Introduction: Science and Connoisseurship in the European Enlightenment

A perfume merchant smells a piece of ambergris to check that it is the real thing. A general surveys the site of an upcoming battle. A physician describes the spleen of a deceased collector, noting its unusual triangular shape. A gem-cutter lets a stone slide through his fingers, using the greasiness of the stone to judge its quality. These activities took place in early modern Europe, and at first glance they might seem to have little in common. What do gemstone cutters have in common with physicians, and what possible connection might those two have with a general?

The answer lies in a set of practices known as "connoisseurship" in English, and "*connoissance*" in French. These terms emerged in Europe during the 17th and 18th centuries to refer to the act of making fine distinctions between material things with a view to determining their authenticity, identity, or quality. In turn, that activity has almost always aimed at the determination of value. Thus connoisseurs of art wanted to know whether paintings and drawings were authentic because their identification as coming from the hand of a great artist gave them both aesthetic and monetary value. But the discovery of value in works of art also involved forms of judgment that may seem highly subjective. A connoisseur may assign a value to a work of art because it is authentic, but they might judge it as authentic because they find it beautiful or pleasurable. In this special issue, we hope to show that such evaluations were fundamental to knowledge production in early modern Europe. In other words, we regard the ideas and practices associated with valuing material things – including valuations arising from apparently subjective feelings of beauty and pleasure – as central to the history of science. Connoisseurship is not the only actor's category that helps to understand these ideas and practices: "discernment," "judgment,"

and “assaying” are closely related categories. But connoisseurship was an especially broad category, going well beyond the fine arts and the social elite.

This intellectual agenda emerged from a pair of events examining early modern practices for authenticating and valuing material things: a double panel at the British Society for the History of Science Annual Conference at York in 2017; and a workshop at University College London in 2018. These events revealed that scholars in a wide range of fields, from art history, literary scholarship, and the history of science, increasingly seek to understand the place of supposedly subjective means of judging value in the sciences. Thus Elizabeth Swann discussed the erotics of the empirical sciences in 17th-century England, while Charlotte Guichard investigated the means used by French connoisseurs to turn the judgment of art into a stable, scientific system for attributing value. Meanwhile, Simon Werrett and Ardeta Gjikola both examined the social mechanisms by which people attributed value to objects, with Gjikola exploring the parliamentary inquiry into the value of the Parthenon marbles acquired by the Earl of Elgin, and Werrett considering the auction house as a setting for the negotiation of value. In addition, [redacted to preserve anonymity of contributors to this special issue] both explored the role of tacit knowledge and sensory practices used by early modern experts to determine the authenticity of precious substances, whether gemstones or perfumes. These examples, along with the other papers presented at the panels and workshop, give a sense of the breadth of scholarly interest that has now coalesced around connoisseurship. Rather than seeing it as concerned only with fine art and collecting, scholars are increasingly convinced that connoisseurship can tell us a lot about strategies for the production of knowledge during the long eighteenth century. In developing this theme further, we are indebted to all the contributions to the panel and workshop.

The four papers in this special issue address a tension that several of those participants identified as central not only to connoisseurship, but to the broader epistemological projects of 17th- and 18th-century Europe. On the one hand, it is well known that many thinkers wanted to make value into an object of calculation – something that could be determined by rational means, and perhaps expressed in logical or numerical terms. This view of the Enlightenment, well-established in the human sciences, is becoming increasingly common in the study of the natural sciences, from natural history to experimental physics. On the other hand, recent scholarship shows that many of the same thinkers were preoccupied by the role that feeling, intuition, and sensation might play in the formation of such value judgments. To take just one example, the English painter Jonathan Richardson (1667-1745) devised a technique for turning judgments about the beauty of paintings into numerical scores – scores that would facilitate comparison and ranking. But at the same time, he saw the consumption of art as akin to the consumption of food, recognizing that our perceptions of beauty sometimes arise instantaneously, without the involvement of a thought process that can be represented in rational or scientific terms.[1] In the first part of this introduction, we sketch out the increasingly important role that such subjective forms of judgment have played in recent accounts of eighteenth-century science. Where scholars – including historians of science – once characterized the European Enlightenment as a decisive shift towards cold-hearted rationality, they now recognize its preoccupation with the possibility that reason might be grounded in apparently irrational feelings such as pleasure and disgust.

[1] Carol Gibson-Wood, *Jonathan Richardson: Art Theorist of the English Enlightenment* (New Haven, 2000), 188-9. [citation redacted for anonymity]

How can historians of science understand this dual pursuit of rational evaluation and affective judgment? As argued in the second section of this introduction, we can take inspiration from the new history of connoisseurship, a movement in art history that has tackled a similar dualism in the history of the fine arts, especially painting. As argued in the third section, we can also expand on the work of historians of natural history, who are alert to the ways in which naturalists relied on a connoisseurial mixture of intuition and classificatory precision to identify and group together the species of natural things. We think these insights are ripe for application to a far wider range of activities than the term "connoisseurship" is usually associated with in the present day. Enlightenment connoisseurship was not simply the preserve of those who set themselves up as judges of artworks, curiosities, and fine comestibles. Connoisseurship was mobilized by a remarkably wide range of actors in pursuit of equally diverse forms of value, from the fitness of terrain for a military confrontation to the price of an authentic specimen of ambergris. The practice cut across disciplines, materials, and social groups in a way that is neatly captured by the French word "*connoissance*," as a close study of the history of that word will show. Together, the contributions to this special issue reveal just how important connoisseurship was as a mode of understanding in the European Enlightenment. In doing so, they bring together evaluation and subjectivity, two dimensions of early modern science that historians are only beginning to understand.

1. Reason and value

"If there is no accounting for tastes, that's news to the accountants." So wrote the historian and sociologist of science Steven Shapin in a provocative essay published in 2012. He had in mind a peculiar feature of late capitalism, namely the use of advanced scientific techniques to make judgements that most of us would normally think of as "aesthetic" or "subjective." An example is the Flavour Profile Method, a technique for measuring the amount of pleasure delivered to a given individual by a given item of food or drink. The method, Shapin explained, has its origins in the Second World War, when the US Army sought to make its innovative foodstuffs more palatable to the troops they were supposed to nourish. These methods soon made the leap from the military to business; they are now part of an "aesthetic-industrial complex" (Shapin's phrase) that includes food and beverage scientists as well as multinational companies. Shapin presented this example as part of a wider argument for a new approach to the study of science. So far, he argued, historians and sociologists of science have been concerned mainly with the deflation of objectivity. They have shown that science is a more mundane activity than it was once considered by scientists and philosophers of science. This project has drawn attention away from subjectivity, the flipside of objectivity. Our next task, then, is to inflate subjectivity—to show that there is more to it than social discipline, arbitrary preference, or random flashes of intuition. Subjective judgments are made up of material, literary and conceptual resources that resemble those of the natural sciences. Hence the title of Shapin's article: "The sciences of subjectivity."[2]

[2] Steven Shapin, "The Sciences of Subjectivity," *Social Studies of Science* 42, no. 2 (2012): 170-184.

