FEATURE

Secrets of their craft

Many metalworkers and ceramicists in Renaissance Europe seemingly had no qualms about killing a lizard – or other animal – for their art. Pamela Smith investigates the intriguing practice of life-casting that turned nature into art, and why artisan authors recorded practical knowledge in words.

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Why would a 16th-century artist create a lifelike simulacrum of a lizard? Creating such a work involved catching a live lizard, done by making a slipknot in a string hung from the end of stick, distracting the lizard by whistling, and then dropping the slipknot over the lizard's head and pulling it tight – as written in an anonymous manuscript compilation of hundreds of artisanal techniques (Bibliothèque nationale de France Ms. Fr. 640). Next, the lizard had to be carefully fed and looked after until it could be killed by drowning in brandy or 'good vinegar & urine', and then posed (before its corpse stiffened) in a lifelike position on a clay slab. Then it was fitted out with 'veins' of wax (for metal to run through) and encased in plaster. After the plaster set, the lizard and the wax were removed, normally by burning them out in a metalworker's forge, at which point molten metal was poured into the void left by the lizard's body. This technique, now called life-casting, goes back to antiquity and is mentioned by the 14th-century painter Cennino Cennini in his Libro dell' Arte ('Book of Art'). It was especially frequent in 16th-century Europe.

Life-cast plants and animals were common items in noble inventories, particularly as courts began to assemble Kunstkammer ('Chambers of Art'), which brought together rare works of nature with works of the human hand. Materials and objects that demonstrated the creative artifice of nature, such as medicinal stones, beautiful shells, and precious gems, were often ornamented by beautifully worked fittings and settings that, in turn, aimed to showcase the artistry of the human hand. Lifelike metal lizards fit right into such a collection.

st silver lizard, *c.*1540-1550. *Size: 7 x 3.8 x 2.9cm*. The remarkable detail of this lizard was achieved by moulding and casting accor
es detailed in Ms. Fr. 640, fol.124v (see p.35). The slightly raised oval area on the farthest right curve of the tail indicates that the
which the mould was filled had to be filed off, and the casting seam along the lower right edge of the tail shows where the mould h
ge: Germanisches Nationalmuseum, Nuremberg

The Kunstkammer inventories of the Wittelsbachs in Bavaria and of the Habsburgs of Austria contain hundreds of life-casts, which were produced in large numbers throughout Europe at this time, especially in Nuremberg, where life-casting reached a high point in the work of the master Wenzel Jamnitzer (1508-1585). So, why would European elites eagerly seek out, commission, and even learn from craftspeople how to create such works themselves? The appeal was evidently multifaceted: life-casts could prove rare natural phenomena, such as the seven-fingered hands of peasants and the misshapen lemons cast in plaster in the Bavarian Kunstkammer. Life-casts could stand in for flower

blossoms long after those had withered and died, and the strikingly lifelike objects could display the talent of the artist in producing fine moulds and in understanding the casting properties of metals. But they also possessed a deeper significance of demonstrating the human ability to imitate the generative and transformative powers of nature.

s cup with decoration featuring dolphins, fish, mermaids, and sea gods and goddesses. Gilded silver and nautilus shell, *c.*1630-166
13.5cm. Pieces like this, combining natural wonders such as the nautilus shell and human artistry, were popular choices for the
nmer. Image: Rijksmuseum, Amsterdam / Public Domain

The creatures most often chosen for life-casting – including birds, snakes,

lizards, crayfish, frogs, and insects – were to be found in the wild around natural water sources. The life-casts of these animals often ornamented fountains and grottoes that adorned the gardens of the nobility. The lizards, snakes, insects, and other creatures cast from clay by the celebrated Huguenot potter Bernard Palissy (c.1510-1590) and from metal by Jamnitzer could have symbolic or allegorical meaning, but such beings were distinctive within the natural world, too: they were seen as inhabiting more than one of the four elemental zones (earth, water, air, fire). Lizards, snakes, toads, and crabs lived both on land and in water, while insects and birds inhabited both air and land, and often water as well. Lizards, snakes, frogs, toads, turtles, and all kinds of insects were often found in warm, wet, and muddy conditions, and swarmed, seemingly spontaneously, from putrefying matter; they were associated with a process of decay from which new life sprang.

