightly further while also ensuring it was smooth and even.



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While the thin rectangles of horn are to be transformed into jasper, the very thin curls resulting from the planing of the horn, as the author-practitioner instructs “you know how, with scrapings of the said horn, roses can be imitated.” No further information is provided in the jasper entry about these shavings, but the topic is picked up again in “Roses,” an entry on the same folio, that describes that roses “are counterfeited either with the scrapings of ~~fillegible~~ horn used for lanterns, or with scrapings of parchment, very clear & delicate.” Estrades describes that “the horn scrapings, comparable to wood shavings, had a white-yellowish color, and, in texture and translucency, they did look similar to parchment.”¹²



Scrapings of horn, produced by planing the horn. Ana Estrades, 2015. © Making and Knowing Project ([CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/)).

The entry on “Roses” instructs that the shavings should be “dyed & employed as you know,” though what knowledge the reader is supposed to possess about how to employ the shavings is unclear. In keeping with the common practice of using excess, or waste, material on hand, the horn shavings were painted with the red varnish prepared for the imitation jasper (described below). Before the varnish dried, the shavings were arranged in concentric circles like rose petals surrounding a central bud. As the varnish became tacky and eventually dried, the horn shavings remained in place, stuck to each other and to the small plastic dish in which they rested, resulting in a striking flower-like arrangement. The “petals” of horn were convincing imitations of the appearance and texture of a rose blossom.

¹² Ana Estrades, “Jasper Imitation in Horn,” https://edition640.makingandknowing.org/#/essays/ann_028_fa_15.



Rose made from horn scrapings painted with Venice red and Venice turpentine varnish. Ana Estrades and Wenrui Zhao, 2015. © Making and Knowing Project ([CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/)).

The sentence following the note on imitating roses in “Counterfeit jasper” explains that “the horn colors for this jasper want to have a base with clear turpentine or spike lavender varnish.” Recipes for both of these can be found within Fr. 640. “Varnish of spike lavender oil” on fol. 4r can be made by heating spike lavender oil to a simmer before adding powdered sandarac gum until it melts. Turpentine varnish can be made in a similar fashion, as described in “Varnish for panels” (fol. 3r), by heating Venice turpentine to a simmer and adding turpentine oil (distilled turpentine).

Jasper comes in a variety of colors and degrees of translucency depending on particular mineral inclusions. The entry provides no guidance on which colors to use, only that “colors matte in body are not so appropriate here, although they are very beautiful.” As such, pigments were chosen based on their translucent properties, allowing light to shine through and refract: madder lake, a red pigment made from *Rubia tinctorum*, and verdigris, a green pigment of copper acetate.¹³ By pairing the translucent varnishes with non-opaque pigments, their application to the horn preserved the translucency first achieved by planing the horn. The painted side of the horn was glossy and shiny, and when viewed from the unpainted side, the horn could be seen as having a “fatty polish.” The horn became even more translucent when spike lavender oil was applied to the non-painted side of horn as suggested by the entry. Thus, painting the horn on one side and oiling it on the other produced the glossy, polished, and translucent qualities of jasper that the author-practitioner sought.

¹³ Madder lake pigment prepared by the Making and Knowing Project according to historical recipes adapted for researchers in Jo Kirby et al., *Natural Colorants for Dyeing and Lake Pigments: Practical Recipes and Their Historical Sources* (London: Archetype Publications, 2014). See also Naomi Rosenkranz and the Making and Knowing Project, “Making Lake Pigment With Madder: A Historical Reconstruction,” The Making and Knowing Project Sandbox, January 29, 2022, https://cu-mkp.github.io/sandbox/docs/pigment-madder-lake_assignment.html. Verdigris prepared by the Making and Knowing Project, see Naomi Rosenkranz and The Making and Knowing Project, “Verdigris Pigment ‘Growing’ Reconstruction,” The Making and Knowing Project Sandbox, August 19, 2021, <https://cu-mkp.github.io/sandbox/docs/verdigris-assignment.html>; and Marie-France Lemay, “Verdigris,” *Traveling Scriptorium* (blog), January 17, 2013, <https://travelingscriptorium.com/2013/01/17/verdigris/>.



