THE LOST “ART” OF THE PATENT SYSTEM

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Patent systems emerged in the early modern period of the West to incentivize development and dissemination of skills-based artisanal innovations. This approach appears to have been adopted by the Framers in drafting the Intellectual Property Clause. Only later, in the Industrial Revolution, did “science” and “technology” begin to displace “art” as the perceived object of the U.S. patent system. This was in large part because of the emergence of the concept of “technology” itself as science-based innovation in artisanal and mechanized production. The loss of an “art”-based concept of the patent system is arguably causing some of the confusion over the proper scope and nature of the patent system, especially with regard to upstream patenting. I argue that this loss is leading to over- and underinclusive senses of patent eligible subject matter as well as amnesia as to the long-standing importance of method patents. I offer suggestions on how to reorient the patent system back to a focus on (useful) “art.”

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I.  INTRODUCTION

Many modern commentators assume that the patent system originated to incentivize progress in science and technology. In the United States, this is often mistakenly attributed to the preamble of the Intellectual Property Clause of the Constitution (“IP Clause”): “Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.” Today it seems natural to infer that promoting the progress of science would be done through exclusive rights for inventors’ discoveries, while promoting the progress of “useful Arts” would be left to exclusive rights to authors for their writings (and somehow the other fine and entertainment arts as well). This raises some questions as to the latter rights—why “useful”

1. U.S. CONST. art. I, § 8, cl. 8 (emphasis added to show preamble).
arts and why only authors and writings? But the patents-for-science part seems straightforward enough. At the same time, fundamental art-based terminology of the patent system—prior art, person having ordinary skill in the art, state of the art—continues to this day, only to be shrugged off or ignored as a mere curiosity or vestige.2

The intellectual worldview in the West long distinguished the mechanical arts from both sciences and liberal arts (and later the fine arts). Patent systems emerged during the Renaissance to incentivize invention, disclosure, and commercialization of advances in the “useful” (i.e., practical, mechanical) arts. In the United States, Madison and the Framers likely relied in substantial part on the famous French Encyclopédie construction of “art” as artisanal skill to authorize Congress to grant exclusive rights to promote the progress of such skills.3 Similar to Hamilton’s views expressed in his Report on Manufactures, the Framers seemed to have viewed artisanal manufacture and commerce as an important area of development for the new U.S. economy.4

But the concept of “technology” as science-based artisanal innovation that emerged in the nineteenth century led Congress, courts, and commentators to focus on science-based inventions.5 While not asserting these as the only patent eligible inventions, the various cases and commentary coincided with a constriction of the term “art” to mean only the fine arts in popular usage.6 Thus, by the twentieth century the term “art” became complicated as a descriptor for patent eligible invention. Further, a sense that such inventions needed to be based in “technology” spread throughout the patent community. But this attitude may have contributed to the misplaced views among some mid-century Supreme Court justices that inventions had to not only be technology based but also represent significant advances in the sciences to be patent eligible.7 While this was an extreme position rejected by other justices, Congress, and commentators, the notion that patent eligible inventions must be technology based has become quite resilient, resulting in the supposed “technological arts” test that is sometimes still cited as a measure of patent eligibility.8

The problem is that a science or technology based patent system is both under and over inclusive for the sorts of inventions targeted quite

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4. Id. at 819—20.
5. See SEAN M. O’CONNOR, METHOD+OLOGY AND THE MEANS OF INNOVATION ch. 6 (forthcoming 2016).
6. See infra Part IV.
7. See id.
usefully by traditional patent systems. Innovations in the useful arts can occur serendipitously or through nonscientific trial and error. They require no knowledge or training in the natural sciences (although that can be helpful). At the same time, much innovation and discovery in the sciences was never viewed as patent eligible. In particular, “laws of nature” have long been held as a specific category judicially excluded from patent eligibility. Further, the emphasis on “arts” as human skills or methods was lost as industrialization turned the focus of manufacture from manual to machine. The resulting emphasis on machines, as well as on the manufactured artifacts and new compositions of matter themselves, accentuated the sense that patents were about incentivizing the progress of science and technology. I contend that the shift from “art” to “technology” (and, even worse, “science”) loses sight of critical parts of a well functioning patent system and blurs boundaries than can result in both a temptation for problematic “upstream” patenting of basic science research results and an improper bias against “nonscientific” artisanal innovation. Instead, I argue for a system that focuses once again on advances in the “useful arts.”

Part II of this Article examines the radical—but often overlooked—transformation of the term “art” in Western culture during the nineteenth and twentieth centuries. Part III shows the central role of the older skills concept of “art” in the development of patent systems from Renaissance Venice to early modern Britain and then to the IP Clause of the U.S. Constitution. Part IV then argues that the later recharacterization of patent systems as solely concerned with scientific and technological progress confused the scope and nature of patents. Part V suggests how to reorient the U.S. patent system to promote the progress of the “useful arts.” Part VI concludes.