Many of these reptiles and insects were also known for their brief lifespan and the processes of transformation through which they passed in their short lives. Caterpillars metamorphosed through a period of ‘sleep’ or ‘death’ into moths and butterflies; their metamorphosis from pupae was sometimes seen as evidence of the possibility of resurrection. Lizards regenerated their tails when detached, snakes shed their skins, adult frogs and turtles emerged from the ground after freezing winters, and, as reports insisted well into the 18th century, crustaceans were found alive within solid stone. These crawling earthly creatures were sometimes viewed as impure, yet also as connected to processes of generation, such as birth.

amnitzer, table ornament. Cast, enamelled, etched, and gilded silver, 1549. *Size: 99.8cm tall.* This centrepiece is a paean to Terra M ty. Plants and small reptiles cluster at the base. Mother Earth supports a basin, with life-cast snakes and lizards around the rim. Th sin is decorated with cornucopias and moresques, while the egg-shaped vase holds plants and flowers, also cast from life. Image: eum, Amsterdam / Public Domain

Of all the life-cast creatures, lizards possessed special powers and significance in early modern Europe, as, in fact, they still do for scientists now. Scientists study lizards today for their ability to regenerate their tails, which is of interest in connection with damage to human limbs and organs, and for the ability of some species to reproduce asexually. Their association with birth appears to have been very ancient and endured at least until the 20th century, when Jewish silversmiths in Morocco adorned birth amulets with naturalistic lizards and salamanders. And in the 16th century they were connected particularly to metal processes: a 1531 collection of pigment-making and metalworking recipes, Rechter Gebrauch der Alchimei ('The Proper Use of Alchemy'), contains several for creating noble metals through a process of catching, feeding, and burning lizards.

Such techniques may sound arcane, but, in fact, much straightforward experimentation went into the workshop processes of life-casting. An early Nuremberg goldsmith, Hans Lobsinger (c.1510-1584), who in 1550 asserted that he was able to 'make an artificial clay that produces such a sharp cast in copper and brass that it does not need any afterwork and the mould can be removed immediately after the casting with only the help of a little brush, so long as it is soaked in water.' Lobsinger referred to the essential qualities of a moulding material: easy removal from the mould of the metal-cast object, a sharp impression, and no need for clean-up of the cast with chisels and polishing substances. Such qualities could only be discovered by repeated experiment with natural materials, as 16th-century accounts testify. Writers point out that knowledge of moulding was where nature and art met with labour and ingenuity, for useful sands could either be obtained from nature or

made by art, and thus constant observation, experiment, and experience were crucial.