It may not be immediately obvious how all this applies to the sciences of the European Enlightenment. After all, the distinction between "objectivity" and "subjectivity" only gained currency in European thought in the middle of nineteenth century.[3] In spite of this anachronism—perhaps because of it—the notion of subjective science does useful work for an earlier period. It serves as a shorthand for several recent trends in the historiography of European science in the period between the founding of the Royal Society of London (1660) and the abolition of the Académie Royale des Sciences (1793). These trends are usefully divided into those concerning the *means* of science and those concerning the *ends*. Regarding means, the trend has been to play up the role of affect in the methods and practices of the sciences. Passion, sentiment, taste, and pleasure—each has been identified as a key category for early naturalists, natural philosophers, and experimenters. The Enlightenment was filled with "sentimental empiricists," including Benjamin Franklin and Maximilien Robespierre, as Jessica Riskin argued in a book published in 2002.[4] Taste, both as a sensation and a source of knowledge, is the theme of Emma Spary's study of food in eighteenth-century France.[5] For an earlier period, Harold Cook argued that René Descartes placed the passions at the centre of his account of mind and body, partly due to his exposure to medicine and anatomy in the Dutch Republic. For Descartes, the passions were not just an aid to thought—they *were* thought.[6] Alexander Wragge-Morley has taken a similar view of the Fellows of the Royal Society of London, showing that the pleasures of beauty were integral to the work of obtaining knowledge through the senses, and thus to

[3] Lorraine Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007), 27-35.
[4] Jessica Riskin, *Science in the Age of Sensibility: The Sentimental Empiricists of the French Enlightenment* (Chicago University Press, 2002).
[5] Emma Spary, *Eating the Enlightenment: Food and the Sciences in Paris* (Chicago University Press, 2012).
[6] Harold Cook, *Matters of Exchange: Commerce, Medicine, and Science in the Dutch Golden Age* (Yale University Press, 2007), chap. 6.

their broader empirical project.[7] The Age of Reason, it seems, was also the Age of Affect. This is not to downplay the role of dispute and deliberation. On the contrary, affect appeals to these historians precisely because it generated such lively discussions. Judgments about the taste of coffee were tied to theories about the operations of the bowels; the sensation of a lightning strike was bound up with the debate about the possibility of innate ideas. Talk about affect led quickly into to talk about metaphysics, epistemology, aesthetics, and theology.

Subjectivity has also emerged as part of the *ends* of science. Evaluation, not just production, was the goal of naturalists, natural philosophers, and practical mathematicians. They aimed to determine the goodness of things, not just to make good things. Simon Schaffer's studies of the role of precision instruments in determining the value of gold (at the end of the seventeenth century) and air (at the end of the eighteenth) are exemplary.[8] William Ashworth has approached the topic from an institutional point of view, looking at techniques introduced by the British Board of Customs and Excise to determine the quality (and hence the tax value) of goods traded across the borders of the kingdom, especially spirits.[9] A similar story has been told for the Swedish Bureau of Mines, where metals rather than beverages were the materials under investigation.[10] In the history of medicine, a team

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[7] Alexander Wragge-Morley, *Aesthetic Science: Representing Nature in the Royal Society of London, 1650-1720* (Chicago University Press, 2020).

[8] Simon Schaffer, "Measuring Virtue: Eudiometry, Enlightenment, and Pneumatic Medicine," in *The Medical Enlightenment of the Eighteenth Century*, ed. Andrew Cunningham and Roger French (Cambridge: Cambridge University Press, 1990), 281–318. Simon Schaffer, "Golden Means: Assay Instruments and the Geography of Precision in the Guinea Trade," in *Instruments, Travel and Science: Itineraries of Precision from the Seventeenth to the Twentieth Century*, ed. H. Otto Sibum, Marie Noelle Bourguet, and Christian Licoppe (London: Routledge, 2003), 20-50.

[9] William Ashworth, "'Between the Trader and the Public': British Alcohol Standards and the Proof of Good Governance," *Technology and Culture* 42, no. 1 (2001): 27-50. William Ashworth, *Customs and Excise: Trade, Production, and Consumption in England, 1640-1845* (Oxford University Press, 2003).

[10] Hjalmar Fors, "Elements in the Melting Pot: Merging Chemistry, Assaying and Natural History, c. 1730-1760," *Osiris* 29 (2014): 230-44. Idem, *The Limits of Matter: Chemistry, Mining and*

led by Elaine Leong and Alisha Rankin has investigated judgments about medical remedies made across the medieval and early modern period. Drug testing was one of the drivers of early chemistry and anatomy, as the examples of the University of Leiden and the Académie Royale des Sciences show.[11] Food testing — the evaluation of the nutritional, medical and aesthetic qualities of food – is a major theme of Emma Spary's two books on food and the sciences in Enlightenment France.[12] The resemblance between these different lines of research has been obscured by the range of terms that are used to describe them: "testing" for drugs, "assaying" for metals, "quality control" for beverages and other taxed goods, "metrology" for practical measurement, "standardisation" for efforts to turn local evaluations into national or global ones. These are all forms of evaluation, but they are rarely studied together. They are usually studied with a view to linking science to one or other feature of the wider world, such as medicine, state-formation, global trade, or the handicrafts. They are often studied under the heading "production," as if evaluation is one aspect of production rather than a distinct (though complementary) practice. The result is that evaluation has become a major theme in the study of enlightenment science without anyone quite noticing.

What do these two sides of subjective science—the ends and the means—have in common? And what did they have in common with the Enlightenment? A short answer is

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Enlightenment (Chicago University Press, 2015). Charlotte A. Abney Salomon, "The Pocket Laboratory: The Blowpipe in Eighteenth-Century Swedish Chemistry," *Ambix* 66, no. 1 (2019): 1-22.

[11] Elaine Leong and Alisha Rankin, "Testing Drugs and Trying Cures: Experiment and Medicine in Medieval and Early Modern Europe," *Bulletin of the History of Medicine* 91, no. 2 (2017): 157-182. See also these papers in the same issue: Michael Bycroft, "Iatrochemistry and the Evaluation of Mineral Waters in France, 1600-1750," *ibid,* 303-330; Evan R. Ragland, "Experimental Clinical Medicine and Drug Action in Mid-Seventeenth-Century Leiden," *Bulletin of the History of Medicine* 91, no. 2 (2017): 331-361; Justin Rivest, "Testing Drugs and Attesting Cures: Pharmaceutical Monopolies and Military Contracts in Eighteenth-Century France," 362-390.