Horn painted with Venice red and verdigris varnish. The Venice red was mulled with walnut oil, then mixed with spike lavender oil and sandarac varnish (fol. 4r), and the verdigris was mulled in linseed oil, then mixed with Venice turpentine (larch balsam) and turpentine oil (fol. 3r). Ana Estrades and Wenrui Zhao, 2015. © Making and Knowing Project ([CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/)).

Reconstruction 2: Imitating Raw Nature

The first reconstruction of fol. 10r's "Counterfeit jasper" in 2015 made clear that this entry discusses ways to imitate the visual effects of jasper with painted horn as well as a separate process to make a rose from colored horn shavings produced as a by-product of making jasper. This reconstruction, however, did not get the opportunity to explore additional methods mentioned by the author-practitioner to fully transform the horn into jasper, resulting in imitation jasper that was convincing to a moderate degree. In 2016, Isabella Lores-Chavez and Charles Kang returned to this entry for a second reconstruction in that year's Fall Lab Seminar, working from the insights gained the previous year.¹⁴ Their goal was to test the marginal note that "to better counterfeit mottled jasper," you should "apply wool with thick hairs dyed in diverse colors & intermingled." The author-practitioner provides no further information about how this wool should be colored or how to attach it.

This second reconstruction began by following the same steps as the first iteration: they prepared spike lavender varnish, mixed in the same red madder lake and green verdigris, and painted small rectangles of horn with this translucent mixture. Two samples of 100% undyed, unbleached sheep's wool roving yarn (wool partially spun into yarn) were colored with two of the most common colorants in the Renaissance, madder (red) and weld (*Reseda luteola*, yellow).¹⁵ The thick, fibrous pieces of wool proved difficult to attach to the horn, requiring first a dip in the varnish (acting as an adhesive) before pressing onto the painted side of the horn. The next suggestion for better imitating marbled jasper "after you have layered all the colors," writes the author-practitioner, is to "scrape oblique lines on them, then layer gold & silver leaf." Lines were incised through the varnish onto the horn with a sharp metal point.

¹⁴ Isabella Lores-Chavez, "Imitating Raw Nature," https://edition640.makingandknowing.org/#/essays/ann_045_fa_16.

¹⁵ Samples were prepared by the Making and Knowing Project according to historical recipes adapted for researchers in Jo Kirby et al., *Natural Colorants for Dyeing and Lake Pigments: Practical Recipes and Their Historical Sources* (London: Archetype Publications, 2014).



Two samples of horn, one painted green (verdigris and spike lavender varnish), the other painted red (madder lake and spike lavender varnish), both with red yarn applied. Isabella Lores-Chavez, 2016. To test the technique of applying yarn on the sticky spike lavender varnish painted onto these two samples of horn, we pressed a strand of red yarn onto the horn sheet painted green (top) and a strand of red yarn dipped in spike lavender oil to onto the horn sheet painted red (bottom). © Making and Knowing Project ([CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/)).



<https://www.flickr.com/photos/128418753@N06/31668396842/>

Finally, on top of the paint, yarn, and scratches, gold transfer leaf was applied. The piece was then flipped over and the unpainted side was oiled with spike lavender oil as had been done in 2015.



Sheet of horn (trial #5) painted with red varnish. Isabella Lores-Chavez, 2016. On our fifth sheet of horn, we applied red yarn (dipped in spike lavender varnish) to the bottom half of the sample. We did not apply yarn to the top half of the sample. Instead, we tested the scratching and gilding on this half of the sheet. © Making and Knowing Project ([CC BY-NC-SA](https://creativecommons.org/licenses/by-nc-sa/4.0/)).

These last three steps (scratching, application of gold leaf, and oiling the front) contributed significantly to the effect. The scratched lines created delicate patterns not unlike those found in real jasper, while the gold backing brightened the color of the painted horn and highlighted the fine scratched lines further. Oiling the unpainted side with spike lavender oil rendered the horn immediately more translucent, making the painted side more visible, while helping the horn retain the “luster & fatty polish like jasper” that made it the author-practitioner’s material of choice.



<https://www.flickr.com/photos/128418753@N06/38766679020/in/album-72157693280033294/> Application of spike lavender oil to the unpainted side of the horn greatly enhances the visual effect of the imitation jasper.

Nevertheless, the pieces of imitation jasper from this reconstruction still lacked a close verisimilitude to jasper, and the purpose of the colored yarn was unclear, particularly in the form of thick strands.