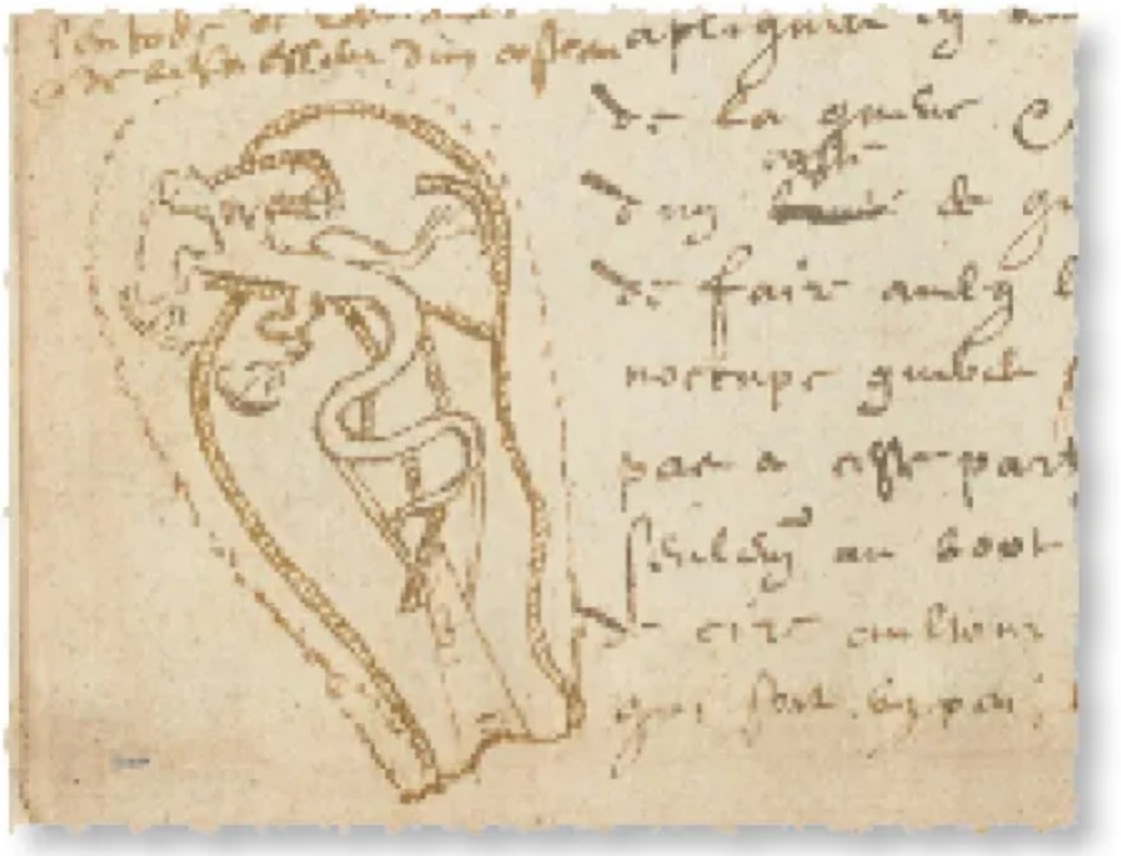
of Bernard Palissy, platter decorated with fish, frogs, a snake, a lizard, a water beetle, crayfish, and shells. Glazed ceramic, last qua century. *Size: 52.1 x 39.7 x 7.1cm* To create works like this one, Palissy moulded plants and animals in a process similar to that of iths.