[12] Spary, *Eating the Enlightenment*. Idem, *Feeding France: New Sciences of Food, 1760–1815* (Cambridge University Press, 2012).

the rationalization of value. They all involve the application of reason to questions of value, whether by explaining how judgments are made or by finding better ways to make them. The rationalization of value is a familiar theme in the study of the Enlightenment. Reason was intended not just to make life better, but to decide what "better" meant. What was the utilitarian calculus but a device for measuring the quality of life? What was the Scottish Enlightenment but an attempt to grade societies according to their level of civilisation? It is not for nothing that the science of human nature was called "moral philosophy." It was a study of the way humans *are* that aimed to say what they *ought* to be. The principle of the association of ideas was a "logical" principle as well as a "psychological" one, to use a distinction that is familiar to us but alien to the eighteenth century. Similarly, the principle of utility was an ethical principle as well as a sociological one. What is true for the human sciences, we suggest, was also true for the natural sciences. The point is not simply that nature was normative in this period—that the naturalistic fallacy had not been invented yet, as Lorraine Daston has shown.[13] That thesis can easily slide into the idea that values were arrived at by a subterranean process. This is the thrust of Daston's discussion of Enlightenment natural history, where the emphasis lies on "regimens of experience…rather than proof and arguments."[14] We do not deny that Enlightenment natural history depended upon such regimens of experience. But we would also insist that Enlightenment thinkers sought to premise their evaluations on "proof and arguments." What we need to understand, therefore, is how Enlightenment thinkers integrated their regimes of experience into intellectual strategies for making value into an object of rational calculation.

[13] Lorraine Daston, "The Naturalistic Fallacy Is Modern," *Isis* 105, no. 3 (2014): 579-587.
[14] Idem, "Attention and the Values of Nature in the Enlightenment," in Lorraine Daston and Fernando Vidal, *The Moral Authority of Nature* (University of Chicago Press, 2003), 100-126.

Indeed, one might regard the increasingly complex aesthetic theories elaborated by thinkers from Baumgarten and Hutcheson to Burke and Kant as symptoms of the tension between those two tendencies. If philosophers of the Enlightenment wanted to turn value into an object of rational demonstration, they nevertheless recognised that our judgments of value often appear to emerge without any deliberation at all. Connoisseurship, we suggest, is a useful category for understanding this peculiar hybrid of rational evaluation and affective judgment. And to understand connoisseurship, historians of science must pay close attention to what their colleagues in art history are saying on the topic. As it happens, they have been saying a great deal about it in the last two decades.

2. The new history of connoisseurship

Recent histories of connoisseurship in the fine arts can be traced, appropriately enough, to a twentieth-century science of subjectivity: the use of physics and chemistry to determine the author of historic paintings and thereby to determine the value of those paintings.[15] Scientific connoisseurship, sometimes called "technical" connoisseurship, came of age in the Rembrandt Research Project. Began in 1968, and still in progress today, the project has the goal of compiling a complete and accurate catalogue of paintings done by Rembrandt. Dendrochronology, X-ray photographs, ultraviolet radiation, neutron activation autoradiographs, chemical analysis of paint samples—a volley of techniques was launched at the paintings in the hope of separating the works by Rembrandt from those by assistants,

[15] This paragraph summarises Anna Tummers, *The Eye of the Connoisseur: Authenticating Paintings by Rembrandt and his Contemporaries* (Amsterdam University Press, 2011), 39-57.

copyists, and forgers. The results were underwhelming. Scientific connoisseurship, however useful for distinguishing seventeenth-century works from modern forgeries, turned out to be less useful for distinguishing a range of seventeenth-century works from each other. Which works were by Rembrandt himself, which by his assistants? Which, if any, showed the hands of both Rembrandt and one or more assistants? Among the copies, were these all done by assistants, or were some by Rembrandt himself, perhaps on commission? Were poor paintings inauthentic, or were they "Monday morning paintings" by the master? Paintings done in an unusual style, or with eccentric materials, posed another problem. These could be marks of inauthenticity—or of the evolution of Rembrandt's style. These were historical questions as much as scientific ones. They called for studies of style, authorship and originality, not as we understand them today but as they were understood by Rembrandt and his contemporaries. These questions became an integral part of the Rembrandt Research Project from 1990, when the historian of early modern art Ernst van de Wetering took charge of the project. The resulting mixture of scientific and historical methods has since been called "the new connoisseurship" (*le nouveau connoisseurship*).[16]

The new connoisseurship has been followed by a new *history* of connoisseurship.[17] This history has its roots in the history of ideas[18], contextual art history[19], Italian

[16] Charlotte Guichard, "Du « nouveau connoisseurship » à l'histoire de l'art: Original et autographie en peinture," *Annales: Histoire, Sciences Sociales* 65, no. 6 (2010): 1387-1401.
[17] We have not come across the phrase "new history of connoisseurship" in print before, but it seems an appropriate label for the works summarised in this paragraph, which is heavily indebted to the surveys in Charlotte Guichard, "Original et autographie"; and idem, "Les formes de l'expertise artistique en Europe (XIVe –XVIIIe siècle)," *Revue de Synthèse* 132, no. 1 (2011), 1-11.
[18] Carol Gibson-Wood, *Studies in the Theory of Connoisseurship from Vasari to Morelli* (New York and London: Garland Publishers, 1988) was a key early work on the intellectual history of connoisseurship.
[19] Svetlana Alpers referred to "circumstantial" art history in her influential *The Art of Describing: Dutch Art in the Seventeenth Century* (University of Chicago Press, 1983), xxiv. Alpers went on to apply this approach to the history of connoisseurship in her *Rembrandt's Enterprise: The Studio and the Market* (University of Chicago Press, 1988).

microhistory[20], and French literary theory[21], as well as in the attempt to apply physics and chemistry to the authentication of artworks. In the last two decades, these strands have been woven into an ambitious account of the long-term evolution of the practice of authenticating paintings. The unifying idea of this literature is that connoisseurship is a recent invention. Modern connoisseurship relies on a correspondence between an artist, a style, and an oeuvre. It assumes that there are a set of paintings that were made entirely by Rembrandt, for example, and that these paintings can be identified as Rembrandts through painterly characteristics that are common to all the paintings in the set. The achievement of the new historians of connoisseurship has been to historicise these assumptions—to study their emergence over time, to link them to related concepts such as authenticity and originality, and to anchor them in wider changes in social, political, economic and intellectual history.