II. THE TRANSFORMATION OF “ART” IN WESTERN CULTURE

When someone mentions art or the arts today, they usually mean the Fine Arts. This is an impoverished usage that obscures the central role that art(ifice)—any manipulation of physical or mental objects for

9. See Alice Corp. v. CLS Bank, 134 S. Ct. 2347, 2354 (2014) (citing Assoc. for Molecular Pathology v. Myriad Genetics, 133 S. Ct. 2107, 2116 (2013)).
10. Note the roots of manufacture as “manu” + “factor,” revealing its origins as a descriptor of manual human production. The term arose long before the Industrial Revolution and was used by Adam Smith and others to describe human production. It is one of the many linguistic ironies I explore here and elsewhere that this descriptor of human production flipped after the Industrial Revolution to primarily signify machine production in popular usage. Manufacture, N., OXFORD ENGLISH DICTIONARY ONLINE, http://www.oed.com/view/Entry/113769?isAdvanced=false&result=1&rskey=hxzol& (last visited July 29, 2015).
11. O’CONNOR, supra note 5, at ch. 4.
12. The traditional fine arts—as established by the late eighteenth century—include music, poetry, painting, sculpture, and architecture. See Paul Oskar Kristeller, The Modern System of the Arts: A Study in the History of Aesthetics (1), 12 J. HIST. IDEAS 496, 497 (1951). Today, however, the popular sense of “art”—and even the “fine arts”—often seems to include “minor” or “entertainment” arts such as film, photography, dance, and others.
practical ends—has played in Western history. The notion of the fine arts as a set of prestigious intuition-based activities related by aesthetics and creative self-expression did not even emerge until the eighteenth century. Before this, the visual fine arts (painting, sculpture, and architecture) were part of the mechanical arts which also included craft skills such as carpentry, masonry, and metallurgy, while music and poetry were part of the liberal arts. From the eighteenth until the twentieth century, these “fine arts” were referred to alternately as Art (with a capital A), the Fine Arts, or the Beaux Arts. The generic art signified any “artifice” produced by humans and thus not naturally occurring. The current popular notion of art as a fuzzy, mysterious, or intuitive talent is quite recent, and contrary to two millennia of usage in which art was only rational, rules-based methods for practical ends.14

A. The Roots of “Art” in “Techné”

The Latin art or ars is the origin of the modern English “art” and its cognates in other European languages. Ars itself was a translation of the Greek techné, which had been in use since the presocratics (c. 500 B.C.). Each techné focused on a particular expertise and goal (telos), although these could be broad and abstract, such as the production of food (the techné of geōrgia). Techné allowed man to control his environment and was mythologized in Greek stories such as Prometheus Bound.

Each techné must demonstrate five characteristics that focused on objective, rational, rule-based systems. Exactitude flowed from the preeminence the Greeks gave to “numbering” as one of the mythical gifts Prometheus gave to humans, Control also flowed from the Promethean myth and reflected the importance of human capabilities to order the natural environment for human survival. Reliability meant that the trained artisan would achieve more consistent results than the amateur. Teachability recognized that a test of mastery was whether the artisan could train others in the techné, as well as the obvious need for

13. See id. at 498.
14. For example, transforming wood into useful objects like furniture or manipulating mental objects like numbers to perform calculations.
15. O’CONNOR, supra note 5, at ch. 4 (citing OXFORD ENGLISH DICTIONARY (online ed. 2014)).
19. Id. at 19–56.
20. Id. at 39.
21. Id. at 33–34.
22. Id. at 45.
the *techné* to be transmitted to each new generation.\(^{23}\) *Certifiability* meant that the artisan must be able to document or demonstrate mastery of the *techné*.\(^{24}\)

While *techné* were valued over other craft skills that were nonrational or based on intuition only, they were still often relegated to low status individuals including slaves.\(^{25}\) To be in command of a *techné* was to not only have practical control of natural elements but to also possess a form of wisdom (*sophos*).\(^{26}\) The Latin form of *techné*—*arti*—serves as the root for many English words denoting human agency: *artificial*, *artifice*, *artifact*, *artist*, *artisan*, and *artisanal*.\(^{27}\) These contrasted with others, such as *nature* or *natural*, which denote actions in the world that occur without human intervention.\(^{28}\)

Plato adopted the presocratic *techné*, sharply contrasting it with the fuzzy, intuition-based activities we think of as the heart of the Fine Arts today.\(^{29}\) In fact, any such fuzziness and lack of rigorous rules were the antithesis of *techné*: the inspired poet has succumbed to “divine madness” and “goes out of his mind and his intellect is no longer with him” as he channels spirits or muses.\(^{30}\) But at times Plato seemed to conflate *techné* (as practical methods or “know-how”) with *epistemé* (as theoretical knowledge about the world or “knowledge that”).\(^{31}\)

Aristotle followed most of Plato’s version of *techné*.\(^{32}\) He clarified the determinate end, or *telos*, that a *techné* must have by distinguishing those where the means itself is the end (e.g., flute playing) from “produc-

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23. This criterion especially contrasts with the modern Romantic notion of *art* as largely unteachable. See, e.g., Kristeller, *supra* note 12, at 498 (“[W]hereas modern aesthetics stresses the fact that Art cannot be learned, and thus often becomes involved in the curious endeavor to teach the unteachable, the ancients always understood by Art something that can be taught and learned.”).