letropolitan Museum of Art, New York / Public Domain

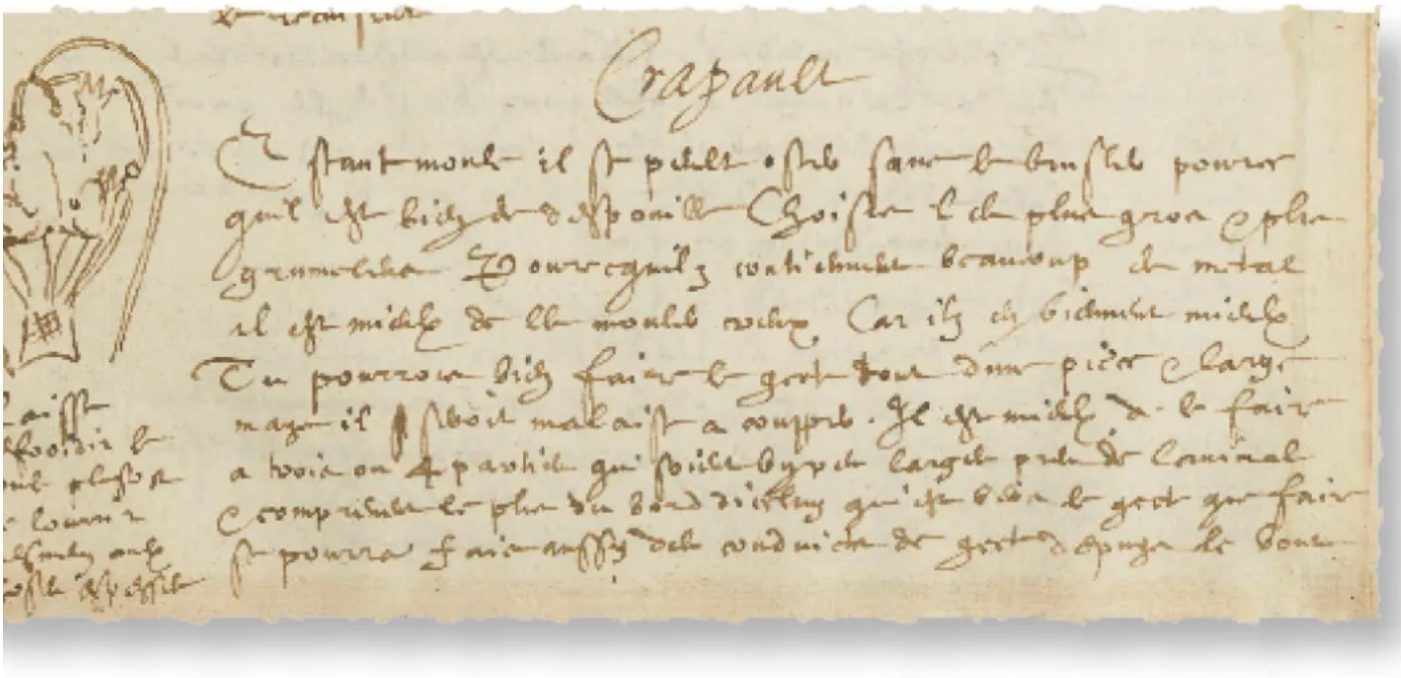
Metalworker and author of the 1540 Pirotechnia, Vannoccio Biringuccio, says about clays, ‘Aside from actual trial, I believe that there is little that can help you, since the clay in itself has no colour or visible sign that I know of to show how satisfactory it is… But all I can say about it is to show you by their effects how the good ones should be in their nature; and so by trial you will choose among those that come into your hands.’

Sculptors and founders used the materials they had at hand. The anonymous author of one manuscript (Ms. Fr. 640) expresses as much when he writes:

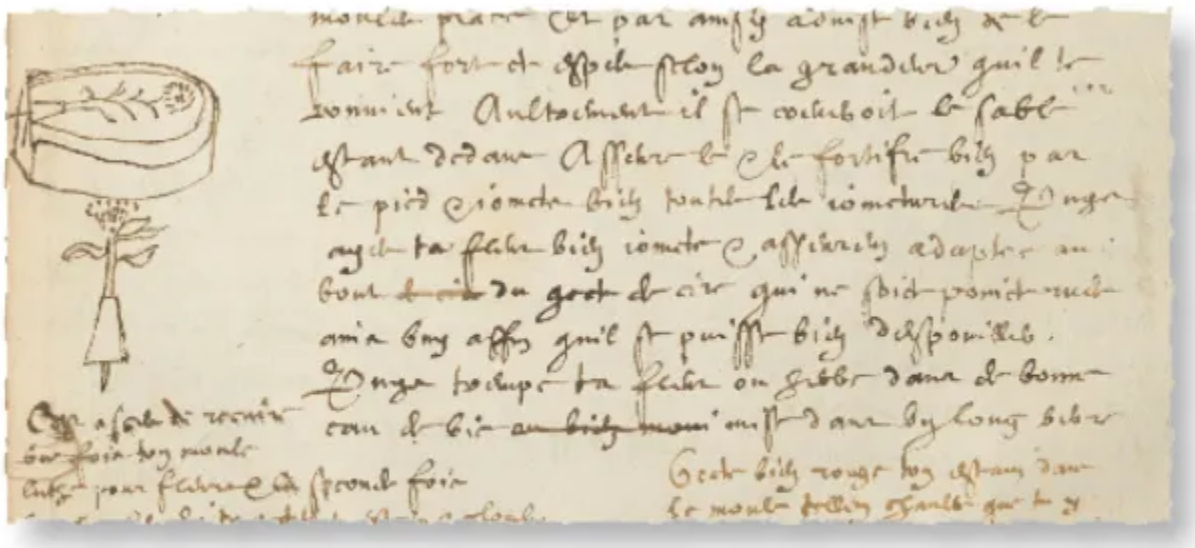
Artisans who work in large works & who need to further their profit by seeking things already prepared in nature, because she does not sell her wares to her children, and to also save the time they would use for grinding finely & for artificially preparing sands, seek the one of the quarry, which is not too fatty, the one that is a kin of earth, not too lean & consequently without bond, but rather that which is pulled from the depths of the sand-bed in bricks & clods that show its natural compaction, which is quite difficult to break & which has a very small & delicate grain, & which is found soft when handling it between the fingers.