It turns out that the phenomena uncovered in the Rembrandt Research Project, such as copies made by Rembrandt himself and joint works that bore Rembrandt's signature, were widespread in early modern Europe. They were routine in Renaissance Italy, for example, where the signature on a painting was understood to refer to the workshop overseen by the signer, not to the signer themselves. The first handbooks on the attribution of paintings appeared in the seventeenth century, but even then the notion of attribution had a premodern twist. The aim was not to show that a work was painted *entirely* by

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[20] Carlo Ginzberg, *The Cheese and the Worms: the Cosmos of a Sixteenth-Century Miller* (Johns Hopkins University Press, 1980). Carlo Ginzberg, trans. Anna Davin, "Morelli, Freud and Sherlock Holmes: Clues and Scientific Method," *History Workshop* 9 (1980): 5-36. The former work epitomised Italian microhistory; the latter applied this approach to connoisseurship in the fine arts, among other activities.

[21] Roland Barthes' 1967 essay announcing the "death of the author" prompted similar reflections on the identity of the artist: Charlotte Guichard, "Qu'est-ce qu'une oeuvre originale?", *in De l'authenticité: une histoire des valeurs de l'art (XVIe-XXe siècle)*, ed. Charlotte Guichard (Paris: Sorbonne, 2014), 11-17.

Rembrandt or Poussin, for instance, but only to show that the *most important parts* of the work (the faces in portraits, for example) were painted by them. Only in the eighteenth century did the equation between artist, style and oeuvre start to make sense. This equation was clearly stated by the English painter Jonathan Richardson in a series of works published early in the century. The equation became a commercial reality later in the same century, when a new class of art merchants set themselves up as experts in the attribution of the paintings they bought and sold. Early in the nineteenth century, the same equation was institutionalised in national museums and galleries, which employed a new sort of art expert to determine the "authenticity" of their expensive holdings. This set the stage for the codification of the art of attribution in the decades around 1900, a task associated with the Italian Giovanni Morelli and the American Bernard Berenson.

This story is usually told, as we have told it, as a prehistory of modern connoisseurship. But it is also a story about the rationalization of value in the Enlightenment. Familiar forms of Enlightenment reason were brought to bear on the problem of determining the value of paintings. Jonathan Richardson couched his advice in the language of "distinct ideas" and "nice distinctions," notions that he borrowed from John Locke's *Essay Concerning Human Understanding,* as Carol Gibson-Wood argued in a chapter entitled "the rationalization of connoisseurship."[22] In France, the *Catalogue raisonné* emerged as the standard literary genre for describing artworks that were up for sale at public auction.[23] The salon was adapted to the world of painting in 1751, when the first *Salon de peinture* was held at the Louvre under the aegis of the Académie Royale de

[22] Gibson-Wood, *Jonathan Richardson*, chap. 5.
[23] Krzysztof Pomian, *Collectors and Curiosities: Paris and Venice 1500-1800* (Cambridge, UK: Polity Press, 1990), chap. 5.

Peinture.[24] Equally distinctive of Enlightenment connoisseurship was the kind of value to which reason was applied. This point is easy to miss in the new history of connoisseurship, with its emphasis on the equation of style, artist and oeuvre.[25] From this point of view, Jonathan Richardson differed little from his twentieth-century counterpart, Bernard Berenson, since they both endorsed this correspondence. Both writers were rationalizers—they both referred to connoisseurship as a "science." But they differed radically in the scope of their respective sciences. Richardson's science covered both quality and attribution, which he called "the goodness of a picture" and "the knowledge of hands" respectively. He went so far as to say that judgments of quality are *more* certain than judgments of authorship.[26] By contrast, Berenson's science covered attribution only. Quality was important to Berenson, both for its own sake and as a guide to attribution. But the study of quality belonged to "the art of connoisseurship," not "the science of connoisseurship," to use his terms. "Quality belongs to another region than that of science," he wrote. "It does not fall under the category of demonstrable things."[27] The English art historian W. G. Constable went even further, distinguishing the "objective" study of attribution from the rules of art criticism, and writing that the latter "all boil down to a feeling in the midriff."[28]

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[24] Charlotte Guichard, "Taste Communities: The Rise of the "Amateur" in Eighteenth-Century Paris," Eighteenth-Century Studies 45, no. 4 (2012), 519-547. This article summarises the argument of Guichard's *Les amateurs d'art à Paris au XVIIIe siècle* (Seyssel: Champ Vallon, 2008).

[25] The point has certainly been eloquently made: Guichard, "Les formes d'expertise," 6-9; Tummers, *The Eye of the Connoisseur*, chap. 6, esp. 185. It is usually secondary to the main point, however, and sometimes it is missing altogether, as in Peter C. Sutton, "Rembrandt and a Brief History of Connoisseurship," in *The Expert Versus the Object: Judging Fakes and False Attributions in the Visual Arts*, ed. Ronald D. Spencer and Eugene Victor Thaw (Oxford University Press, 2004), 29-38. Gibson-Wood discusses quality in several places in her *Theory of Connoisseurship*, but only insofar as quality bears upon attribution, which she uses (p. 6) as a synonym for connoisseurship.

[26] Gibson-Wood, *Jonathan Richardson*, 187-192, 205.

[27] Bernhard Berenson, "Rudiments of Connoisseurship," in his *The Study And Criticism Of Italian Art: Second Series* (London: George Bell and Sons, 1902), 111-48, on 148.

[28] William George Constable, *Art History and Connoisseurship: Their Scope and Method* (Cambridge University Press, 1938), 9-10, 72-3.

The spirit of Berenson and Constable lives on in today's scientific connoisseurs, who hope "provide a basis for attributions without taking the aesthetic quality of the art work into account," in the words of one practitioner.[29]

The contrast between Richardson and Berenson is a reminder that the distinction between subjectivity and objectivity was modern, not early modern; and that the distinction was made within the fine arts, not just between the fine arts and natural sciences.[30] Most importantly for our purposes, it suggests that eighteenth-century reasoners were unusually ambitious in their dealings with value.[31] They sought to rationalise value without devaluing it. Whether they succeeded is, of course, another question. The *Catalogue raisonné* may have begun as a guide to quality, but it became a guide to attribution over the course of the eighteenth century, due in no small part to the markets it helped to create.[32] This could reasonably taken as an example of what Max Horkheimer once called "the self-destructive tendency of Reason."[33] Nevertheless, the intention was there, whether in Richardson's writings, in the early *Catalogue raisonné*, or in the attempts by the Académie to rationalise good taste in the form of free, public exhibitions. Understanding the Enlightenment means understanding this effort to put value—in the richest sense of the term—on a rational footing. This in turn means asking what sort of reason was consistent with this project. To