The reconstruction's failure to incorporate the dyed wool to create a more convincing imitation of jasper prompted a closer look at the original text and ultimately resulted in a significant change in translation. In the Making and Knowing Project's working translation of Fr. 640 at the time of this reconstruction, the original French ("*aplique des laines a gros poil tainctes de diverses couleurs & entresmeslees*") had been translated as "apply **yarn** with thick hairs dyed in diverse colors & intermingled" (emphasis added). The experience of using thick yarn led us to theorize that using unspun wool, or even slightly thinner yarn, might produce a more convincing effect of variegated stone (this was to be picked up in the third reconstruction, described below). Changing the translation of "*laine à gros poil*" to indicate coarse wool rather than spun yarn allowed us to keep the ambiguity in language.

Reconstruction 3: Success? And Encrusting Beds

In 2018, the Making and Knowing Project returned once again to "Counterfeit jasper" to retry the application of dyed wool to create a more convincing variegated jasper imitation. In a dedicated session, the Making and Knowing team and a few dedicated students, including Lores-Chavez, set up an assembly line for everyone to try their hand at the process: reference materials (printouts of fol. 10r, previous notes and general protocol, pictures of museum objects, and samples of jasper stones), sandpaper to smooth the pieces of horn, paint mulling stations (one set for spike lavender varnish and one for turpentine varnish), pigments (madder lake, stil de grain [buckthorn berry lake purchased from Kremer Pigments], and verdigris), metal points to scrape incisions into the horn, unspun wool and yarn (all 100% sheep's wool) dyed in the lab with natural colorants: madder (red), annatto (orange), and gallnuts-iron (brown), as well as gold and silver leaf, and finally spike lavender oil to apply to the unpainted side at the very end.



<https://www.flickr.com/photos/128418753@N06/39682135205/in/album-72157693280033294/>

Lab setup for 2018 reconstruction

Each team member brought their own individual vision to the process, trying different combinations of the author-practitioner's recommendations. Some tried only one kind of varnish

or one pigment, while others tried to see if there were differences in the way the pigments interacted with the medium to create more convincing stone. Many took small amounts of the unspun wool and flattened it into a thin layer to apply over the entire surface of the painted horn, though some also added small threads of thinner yarn and others omitted the wool completely. Most abandoned the recommendation to incise lines into the horn, as the wool and paint seemed more effective in creating the illusion of inclusions in the “stone.” Some applied gold leaf and others silver leaf. In the spirit of the author-practitioner’s improvisatory and thrifty resourcefulness, we also tried the process on some of the horn shavings as the base in place of the approximately 2mm thick rectangles.



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Thin shavings used as base

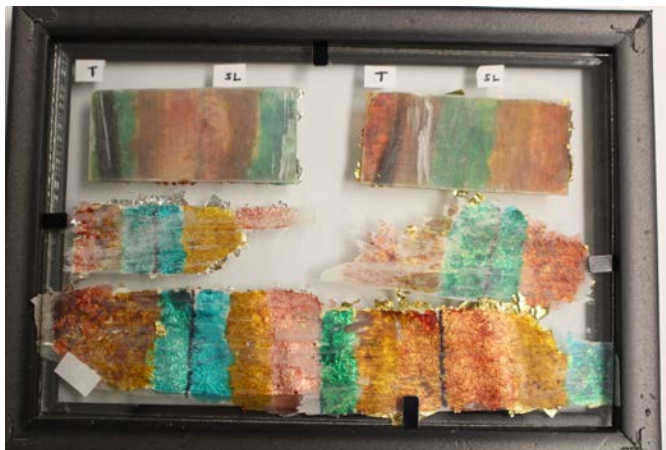
This third reconstruction also sought to explore two marginal notes not fully investigated in the previous two trials. First, while the entry initially states that either gold or silver leaf can be applied, the author-practitioner subsequently adds that “if you layer on the horn colors of turpentine, give it a base of silver or of tin leaf.”



<https://www.flickr.com/photos/128418753@N06/40727953892/in/album-72157693280033294/>

Application of silver leaf

While both varnishes of spike lavender oil and turpentine can be used and both gold and silver leaf can be layered on, the author-practitioner suggests that there is possibly some benefit to the pairing of turpentine varnish and silver leaf. It is unclear whether that means that gold leaf should be used with the spike lavender varnish. We prepared a set of six sample pieces for each possible combination of the two varnishes, three pigments (madder, stil de grain, verdigris), and two types of metal leaf. For three different thicknesses of horn (the “regular” 2mm rectangles, thicker shavings, and very thin shavings), we divided each piece in half with a line down the middle. One half was painted with spike lavender varnish (one line of paint for each of the three pigments) and the other with turpentine varnish. One of each thickness was covered with silver leaf and one with gold leaf. Our trials did not really yield any significant insights into this pairing of varnishes and metal leaf, but the set of six pieces serves as a very useful reference.