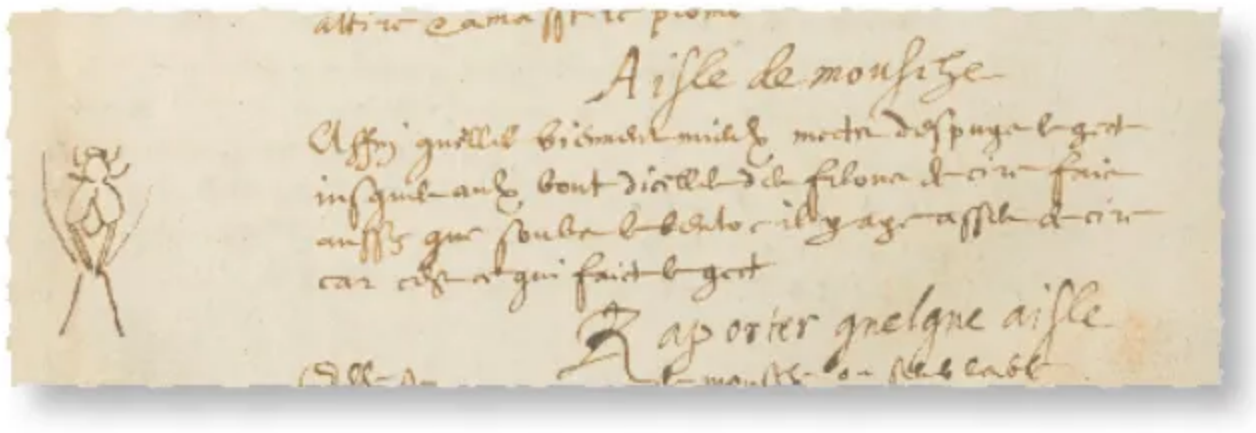
a lizard for life-casting in the 16th-century manuscript Bibliothèque Nationale de France Ms. Fr. 640 (fol.124v). The sketch shows the mould with metal entering a narrow section of the tail at the bottom of the drawing, with channels and vents shown as scored . The outline of the mould is indicated by the dashed line. The infrastructural elements would have been shaped with wax and melte time the lizard was removed or burned out to prepare the mould for casting.



a frog for life-casting (fol.143r). This information-rich drawing shows four channels branching off the gate, two entering the back c two entering the underside of the frog's feet, where balls of wax at the toes create void space when melted out to ensure air space l enters the small spaces of the toes.



Instructions on how to mould a flower for life-casting (fol.145v).



A diagram showing how to mould a fly for life-casting (fol. 165v).
Images: Bibliothèque Nationale de France, Paris. Source: *gallica.bnf.fr*

This passage demonstrates the observation and experiment needed to use non-standardised natural materials. How similar this trying and testing was to the methods of science is evident in Biringuccio's accounts of metalworking: 'It is necessary to find the true method by doing it again and again, always varying the procedure and then stopping at the best.' Biringuccio goes on, 'For this reason it is necessary to have a superabundance of tests, and to test and try enough to find the desired aid [to smelting], not only by using ordinary things but also by varying the quantities, adding now half the quantity of the ore and now an equal portion, now twice and now three times.'