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[29] Anna Tummers, *Eye of the Connoisseur*, 39.
[30] These are major themes in Daston and Galison, *Objectivity*.
[31] The denigration of quality among connoisseurs is usually traced to Morelli in the late nineteenth century or to Immanuel Kant in the late eighteenth century. Morelli is emphasised at Sutton, "Rembrandt and a Brief History of Connoisseurship," on 33; and Tummers, *Eye of the Connoisseur*, 39. Kant is emphasised at Tummers, *Eye of the Connoisseur*, 185. That said, Gibson-Wood's discussion of Antoine-Joseph Dezallier d'Argenville suggests that the process was already underway in the middle of the eighteenth century: *Theory of Connoisseurship*, chap. 6, esp. 72, 79, 92, 94.
[32] This trend is documented in Pomian, *Collectors and Curiosities*, chap. 5.
[33] Max Horkheimer, "Reason Against Itself: Some Remarks on the Enlightenment," in *Theory Culture Society* 10 (1993), 79-88, on 80. This essay was first published in 1947; it is a concise statement of the argument in Theodor Adorno and Max Horkheimer, *Dialectic of Enlightenment* (London, Verso Books, 1997), which was also first published in 1947.

take one example: Richardson argued for the certainty of quality judgments on the Lockean grounds that the qualities of a painting are immediately present to the senses of the connoisseur whereas the author of the painting is not immediately present. This argument makes assumptions about where knowledge comes from (the senses), what counts as experience (qualities as well as quantities), and where the beauty of a picture lies (in the picture).[34] Aesthetics, epistemology and metaphysics were all part of the rationalization of value. The new history of connoisseurship is a model of how to study this phenomenon in a precise and holistic way.

3. Natural history and beyond

We are not the first to look for connections between science, connoisseurship, and Enlightenment. Historians of natural history have led the way.[35] In an article published in 2000, Emma Spary made the case for the existence of "rococo readings of the book of nature" in Paris in the early eighteenth century.[36] Books on natural history, especially shells, shared aesthetic values such as symmetry and variety with the decorative arts of the period. Soon afterwards, Bettina Dietz and Thomas Nutz made a similar point about *collections* in

[34] This is a counter-example, in the aesthetic realm, to Horkheimer's suggestion that Locke's epistemology was incompatible with judgments of value. "One does not with impunity," Horkheimer wrote, "embrace Locke's theory of knowledge and at the same time side with Leibniz when it comes to ethical truth." Horkheimer, "Reason Against Itself," 82.

[35] There were also notable early contributions from art historians, such as: Alastair Laing, "French Ornamental Engravings and the Diffusion of the Rococo," in *Le stampe e la difusione delle immagini e degli stili, Atti de XXIV Congresso Internazionale di Storia dell'Arte* (1979), 109–27, on 114-17; and Gibson-Wood, *Theory of Connoisseurship*, 89-94.

[36] Emma Spary, "Rococo Readings of the Book of Nature," in Marina Frasca-Spada, Nicholas Jardine, and Emma Spary, *Books and the Sciences in History* (Cambridge University Press, 2000). See also Emma Spary, "Scientific Symmetries," *History of Science* 42 (2004): 1-46.

Paris over the whole of the eighteenth century, paying close attention to exchanges between art merchants, wealthy collectors, and members of the Académie Royale des Sciences.[37] Since then, Daniela Bleichmar has explored the different kinds of "visual expertise" that were involved in these communities, paying particular attention to the correspondence between different levels of expertise and different social groups, such as the *curieux* and the *amateur*.[38] Charlotte Guichard includes natural historians, their books and their collections, in her exhaustive study of the world of the *amateur* in eighteenth-century Paris.[39] Jonathan Simon has extended this kind of analysis to the mineral kingdom in a series of articles that link changes in collecting practices with the onset of the French Revolution.[40] Most recently, Sarah Easterby-Smith has extended the literature in two further directions—to plants and to Britain—in her study of plant traders on both sides of the channel in the latter part of the eighteenth century.[41] These authors, like the new historians of connoisseurship, show how affect and evaluation worked together in the production of knowledge,

Where these historians have gone, we suggest, others can follow. The theme of science and connoisseurship can be fruitfully applied to new subjects (such as spleens and

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[37] Bettina Dietz and Thomas Nutz, "Collections Curieuses: The Aesthetics of Curiosity and Elite Lifestyle in Eighteenth-Century Paris," *Eighteenth-Century Life* 29, no. 3 (2005): 44-75. Bettina Dietz, "Mobile Objects: the Space of Shells in Eighteenth-Century France," *The British Journal for the History of Science* 39 (2006): 363-382.

[38] Daniela Bleichmar, "Learning to Look: Visual Expertise across Art and Science in Eighteenth-Century France," *Eighteenth-Century Studies* 46, no. 1 (2012): 85-111

[39] See note 24, above.

[40] Jonathan Simon, "The Values of the Mineral Kingdom and the French Republic," in Donald Diana and Frank O'Gorman, *Ordering the World in the Eighteenth Century* (Basingstoke: Palgrave Macmillan, 2006), 163-189, cf. *idem*, "Taste, Order and Aesthetics," and "Mineralogy and Mineral Collections in 18th-Century France," *Endeavour* 26, no. 4 (2002): 132-136.

[41] Sarah Easterby-Smith, Cultivating Commerce: Cultures of Botany in Britain and France, 1760-1815 (Cambridge University Press, 2017). See also her "Selling Beautiful Knowledge: Amateurship, Botany and the Market-Place in Late Eighteenth-Century France," *Journal for Eighteenth-Century Studies* 36, no. 4 (2013): 531-43.

military terrain), to new communities (such as gem-cutters and perfume merchants) and to new senses (touch and taste, not just sight). This means overcoming three pervasive assumptions about the history of connoisseurship. One is that there is an affinity between connoisseurship and certain scientific disciplines (especially natural history, medicine and psychoanalysis) that does not hold for other scientific disciplines (such as experimental physics). Carlo Ginzburg enshrined this distinction in his article of 1980, where he connected connoisseurship to sciences that were historical, qualitative, and human-centred. Other sciences, he implied, have a radically different epistemology, one exemplified by the physics of Galileo. On the one side, there is "conjectural" knowledge; on the other, "Galilean" knowledge.[42] It must be said that this distinction is not entirely spurious. There is certainly a form of knowledge in which "tiny details provide the key to a deeper reality, inaccessible by other methods," to use Ginzburg's most precise definition of conjectural knowledge.[43] But this form of knowledge is not restricted to the human sciences, nor to qualitative ones, nor to historical ones. The litmus test in chemistry, no less than the Freudian analysis of language, involves the use of small, seemingly insignificant phenomena to understand a deeper reality—in the one case a set of invisible molecules, in the other a set of subconscious desires. Other examples are easy to generate. The use of light spectra to determine the composition of stars, of bubble chambers to determine the identity of subatomic particles, of crystallography to sort minerals into kinds—each of these satisfies the definition of conjectural knowledge just above.