25. See Kristeller, *supra* note 12, at 502-03; Lloyd, *supra* note 17, at 259. For example, Plutarch states that Archimedes would not write about his significant mechanical inventions because he regarded the “work of an engineer and every art that ministers to the needs of life as ignoble or vulgar.” 5 PLUTARCH’S LIVES § 17.4, at 479 (Bernadotte Perrin trans., G.P. Putnam’s Sons ed., 1917).


30. Id. at 16-17.

31. *Epistemé* is often misleadingly translated as “science” or “scientific knowledge.” It is not synonymous with the modern sense of “Science.” Is it rather “knowledge” as opposed to “belief” or “opinion.” There are weak and strong versions of *epistemé*. See, e.g., Richard Parry, *Episteme and Techne*, *Stan. Encyclopedia Phil.* (Edward N. Zalta ed., June 22, 2014), http://plato.stanford.edu/entries/episteme-techne/. The strong version includes only statements that can be demonstrated to be necessarily true (such as logical or mathematical propositions deducible from axioms) or that we believe to be invariably true (such as “laws of nature”). The weak version can include contingently true statements based on inductive probabilities.

32. See Angier, *supra* note 26, at 36-41.
tive’’ arts where the means produce something else (e.g., brick making).33
Almost anything, including the practice of economics, could be a techné.34

Three aspects of Aristotle’s ethics outside of techné are relevant to the development of art. First, his “practical wisdom” (phrónēsis) was directed to all contingent things in the world. This is the province of art.35
By contrast, theoretical wisdom (sophia) is directed to the strictly necessary, eternal, and unchanging aspects of the world. While one can only change contingent things, this requires knowledge of the necessary and eternal (to know what is unchangeable).36

Second, and in part because of the preceding, Aristotle believed the contemplative life seeking sophia to be the highest calling.37 For better or worse, this emphasis on sophia over both phrónēsis and the production of poiesis of technai set a trajectory in the West that arguably slowed artisanal innovation by privileging liberal arts as activities fit for the free (libere) mind of high-status citizens over “illiberal” mechanical arts (banausiki technai, the vulgar, or visceral arts).38 Third, Aristotle’s doctrine of “habituation” for training ethical individuals was his “learn by doing” approach adapted from the apprenticeships of craftsmen: “[V]irtues we get by first exercising them . . . for the things we have to learn before we can do, we learn by doing.”39

Cicero provided the transition for the notion of techné art between the Ancient Greeks and the Middle Ages.40 As part of his mission to introduce his fellow Romans to Greek philosophy by translating major works into Latin, he used artes in place of techné.41 He also contributed

33. ARISTOTLE, NICOMACHEAN ETHICS I.i.1---3, eds. n.a (H. Rackham trans., Loeb Classical Library, Harvard Univ. Press 2d ed. 1934).
34. ANGIER, supra note 26, at 37 (“[A]s there are many . . . technai . . . their ends are also many; the end of the medical art is health, that of shipbuilding a vessel, that of strategy victory, that of economics wealth.”). Some translations of Aristotle appear to improperly read in modern notions of “arts” and “sciences.” For example, the Loeb Classical Library adds the terms “science” for medicine and “art” for shipbuilding in the preceding quote even though the original Greek has only the prefatory term technai as in Angier’s translation above, and does not include the terms techné or epistemé in any of the list items. ARISTOTLE, supra note 33, at I.i.3 (“[T]he end of the science of medicine is health, that of the art of shipbuilding a vessel, that of strategy victory, that of domestic economy wealth.”).
35. ANGIER, supra note 26, at 41.
36. ARISTOTLE, supra note 33, at VI.x.3--4. In modern times, this is captured in Reinhold Niebuhr’s Serenity Prayer: “God give us grace to accept with serenity the things that cannot be changed, courage to change the things that should be changed, and the wisdom to distinguish the one from the other.” THE ESSENTIAL REINHOLD NIEBUHR: SELECTED ESSAYS AND ADDRESSES xxiv (Robert MacAfee Brown ed., 1986).
37. See ANGIER, supra note 26, at 66--78. While happiness (eudaimonia) results from individuals performing their appointed functions (ergon), Aristotle may only have been speaking of craftsmen qua craftsmen, not as fully flourishing humans. Notwithstanding, this sense of satisfaction in fulfilling one’s function was given a modern gloss in the concept of flow. See generally Mihaly Csikszentmihalyi, FLOW: THE PSYCHOLOGY OF OPTIMAL EXPERIENCE (1990).
38. Kristeller, supra note 12, at 505; Parry, supra note 31. This debate continues in the tension between “pure” and “applied” science from the nineteenth century to the present. See Peter Dear, What is the History of Science the History of?, 96 Isis 390, 401--02 (2005).
39. ANGIER, supra note 26, at 106.
40. Parry, supra note 31.
41. See id.; Julia Annas, Introduction to MARCUS TULLIUS CICERO, ON MORAL ENDS ix (Julia Annas ed., Raphael Woolf trans., Cambridge Univ. Press 2001) (c. 45 B.C.E.) [hereinafter CICERO]. Artes was conveyed to both Modern English and Modern French from the Anglo-Norman, Old
an insight central to distinguishing the subject and the object of a field: “no [discipline can] be based on itself. There is always something external to it that it comprehends. . . . Thus, medicine is the art of health, navigation the art of steering a ship.”  