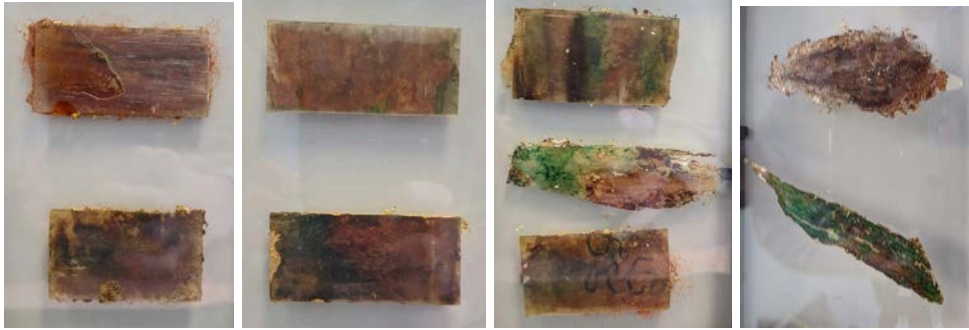
<https://www.flickr.com/photos/128418753@N06/38886350820/in/album-72157693280033294/>
Testing of different varnishes, pigments, and metal leaf (gold vs. silver)

The second marginal note tested was whether we could “encrust beds with” the imitation jasper. The standalone pieces of imitation jasper from each of the reconstructions had some of the desired properties of the stone, but we wondered whether the effect of embedding the pieces in a wooden frame, in the way it might perhaps be found in a decorated bed, would enhance the appearance even further. Using “imitation wood” (contact paper with a wood grain pattern), we fashioned a small window for the imitation jasper and a “wooden” backing that covered the piece from behind, preventing light from shining through from the back.



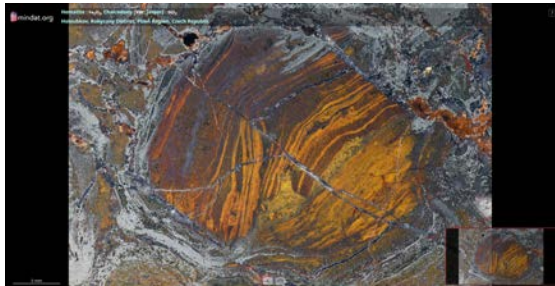
Imitation jasper inlaid into an imitation wood frame, 2018. The Making and Knowing Project.

The 2018 collaborative making session resulted in the most convincing imitations of the stone. The ability to discuss our interpretations of the text as a group and to test different elements individually not only stimulated conversation but was particularly effective for gaining a better understanding of the entry, the author-practitioner’s process, and his motivations behind recording these notes.



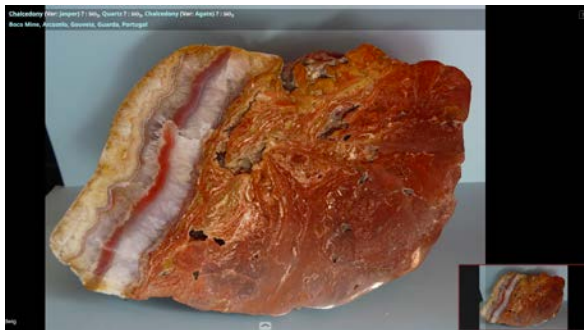
Images of actual jasper: –

<https://www.mindat.org/photoscroll.php?searchbox=Jasper+with+Quartz>



<https://www.mindat.org/photo-1241296.html> -

<https://creativecommons.org/licenses/by-nc-sa/3.0/>



Chalcedony (Var: Jasper) ? : SiO_2 , Quartz ? : SiO_2 , Chalcedony (Var: Agate) ? : SiO_2
 Boco Mine, Arcozelo, Gouveia, Guarda, Portugal

minID: AF6-Y9Y

Chalcedony (Var: Jasper) ? : SiO_2 , Quartz ? : SiO_2 , Chalcedony (Var: Agate) ? : SiO_2

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Locality: Boco Mine, Arcozelo, Gouveia, Guarda, Portugal

Dimensions: 190 mm x 119 mm x 75 mm

Cutted and polished specimen, it consists for the most part of red jasper, self collected.