Ginzburg appears to have been led astray by the distinction between the particular and the general: "scientific generalisation versus the particular" was the title of one section

[42] Ginzburg, "Morelli, Freud and Sherlock Holmes," esp. 15-16, 19-21, 23.
[43] Ibid, 12.

in his article. The idea that generality is characteristic of science may seem plausible, but it is hard to reconcile with the well-established thesis that particulars were at the heart of the reform of natural philosophy in the sixteenth and seventeenth centuries.[44] It is tempting to rescue Ginzburg's thesis by distinguishing between experimental and mathematical sciences, and by insisting that particulars mattered to the former but not to the latter. Ginzburg himself cited an article in which Thomas Kuhn distinguished between "classical" and "Baconian" sciences, where the former were mathematical in antiquity and the latter became mathematical only around 1800.[45] Kuhn's distinction has stood the test of time, but it does not help Ginzburg, since it places most of physics and chemistry (not just medicine and natural history) under the heading of qualitative science. In any case, a glance at art history shows that connoisseurship has no obvious hostility to quantification. Roger de Piles and Jonathan Richardson both published numerical scoring systems for paintings.[46] Morelli's own approach to connoisseurship—a paradigm case of conjectural knowledge, according to Ginzburg—was quantified by one of Morelli's followers in the twentieth century.[47] Galileo himself was involved in the quantification of one branch of connoisseurship when he designed an instrument for measuring the density, and hence the value, of precious stones.[48] This is not to say that quantification was always essential to connoisseurship—only that we should be wary of drawing a sharp distinction between qualitative sciences and

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[44] Lorraine Daston and Katharine Park, *Wonders and the Order of Nature, 1150-1750* (New York: Zone Books, 1998), chaps. 4, 5 and 6. Anthony Grafton and Nancy G. Siraisi, *Natural Particulars: Nature and the Disciplines in Renaissance Europe* (Cambridge, MA: MIT Press, 1999).

[45] Thomas Kuhn, "Mathematical Versus Experimental Traditions in the Development of Physical Science," *Journal of Interdisciplinary History* 7, no. 1 (1976): 1-31. Ginzburg cited (p. 33) the French version of this paper, published in 1975.

[46] Gibson-Wood, *Jonathan Richardson*, 188-9.

[47] This was the Dutch artist and art critic Maurits van Dantzig: Tummers, *Eye of the Connoisseur*, 34-5.

[48] Annibale Mottana, "Galileo as Gemmologist: The First Attempt in Europe at Scientifically Testing Gemstones," *The Journal of Gemmology* 34, no. 1 (2014): 24-31.

qualitative ones, or between the act of quantification and the act of qualification. Conjectural knowledge does exist, and it does matter. But it is a type of inference, not a set of disciplines.

The linguistic diversity of connoisseurship, no less than its disciplinary diversity, has been underestimated by historians. Modern students of the French language learn that the verb *connaître* refers to a very general kind of knowledge, one that includes any sort of acquaintance with any sort of object. Hence one might imagine that *connoisseur* had only a general meaning in eighteenth-century France, and that only the English version of the word referred to "a special sort of knowing, which was discernment in matters of taste," to quote Shapin's paper.[49] There is a grain of truth here, which is that knowledge-by-acquaintance was, and is, the main sense of *connoissance* for French speakers. "To have in the mind the idea or the image of a thing or a person" was the first definition offered of *connoistre* in the 1694 dictionary compiled by the Académie Française. This was still the first definition of *connaître* in the most recent edition of the dictionary, the only real difference being the replacement of the archaic "ois" with the modern "aî," a change that began in the eighteenth century and was in place by the time of the sixth edition in 1835. The general sense of the term was the one that Diderot and d'Alembert had in mind when they drew up a *Système figuré des connoissances humaines* for their famous encyclopaedia. The full title of their tree of knowledge implied that *connoissances humaines* was as broad as *entendement*, which was a translation of John Locke's "understanding," as the article CONNOISSANCE in the encyclopaedia makes clear.[50]

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[49] Shapin, "The Sciences of Subjectivity," 177-178.

[50] Jacques-Christophe Valmont de Bomare, *Minéralogie, ou Nouvelle exposition du règne minéral* (Paris, 1762), 1. *Dictionnaire de l'Académie Française* [first edition] (Paris, 1694), vol. 1, 232. *Dictionnaire de l'Académie Française* [sixth edition] (Paris, 1835), vol. 1, 379. *Dictionnaire de*

Yet the same authorities show that *connaître* and *connaissance* had a more specific usage that was most certainly bound up with taste and discernment. "*Il connoist bien les bons livres, les pierreries, les bons tableaux*," reads one of the examples of usage in the first edition of the Academy's dictionary. This implies that the ability to distinguish good books, gems and paintings from bad is one aspect of *connoistre*. This sense of the word becomes explicit later in the definition, where it is said that knowing a thing includes knowing how to judge it (*sçavoir bien en juger*), with gems, paintings, and poetry given as examples. The same dictionary gives a similar definition under *connoissance*, with gems and paintings as examples. The same two examples feature in the definition of *connoisseur*: "if you say that this diamond, or this quadruple, is good, you are no *connoisseur*; the great *connoisseurs* of paintings; I defer to the *connoisseurs*." All this suggests that the French *connoisseur*, far from lacking the specific sense of discernment in matters of taste, had that as its primary sense. Moreover, the very same sense was an aspect of *connoissance* and *connoistre*, even though the primary sense of those terms was the general one.[51] In other words, the boundary between knowledge-by-acquaintance on the one hand, and discernment-in-matters-of-taste on the other, was a fuzzy one. This is confirmed by French handbooks on connoisseurship from the period, where the word *connoissance* could reasonably be translated as "connoisseurship" or as "knowledge." The title of Roger de Piles' fundamental discussion of the topic, published in 1699, was *De la connoissance des tableaux*.[52] Piles

l'Académie Française [eighth edition] (Paris: Hachette, 1932-1935), vol. 1, 282. Anonymous, "CONNOISSANCE," Denis Diderot and Jean le Rond d'Alembert, *Encyclopédie*, vol. 3 (1753), 889-898.

[51] Later editions of the Academy's dictionary corroborate this; they also add other senses (*discerner, distinguer, sentir, éprouver*) that suggest a link between connoisseurship and the making of fine distinctions between things through physical interaction with them.