The aim of this testing was to gain understanding of the innate, hidden powers of things. Biringuccio wrote that 'those things that have such inner powers, like herbs, fruits, roots, animals, precious stones, metals, or other stones, can be understood only through oft-repeated experience.' Such 'oft-repeated experience' enabled artisans to identify and employ nature's powers in transforming materials for human use, producing both material objects and knowledge of nature.

About a century later, life-casting was prized by Gottfried Wilhelm Leibniz (1646-1716) as a means to gain scientific knowledge of nature. He noted that the fossils could be explained by the technique of casting from life: 'I gladly

compare the secrets of nature with the visible works of men. [Goldsmiths] cover a spider or some other animal with suitable material, though leaving a small opening, they drive the animal's ashes out through the hole, and, finally, they pour silver in the same way. When the shell is removed, they uncover a silver animal, with its entire complement of feet, hairs, and fibres, which are wonderfully imitated.' For Leibniz, as for many other 17th-century natural philosophers, knowing nature had become synonymous with knowing how to imitate nature through human making. This was part of an ongoing process in which Aristotle's definition of knowing as knowledge of causes was transformed by a new understanding of knowing as human making.

rose created in a tin-lead alloy by Giulia Chiostrini and Jef Palframan, the Making and Knowing Project, according to processes des Fr. 640 (fols.155r and 155v), 2015. *Size:* c.*20cm*.
› Making and Knowing Project

While the technique of life-casting seems extraordinary today, it is perhaps more remarkable that it was recorded in writing in such detail. Writing things down seems second nature to us in a mostly literate society, yet the debate over the merit of the written word is as old as writing itself, and using the written word to convey the bodily knowledge of artisanal techniques was especially problematic. As we all know, we cannot learn to ride a bike through reading a written account of it. Indeed, many artisans expressed a distrust of writing, declaring – paradoxically in writing – that words were inadequate. The goldsmith and sculptor Benvenuto Cellini (1500-1571) wrote in the 1550s: 'How careful you have to be with this cannot be told in words alone – you'll have to learn that by experience.' More than a century later, after decades of published technical treatises had established the genre of 'how-to', the printer and mapmaker Joseph Moxon (1627-1691) wrote in his history of trades, Mechanick Exercises, that 'Craft of the Hand… cannot be taught by Words, but is only gained by Practise and Exercise.'

rait of Adam Kraft at the base of the monumental tabernacle he sculpted for the church of St Lorenz, Nuremberg, c.1493-1496. Such eflects the new assertiveness among urban craftspeople in the Renaissance. Image: Wikimedia Commons / Tilman2007 [CC by SA

Indeed, in the premodern workshop, 'practise and exercise' involved the

human body, which functioned as a tool for warming, blowing, handling, manipulating, sensing, tasting, and providing force and dexterity. The body was a source of materials used in manufacture – including urine, bones, blood, ear wax, and saliva. A recipe for soldering in one manual of art, for example, calls for the 'white thick saliva that is found on the teeth.' The human body also worked as a conceptual model for natural processes: the body's fermentation, digestion, and excretion provided a theoretical framework for material transformation in nature. And the quotidian stuff that sustained human growth – bread, butter, eggs, garlic – was employed daily in workshop practices. Furthermore, it was by means of the body and its gestures and techniques, learned through interaction with materials, that the embodied knowledge of craft was produced and reproduced, passed on from one generation to the next.

Craft recipes expressed measures in bodily terms, such as 'four drops of spittle' or 'two-fingers wide'. All five bodily senses were involved in craft: vitriol could be identified by its biting, astringent nature, while rock alum had 'a bitter taste with a certain unctuous saltiness'. Other measurements relied on hearing: 'You will recognise that they are dry enough when… they cry & crackle once brought near the ear.' In another process, 'if the tin cries loudly, it is a sign there is not enough lead. If it cries weakly, that means that there is too much.' The purity of tin was tested by biting to see whether it made cracking sounds, 'like that which water makes when it is frozen by cold.' Such bodily and sensory practices were a challenge to render in prose.