Collected: 2013

This photo has been shown 20 times

Photo added: 14th Aug 2022
Dimensions: 4585x3439px (15.77 megapixels)

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Future Reconstructions

Even after three iterations of reconstruction, there are parts of "Counterfeit jasper" on fol. 10r that have yet to be tested. First, the contradictory notes about using glass in place of horn as a base for the "jasper" remain a puzzle - is horn indeed "more appropriate," or is "thin glass for this effect...very beautiful"? Second, in the advice to encrust beds with the jasper, the author-practitioner seems to suggest that this is done in the manner of mosaics, using a paste-like cement to join different elements (a similar technique is used with grout and tiles). He advises that "on the joints you can throw filings of talc or of pins on the fresh cement," perhaps suggesting another means of decoration (the talc or pins can cover any visible cement between pieces), or perhaps these filings can be used like abrasive powders to polish the surface until smooth, flat, and shiny. This passage is most likely related to a similar observation at the end of the marginal note that begins with the talc or pins advice: "you can also file horn & mix it with strong glue, & layer it onto the joints of the piece of horn, then even it with a joiner's plane."

We might look to *pietre dure* inlay work, where real jasper was cut and polished, which may serve as the possible inspiration for the creation of imitation jasper to encrust beds. As described by Annamaria Giusti, the technique of Florentine *pietre dure* inlay work is like the

construction of a stone puzzle.¹⁶ Typically the process begins with a painting, serving as a model for the pattern. A tracing of the painting breaks it up into sections where each section will be a piece of stone chosen to best represent that element of the composition. Paper stencils of each individual piece were pasted onto the selected thin slices of stone and cut out using a bowsaw of thin iron wire and emery (an abrasive, typically composed of quartz powder). Each piece was cut to ensure a flush fit with its neighboring pieces, sitting at the same height and with no gaps between them. To stick the pieces together, an adhesive made of beeswax and rosin or an animal-based glue would be melted across the back of the pieces. Sometimes small sections would be glued together as the work progressed, adding layers of the adhesive as needed. If the inlay object was a smaller design set into a larger base of slate or marble, for example, the smaller stones of the design would be pieced together first and then set into the backing with a final layer of adhesive. The final step was a series of surface polishings with successively finer abrasives, perhaps not unlike the “filings of talc or pins” to be used on the joints. The *pietre dure* process may also shed light on the author-practitioner’s next note about the joints: “one needs to join them with gum ammoniac soaked in vinegar.” Gum ammoniac, also known as “ammoniac gum” or “ammoniacum,” is a gum-resin, a complex gum/oil/resin mixture obtained from the stems of the carrot family plant, *Dorema ammoniacum*, native to Iran and India.¹⁷ Perhaps this mixture of gum ammoniac and vinegar acted like the wax-rosin adhesive employed in *pietre dure*.

Finally, the author-practitioner, after his instructions for creating marbled jasper and the pairing of turpentine varnish with silver or tin leaf, seems to return again to a cement-like application. He writes, “you can also file horn & mix it with strong glue, & layer it onto the joints of the piece of horn, then even it with a joiner’s plane.” This may be another cement recipe, consisting of glue (likely animal-based) with powdered horn, that can be used to fill the gaps between the joints. Using the same materials to fill the gaps could create a better illusion that there are no gaps between the pieces (using powdered horn and glue to imitate the horn used to imitate jasper), the mark of expert skill in *pietre dure* work. Another interpretation is that the mixture of horn and glue acts itself as an imitation of jasper, reminiscent of recipes for creating imitation coral and stones. In a fifteenth century Italian manuscript, one recipe for coral, for example, even calls for horn, which is to be soaked in lye, boiled, strained, and mixed with vermilion pigment before being shaped “like dough;” another recipe for coral uses pulverized coral mixed with lemon juice to create larger pieces or custom shapes of coral.¹⁸ The process is also similar to *scagliola*, a technique used to imitate marble and even *pietre dure* inlay work by mixing plaster, animal glue, and pigments and pouring the mixture into carefully incised sections of a composition.