[52] Roger de Piles, "De la connoissance des tableaux," in his *Abrégé de la vie des peintres*, 2nd edition (Paris, 1715), 91-104. The first edition of the work appeared in 1699. On the importance of this text, see Gibson-Wood, *Theory of Connoisseurship*, chap. 5, esp. 60. Note also the title of Piles' earlier work, *Conversations sur la connoissance de la peinture* (Paris, 1677).

explained that there were three parts of the *connoissance des tableaux*, namely judgments of quality, author and originality.[53] In other writings, Piles moved easily between the word *connoissance* and the word *connoisseur*.[54] The same applies to Piles' eighteenth-century successor, Antoine-Joseph Dezallier d'Argenville.[55] Knowledge and connoisseurship were closely related in the French language, even if they appear distinct in the English one. They were equally closely related in English *philosophy*, at least in the philosophy of John Locke and in the work of his eighteenth-century follower, the painter and art theorist Jonathan Richardson. The ability to "nicely distinguish one thing from another, where there is the least difference between them," was the essence of all knowledge for Locke.[56] It was also the essence of art connoisseurship for Richardson, whose *Argument in Behalf of the Science of a Connoisseur* (1719) was one of the very first uses of word "connoisseur" in English.[57]

The sociological breadth of connoisseurship in Enlightenment Europe also needs emphasising. Today the word "connoisseur" is often associated with the social elite, those who have the leisure and resources to devote themselves to the study of historically significant paintings.[58] In the eighteenth century, the word *amateur* had similar

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[53] Piles, "De la connoissance des tableaux," 91-2.
[54] For example: Piles, *Conversations sur la connoissance de la peinture*, 3-26.
[55] Antoine-Joseph Dezallier d'Argenville, "Discours préliminaire sur la connoissance des desseins et des tableaux," in *Abrégé de la vie des plus fameux peintres*, 2nd edition (Paris, 1762), xxxi-lxxx. The work was first published in 1745-52. Note the three types of *connoissance des desseins* (xlvi) and three types of *connoissance des tableaux* (lxv). The word *connoissance* occurs much more often than the word *connoisseur* in this text, though the latter occurs at least once (lxx).
[56] Gibson-Wood, 185, citing John Locke, *Essay Concerning Human Understanding*, II.xi.1.
[57] *Oxford English Dictionary*, s.v. "connoisseur," gives this work as the earliest example of the word. But there was at least one earlier example, by Bernard Mandeville in 1714: Brian Cowan, "An Open Elite: The Peculiarities of Connoisseurship in Early Modern England," *Modern Intellectual History* 1, no. 2 (2004): 151-183, on 151. The earliest example of "connoisseurship" given by the OED is from 1753.
[58] The correctness of this association is a matter of dispute among art historians, as illustrated by Bendor Grosvenor, "When Art History Goes Wrong," *Art History News*, August 22, 2012, https://www.arthistorynews.com, accessed February 2021. There has also been talk of "the democratization of connoisseurship" and "hipster connoisseurship": Bendor Grosvenor, "The Case for Old-fashioned Connoisseurship," *The Art Newspaper*, 5 June 2014,

connotations. As Charlotte Guichard has shown, the term emerged in Paris in the middle of the century to denote a small group of collectors who were associated with Académie Royale de Peinture and who prided themselves on their superior taste.[59] But we should not confuse the social role of the *amateur* with that of the *connoisseur*. In England, Richardson was a painter who associated connoisseurship with the rationality of the middle classes as opposed to the authority of the nobility.[60] In France, the *Encyclopédie* of Denis Diderot and Jean le Rond d'Alembert distinguished between the *amateur*, who has a pronounced taste for painting, and the *connoisseur*, who makes sure judgments about paintings. The *amateur* need not be a painter himself, the article continued; yet the best *connoisseurs* are painters.[61] The author of this article implied that the word *connoisseur* could be used for any of the fine arts, with music, painting, and literature as examples. The word had an even broader meaning in French commerce, where a *bon connoisseur* was a merchant or artisan who made sound judgments about the quality and identity of goods, such as paper or textiles.[62] Even animals could be connoisseurs. In the *Encyclopédie*, under the article "Connoître," one learns that the term could be applied to horses. A horse who has a delicate sense of the demands of the rider was said to know (*connoît*) the spurs and bridle.[63] The social breadth of connoisseurship—like the disciplinary and linguistic breadth of the

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http://old.theartnewspaper.com, accessed August 2016; and Ben Davis, "Connoisseurship and Critique," in *e-flux* 72 (2016), https://www.e-flux.com, accessed August 2016.

[59] Guichard, "Taste Communities," esp. 522-6. The migration of the term into English from the 1770s is documented in Sarah Easterby-Smith, *Cultivating Commerce*, chap. 3.

[60] Gibson-Wood, *Jonathan Richardson*, 20, 179.

[61] Paul Landois, "Connoisseur," in Denis Diderot and Jean le Rond d'Alembert, *Encyclopédie*, vol. 3 (1753), 898. See also Easterby-Smith, *Cultivating Commerce*, 81.

[62] Yves-Jean Grenier, "Une économie de l'identification: juste prix et ordre des marchandises dans l'Ancien Régime," in Alessandro Stanziani, *La qualité des produits en France (XVIIIe-XIXe siècles)* (Paris: Belin, 2003), 25-53, on 42-6.

[63] Marc Antoine Eidous, "Connoître," in Diderot and d'Alembert, *Encyclopédie*, vol. 3 (1753), 898.

practice—is easy to underestimate. This breadth opens up the possibility of generalising the insights of the art historians and historians of natural history discussed above. The union of rational evaluation and affective judgment was a general feature of Enlightenment knowledge.

4. Outline of the papers

Taken together, the four following papers demonstrate the social and disciplinary diversity of connoisseurship, revealing that early modern people used connoisseurial practices in fields of activity far removed from the fine arts with which they are still commonly associated. Thus [redacted] examines the role of connoisseurship in military strategy and decision making in 18th-century Prussia, while in their respective papers [redacted] and [redacted] examine its role in obtaining knowledge about valuable substances – gemstones and ambergris – in Western Europe during the 17th and 18th centuries. Meanwhile, [redacted] reveals that the connoisseurship of art objects and curiosities had an important bearing on the production of medical knowledge in 18th-century London. In addition, the papers respond to the methodological challenges that arise from integrating connoisseurial practices into the history of knowledge. Although the solutions we propose are different, they have one thing in common. Each paper uses connoisseurship to look beyond the objective-subjective division, resisting the still deeply-ingrained tendency to distinguish sharply between the "soft" sciences of evaluation and the "hard" sciences of calculation and quantification. Instead, they reveal that while the historical actors recognized the potential for tension between these forms of evaluation, they nevertheless devoted much effort to

the task of integrating them. Like artists such as Richardson, who sought to quantify the experience of beauty, a wide range of early modern thinkers and practitioners found ways to integrate the objective and subjective in ways that do not make sense when judged according to standards that emerged later on, in the 19th and 20th centuries.