Even today, many turn to YouTube to learn hand techniques, for techniques take time and much practice. They necessitate communities of practitioners both to develop and define what constitutes skilled practice and to teach and transmit it. The relationship between writing and experience was and is fraught, and recognising this makes clear the significance of a craftsperson putting pen to paper to record shopfloor experience.

Despite such difficulties, texts of practical techniques, called 'books of art',

proliferated from about 1400, with many becoming bestsellers. The popularity of these texts both reflected and fostered a new interest in practical knowledge, which was key in one of the most significant transformations in the interaction of human beings with nature: the founding and growth of a 'new philosophy' that proclaimed a hands-on approach to gain knowledge of nature. What began in unceasing trials of the craft workshop ended in the experimentation of the natural scientific laboratory.

But why were such texts written and published if they could not efficiently instruct readers in 'how-to'? This is the motivating question of From Lived Experience to the Written Word, which examines many texts of practice, including the Making and Knowing Project's multiyear investigation of the 16th-century manuscript of artisanal techniques, Ms. Fr. 640.

The proliferation of such books betokens a new self-conscious assertiveness, especially among urban craftspeople, who experienced greater opportunities for literacy, particularly at the top of the guild hierarchy. Such writers had ambitions to be seen as practitioners of the liberal – rather than the sordid mechanical – arts. These books also responded to the needs of increasingly powerful territorial rulers for artisans who could produce weapons, build and outfit ships for trade, and create the artworks of luxurious noble-living that proclaimed political and cultural power in the rulers' new urban courts. Practitioners vied for these princely patrons' attention by writing texts to advertise their expertise. Noble courts, notorious sites of cut-throat competition, burgeoned in size and opulence at this time, and a book – for example, the ambitious Cellini's Two Treatises on Goldsmithing and Sculpture (1568) – proclaimed intellect and skill. Some texts sought to attract attention or investment to a trade, or to provide pleasure and diversion, while others were compilations put together by entrepreneurial printers responding to a lively market. In common with many books today that celebrate craft, texts on practice in the past also aimed to reform existing paradigms and hierarchies of knowledge and knowledge-making.

As for the readers of these books of practice, they came from many walks of life, such as collectors who desired more information about their objects or who wished to learn conversational vocabulary about them. Manufacturing and crafts were viewed as an important element of political economy as well, as centralised governments sought to extend their power over production and manufacture. But these books were appreciated, too, by monks, humanist scholars, reading and writing instructors, individuals seeking spiritual guidance, and by intellectual and pedagogical reformers.

Perhaps most significantly, these texts, like the collections of the Kunstkammer, fed a fascination with the processes of nature and the ability of humans to shape and manipulate natural materials by art. Moreover, many of the practitioners who penned such texts sought to articulate a powerfully productive way of knowing that required mind, hand, repeated practice, and the expertise to manage emerging processes in real time. Ultimately, by writing, these artisan authors sought to upend a social and intellectual hierarchy of mind over hand by asserting that intelligence is not held by the mind alone, but, instead, emerges from the work of the hand. Their works thus provide one account of that extremely complex amalgam of knowledge-in-practice and thinking-through-making that modern cognitive scientists study today.

- **From Lived Experience to the Written Word: reconstructing practical knowledge in the early modern world,** by Pamela Smith, is published by the University of Chicago Press (ISBN 978-0226818245; $35/£28).
- For more information about the **Making and Knowing Project,** visit www.makingandknowing.org.
- The 16th-century manuscript compilation of hundreds of artisanal techniques, along with accompanying essays, is available online as **Secrets of Craft and Nature in**

Renaissance France: a digital critical edition and English translation of BnF Ms. Fr. 640 at https://edition640.makingandknowing.org.

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