Further research and additional trials of reconstruction may help us understand these elements of the entry. As we have seen, there are many ways to imitate jasper (even just contained in this one entry), and it is possible that creating jasper on glass, using a cement of

¹⁶ Annamaria Giusti, *Pietre Dure, and the Art of Florentine Inlay* (Thames & Hudson, 2006), 253–257.

¹⁷ Jo Kirby, Joanna Cannon, and Susie Nash, *Trade in Artists’ Materials Markets and Commerce in Europe to 1700* (London: Archetype Publications, 2010).

¹⁸ The Bolognese Manuscript (15th century) in *Medieval and Renaissance Treatises on the Arts of Painting*, 544 and 520. Note also that the recipe on 520 begins, “This is a hidden philosophical operation,” suggesting a manipulation of nature and a gaining of knowledge discussed in the section “Insights from Reconstruction.”

gum ammoniac and vinegar, or preparing a mixture of ground horn with glue are additional ways to augment the imitation of jasper—or even procedures separate from the two others already disambiguated from each other (jasper made from a horn base and the horn rose). Looking more closely into these elements may also lead to further insights about the author-practitioner, his techniques, his materials, and his “material imaginary.”

Insights from Reconstruction

The layout of the text on fol. 10r provides compelling evidence for the author-practitioner’s possible sequence of experimentation. The marginal note, which communicates variations on the process, as well as possible uses of the product, extends far down the left side of folio. It includes the tip to use colored wool to make the imitation more convincing. Directly following this advice are instructions for scratching oblique lines and backing with gold leaf, both of which significantly augmented the appearance of the horn as a patterned yet translucent object. The use of wool and the scratching followed by gilding seem to be distinct techniques he employed in later trials, or ideas he wrote down for later testing.

In contrast, the final step of oiling the unpainted side, which undoubtedly contributed to the product’s verisimilitude, appears urgently squeezed in at the end of the main block of the recipe, on either side of the heading for the following recipe. Further modifications were recorded in marginal notes: while the main body of the recipe recommends not using glass, a stray line of text beneath the title contradicts this, stating that “thin glass for this effect is very beautiful,” perhaps another indication that the author-practitioner returned to the recipe with alternate steps or materials. Based on our reconstruction, it seems likely that the author-practitioner either attempted this recipe multiple times or that he returned to his initial recording of the process more than once. Indeed, in our own trials, multiple iterations produced better counterfeits.

Both the analysis of the author-practitioner’s language and our reconstructions make a case for his awareness of the value of his own artifice. He even anticipated a use for his counterfeited stone: the long marginal note squeezed onto fol. 10r begins by stating that the imitation jasper can be used to inlay bed frames. This use could potentially augment its verisimilitude: when not the sole focus of the viewer’s attention, even modest jasper-like visual qualities could be effective.

The purpose of making counterfeit jasper thus was not to deceive: it may have been to convey the “essence” of the material, and perhaps even to understand how the real stone came to have that essence and appearance. The creation of a material mimesis could serve not just to stand in place of the real, but also to “explain the physical problem of the genesis of nature’s materials,” a process comparable to the belief proclaimed by the thirteenth-century philosopher-theologian Albertus Magnus (ca. 1200–1280) “that nature could be understood from the direct analogy to its artisanal counterparts.”¹⁹

In the sixteenth century, jasper was among several precious stones commonly collected in princely *Kunstkammern* (also known as “cabinets of curiosities”) and even in modest collections of *artificialia* and *naturalia*. Already in the medieval period, a taste for jasper existed

¹⁹ Marjolijn Bol, “Coloring Topaz, Crystal and Moonstone: Factitious Gems and the Imitation of Art and Nature, 300–1500,” in *Fakes!?: Hoaxes, Counterfeits, and Deception in Early Modern Science*, ed. Marco Beretta and Maria Conforti (Sagamore Beach: Science History Publications, 2014), 129. For more on