[Redacted]'s paper makes this case by examining the place of subjective judgments in the military practices of the 18th century. As [redacted] notes, historians of warfare in the 18th century have emphasized the emergence of military science, discussing the attempts made by military theorists and pedagogues to impose order on matters such as the manoeuvring of troops and the targeting of artillery. Using the Prussian army's campaign against the Russians in summer 1758 as his case study, Storring puts forward a powerful rejoinder to that narrative. It is true, he notes, that the 18th century witnessed a concerted effort to bring reason and calculation into the conduct of war. But [redacted] shows that the inability to accomplish this rationalization in practice led military commanders to rely instead on a kind of connoisseurship. Indeed, he shows that Frederick II – the Enlightened autocrat *par excellence* – continued to see war as a matter of chance, to be won as much through intuition and risk-taking as rational calculation. Moreover, he shows that military theorists mobilized the language of *connaissance* in strikingly different ways. Where theorists encouraged commanders to thoroughly study the terrain of the battlefield, Frederick spoke of the need to intuitively grasp the lie of the land through a *coup d'oeil*, rapidly intuiting its likely implications for his next move. In other words, he regarded military science as useful but ultimately believed that only a connoisseur could determine the military value of the landscape – at least with the rapidity needed for that determination to be relevant.

Attempts to make the conduct of war into a matter of rational calculation, therefore, frequently gave way to the need to rely on rapid, subjective forms of judgment.

Meanwhile, [redacted] examines the connections between art connoisseurship and medical expertise in 18th-century London. Although it is well-known that the leading physicians at work in London during the first half of the 18th century were closely involved with the emerging market for paintings and prints, the reasons why they persistently invoked their expertise as art connoisseurs in disputes about the causes and cures of disease have remained obscure. Using satirical pamphlets exchanged between warring parties of physicians as his starting-point, [redacted] shows that the key point of contact between those two fields of knowledge was the fraught relationship between the soul and body. In other words, disputes about both the value of art and the causes of disease hinged on more widely diffused anxieties about the possibility that the body's animal impulses – including its embodied appetites – might prevent the immaterial, rational soul from exercising independent judgments about causation and value. In other words, he argues that, in the early 18th century, medicine and connoisseurship were linked by a shared set of concerns about the difficulties intrinsic to a project that made the most refined judgments of value dependent on the very same organs responsible for stimulating the animal appetites of the lower body.

In the next paper, [redacted] makes a powerful case that historians today can use their own connoisseurship to understand Enlightenment practices for assessing both the authenticity and value of material things. She does so by exploring the tortured history of 17th- and 18th-century efforts to find a reliable means of distinguishing ambergris – a fragrant and waxy material produced in the gut of sperm whales – from its many counterfeits. So far, [redacted] points out, historians have focused largely on the ways in

which natural historians attempted to classify and describe ambergris's properties, excluding the work of artisans, perfumers, and merchants. But those hitherto overlooked agents often had a much bigger stake – a financial one – in determining the substance's authenticity, giving them a potent incentive to develop reliable strategies for figuring out whether or not they had the real thing. [redacted] therefore sets out to recover the connoisseurial practices used by those hitherto overlooked agents to assay ambergris. Moreover, she shows that we need to develop our own connoisseurship in order to fully appreciate what those artisans, perfumers, and merchants were up to. Drawing on her own experiences with the substance, along with the work of modern-day perfume chemists, [redacted] shows that historians can, and should, use connoisseurship as a tool of inquiry.

Finally, [redacted] makes an analogous case for the role of connoisseurship in mediating between craft, commerce, and science, principally in France. His example is precious stones, a subject that brings to light a group of craftspeople (gem-cutters), a sense (touch), and a form of knowledge (instruments and numbers) that are rarely covered in the existing literature on science and connoisseurship. In commerce, hardness was a key criterion for distinguishing between precious stones, especially between the high-quality varieties known as "Oriental" and their lower-quality counterparts, known as "Occidental." Gem-cutters were intimately acquainted with the hardness of gems because gems of different degrees of hardness responded differently to the tools used to grind, facet and polish them. Hardness was also central to treatises on "mineralogy," a term that acquired its modern meaning in the eighteenth century, namely a science dedicated to the classification of minerals of all kinds. The end of the century saw the first attempts to quantify hardness, culminating in the hardness scale described by the German mineralogist Friedrich Mohs in 1812 and the "sclerometer" invented by his compatriot in 1833. Bycroft shows that gem-

cutters lay behind both of these developments. The *rankings* of hardness used in the commercial realm merged into the *scale*s used in mineralogy. Cutters and mineralogists also shared a wider culture that included mineral collections, books, taxonomies, and key terms—including *connoissance*.

These last two papers neatly sum up our ambition for the history of connoisseurship. They both reveal that connoisseurship bridged the gap between the sciences of sensory evaluation and those of systematization and quantification. Our point, therefore, is not simply to repeat the now well-established observation that practitioners of the manual arts contributed in important ways to changes in how Europeans obtained knowledge about the natural world.[64] Our concern is not *that* such interactions happened, but *why* they happened. They happened because philosophers and artisans had a shared interest in evaluation, not just because they had a shared interest in production. The category of connoisseurship helps us to understand these evaluations for what they were—as a mixture of affect, practical experience, and explicit calculation. For example, as [redacted for anonymity] notes, the scales of hardness devised by mineralogists early in the 19th century brought together the manual skills of cutters and the numerical tables of practical mathematicians, both of which were geared towards ranking gems in order of beauty and price. We also suggest that new approaches may be required if scholars are to fully recognize the contribution of connoisseurship to the history of knowledge. Thus Christine

[64] An early statement of this view was Edgar Zilsel, "The Origins of William Gilbert's Scientific Method," *Journal of the History of Ideas* 2, no. 1 (1941): 1-32. A recent statement is Lissa Roberts, Simon Schaffer, and Peter Dear, eds., *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialisation* (Koninkliijke Nederlandse Akademie van Wetenschappen, 2007. See also Pamela Long, *Artisan/Practitioners and the Rise of the New Science, 1400-1600* (Oregon State University Press, 2011), including the summary of Zilsel's legacy for historians of science in chap. 1.

Griffiths uses her own reconstructions of early modern assaying techniques to understand how merchants used the senses to test the authenticity of purported ambergris. In so doing, she builds on an exciting new field of scholarship—exemplified by the Making and Knowing Project at Columbia University—that mobilizes material reconstructions to recover the non-textual record of early modern epistemic practices. Such projects raise difficult questions about the role that evidence emerging from the subjective experiences of present-day historians can play in our own attempts to produce knowledge about the past. In this way, such projects reflect the ambiguity at the heart of connoisseurship. We want to make sense of material things, but remain discomfited by the recognition that this seems to require subjective forms of evaluation.