at the imperial courts of Prague, where precious vessels were carved from locally mined stone.²⁰ Generations later, Holy Roman Emperor Rudolf II (1552-1612) continued to display goods made of Bohemian jasper in the capacious *theatrum mundi* he had famously amassed. In the Italian realm, Sicily was another major source for raw jasper, where it was incorporated into decorative objects influenced by Arabic inlay and stone work. Towards the middle of the sixteenth century, stonework called *commesso* (a technique for joining stone pieces together) was increasingly in demand throughout Europe in objects such as cameos, vases, mosaic floors, and furniture. By 1588, Ferdinando I de' Medici, Grand Duke of Tuscany, founded the *Galleria dei Lavori*, today the *Opificio delle pietre dure*, a dedicated workshop for inlay stone work, decisively establishing Florence as the center for this type of work. In the first half of the seventeenth century, the influence of both Prague and Florentine workshop practices could be found in Augsburg, another central hub for the production of *Kunstkammer* objects.²¹ In France, King Louis XIV (1638–1715) established inlay stone workshops, recruiting local artisans as well as experts from Florence. The reach throughout Europe is evident not only in the large demand for this objects, but also in the nationalities of the patrons and the diverse origins of the artists: “amongst the first and most requested masters of *commesso*-work was the Frenchman Jean Meynard, called ‘il Franciosino’ (active 1552 to 1584), who frequented Michelangelo’s (1475-1564) circle and was active at the papal court.”²²



The Farnese Table <https://www.metmuseum.org/art/collection/search/202115>

In the early modern *Kunstkammer*, jasper and other semi-precious stones were displayed in their raw form alongside artistically worked versions of the materials. Jasper was thus appreciated both as a marvelous stone and as a workable raw material. Its study and manipulation could yield insights into the workings of nature: “In noble stones,” writes Rudolph

²⁰ Barbara Drake Boehm and Jiri Fajt, eds., *Prague: The Crown of Bohemia, 1347-1437* (Metropolitan Museum of Art, 2005).

²¹ Annamaria Giusti, *Pietre Dure, and the Art of Florentine Inlay* (Thames & Hudson, 2006), 15, 135.

²² Annamaria Giusti, *Pietre Dure, and the Art of Florentine Inlay* (Thames & Hudson, 2006), 24. For more on the French workshops of Louis XIV, see also 146–152.

Il's personal physician, the Flemish mineralogist and humanist Anselm de Boodt (1550–1632), in *Gemmarum et lapidarum historia* (1609), “you may contemplate the greatness and unspeakable power of God, who unites in bodies so small the beauty of the entire world and the force of all other things, and in this way you have always before your eyes a certain reflection and spark of divinity.”²³ When comparing heliotrope to jasper, de Boodt assigns “greater authority” to heliotrope “than jasper, unless it is the case that nature has imprinted upon this jasper images and effigies.”²⁴ He indicates how figuration naturally occurring in jasper could increase its value, drawing an analogy between the work of nature and the sculptor's carving of images into the stone.

The attempt to imitate natural materials in the craft workshop, such as Fr. 640's “Counterfeit jasper,” were a means to “know” them. In “the art of the earth” section of *Discours admirables* (1580), the French ceramicist Bernard Palissy (1510–1589) asserts that knowledge of nature can only emerge by means of “art,” a direct engagement with the materials of nature involving great bodily labor and direct and repeated experience of the things of nature. Through this engagement, all those who practice an art can learn the principles and causes of natural phenomena.²⁵

In his imitation recipes in Fr. 640, the author-practitioner articulates a practice undertaken on a daily basis in the artisan's workshop: through physical manipulation, certain materials could be pushed to undergo transformations to resemble another material.²⁶ Subjected to a non-natural transformation, one material could take on the visual appearance—and even the physical properties—of another. The author-practitioner seems to indicate a subtle understanding of how workshop versions of coveted raw materials could be the compelling, if not perfectly convincing, simulacra resulting from such processes. The endeavor to create a human-made equivalent for raw natural substances provided an opportunity to learn more about them and to seek practicable techniques that could potentially match nature's creative forces.

Stones such as jasper sustained both visual and scientific appeal in the early modern period; they showed distinctive patterning, but no two specimens were ever quite the same. In Renaissance inlay work, the manipulation and careful selection of the natural patterning of stones was key, whether to highlight particular designs in geometric mosaic work or to create convincing depictions of scenes, still lifes, and portraits (another form of “imitation,” “counterfeit,” and transformation of one material to represent another).

²³ As quoted in Annamaria Giusti, *Pietre Dure, and the Art of Florentine Inlay* (Thames & Hudson, 2006), 116. Anselmus de Boodt, *Anselmi Boetii de Boodt: Gemmarum et Lapidum Historia, qua Non Solum Ortus, Natura, Vis & Precium, Sed Etiam Modus Quo Exiis, Olea, Salia, Tincturae, Essentiae, Arcana & Magisteria Arte Chymica Confici Possint, Ostenditur* (Hanoviae: typis Wecheliani apud C. Marnium & heredes J. Aubrii, 1609).

²⁴ Anselmus de Boodt, *Le parfaict ioaillier...* (A Lyon: Chez Jean-Antoine Huguetan, 1644), 329.

²⁵ Bernard Palissy, *Admirable Discourses* (Urbana: University of Illinois Press, 1957; originally 1580), 188-203.

²⁶ For more on imitation, see Isabella Lores-Chavez, “Imitating Raw Nature,” https://edition640.makingandknowing.org/#/essays/ann_045_fa_16. DOI: <https://www.doi.org/10.7916/a9xc-m996>, and Kathryn Kremnitzer, Siddhartha Shah, and Pamela H. Smith, “Gemstones and Imitation,” https://edition640.makingandknowing.org/#/essays/ann_029_fa_15. DOI: <https://www.doi.org/10.7916/ajz5-bm67>.



Bernardino di Porfirio da Leccio, designed by Giorgio Vasari, Tabletop with Moorish-style decoration, executed before 1557 for Bindo Altoviti. Ebony, ivory, and jasper decoration, 16.51 cm. © Proprietà UniCredit.



Table top with owl and birds in a landscape. Hard and soft stones. 17th century. Provenance: Venturi Ginori Lisci family. Gift of Marquise Donella Torrigiani Torelli. Florence, Museo dell'Opificio delle Pierte Dure. (pic by NJR)



Table top with shells and coral. *Pietre dure* on antique red porphyry. From drawings by Carlo Carlieri, circa 1816. Florence, Museo dell'Opificio delle Pierte Dure. (pic by NJR)

For the author-practitioner, examining this kind of object up close seems to have raised questions about its material peculiarities and about how nature generates them. The author-practitioner's own processes began in readily accessible workshop materials, manipulated in pursuit of his fascination with transforming one material so that it resembles another (both mimetically and in some of its physical properties). Seeing a “fatty polish” in horn, the author-practitioner seeks to extend this property to the “fatty polish” of jasper; he layers varnish and translucent pigments, playing with the addition of opaque inclusions such as dyed wool, to emulate the visual effect of the stone, manipulating the way light passes through the layers and is reflected back by the gold or silver leaf. The counterfeiting of “mottled jasper,” with its layering and intermingling of materials, is a study in the natural formation of the variegation and layering of mineral jasper in the earth. We can see his trials as a result of curiosity about the workings of nature, but they are also simply a fundamental and everyday response to the challenges that arise in the working of natural materials, a part of the exploring, testing, and trying by which practitioners come to understand the constitution and behavior of their materials. The author-practitioner's efforts to overcome and transform horn, pigment, wool, and varnish into jasper were simultaneously an aesthetic quest and a probing of the relationship between nature and art. The author-practitioner's iterative practice, born out of the need to test working hypotheses about his materials, resulted in multiple versions of the “counterfeit” as he adapted his techniques and materials to try to capture the state of the native stone. The iterative experimentation in creating the material mimesis reveals the artisan learning about the natural world in reproducing its hidden (“secret”) processes of making.²⁷ The imitation of jasper presented an opportunity both for working and thinking through the properties of materials, and for investigating the processes by which precious and epistemic objects could be produced and reproduced.

The Making and Knowing Project's repeated and iterative reconstructions of the author-practitioner's “Counterfeit jasper” paralleled those of the author-practitioner. Our active engagement with processes and materials was a form of knowledge production. Attempting to

²⁷ On material mimesis and another discussion of imitation jasper, see Pamela H. Smith and Isabella Lores-Chavez, “Counterfeiting Materials, Imitating Nature,” in Marjolijn Bol and Emma Spary, eds., *The Matter of Mimesis* (Leiden: Brill, forthcoming).

make jasper from horn under the direction of the author-practitioner led us to consider more carefully and immediately the motivations behind the imitation of natural materials, reconstructing not just the entry but also the author-practitioner's epistemic world and material imaginary.



Element from the altar of the Chapel of the Princes. Jasper from Bohemia and Sicily and lapis lazuli. Early 17th century. Florence, Museo dell'Opificio delle Pietre Dure.