B. Classifications of the arts (and sciences)

The formal five Fine Arts of today—music, poetry, painting, sculpture, and architecture—were not linked in antiquity. 43 Music and poetry were part of the liberal arts, while the visual arts of painting, sculpture, and architecture were part of the mechanical arts. 44 At the same time, painting and sculpture were sometimes classed within the imitative arts. The Muses were said to inspire poetry, music, and dance, along the lines of Plato’s divine madness. 45 But much of poetry was also closely associated with rhetoric and logic. 46 Pythagorean mathematical music theory was considered epistemé. Aristotle had also distinguished the arts of necessity and the arts of pleasure, but the latter did not map onto the modern Fine Arts. 47 Our modern sense of “art” and “beauty” are quite different from those of the ancients, who had practical fields in mind for the former and a concept of moral good (not aesthetic value) for the latter. Modern writers commit the presentist error when their writings make it appear that the aesthetics-based Fine Arts concept existed in classical times. 48

A definitive set of seven liberal arts that formed the core of elementary learning arose in the late antiquity, consisting of grammar, rhetoric, dialectic, arithmetic, geometry, astronomy, and music. 49 Medicine and ar-

42. Cicero, supra note 41, at 123. While this translation uses “branch of knowledge,” I have replaced it with “discipline” to minimize the influence of the modern sensibility that will likely conflate “branch of knowledge” with “science.” Further, Cicero clearly is signifying “arts” here because his examples come from them. In *Episteme and Techne*, Parry goes even further by summarizing one point of this passage as “the art is different from its object.” Parry, supra note 31.

43. See Kristeller, supra note 12, at 489–506.

44. Id. at 507–08.

45. This included the improvisational or purely creative composition functions. Music is actually originally derived from the Greek μονσική and the Muses, and is originally a much broader term encompassing poetry and dance as well. Interestingly, there were no Muses for the visual arts in ancient times. These now-familiar visual arts Muses were instead created by the allegorists of the early Modern period. Id. at 501.

46. Poetry, as a variant on the Greek poiesis, was not limited to rhyming or other verse as it is today. Poiesis was the much broader concept of producing any entirely new thing in the world, closer to the broad definition of invention that includes the creation of new devices in language, logic, or mathematics (as well as of new machines or objects).

47. Kristeller, supra note 12, at 504.

48. The term “beauty” centered on moral good for the ancients, as in “beautiful habits of the soul and of beautiful cognitions.” Think of terms like beatify and beatific, related to saintly behavior. See id. at 499.

49. Martianus Capella’s florid fifth century book, *The Marriage of Philology and Mercury*, became the standard text for teaching the liberal arts through the Middle Ages. See William Harris Stahl, *I MARTIANUS CAPELLA AND THE SEVEN LIBERAL ARTS* (Columbia Univ. Press 1971). Capella’s system was based in part on earlier work by Marcus Terentius Varro—especially the *Nine Books of Disciplines* that included all seven liberal arts plus medicine and architecture. Id.
architecture straddled the line between liberal arts and mechanical arts, but increasingly were left out of the formal liberal arts because they were often practiced by slaves or low status men. In the tumultuous times after the fall of Rome, the liberal arts became the sole curriculum for the remaining monastic schools, where they were sometimes referred to as sciences as well. This does not mean that “art” and “science” were interchangeable in the medieval period, but rather signaled the emergence of a consensus on the complementary nature of the two concepts as between when a field was studied as subject or object. When practiced to achieve practical ends, it was a subject and an art. When contemplated as part of systematic study, it was an object and a science.

The Middle Ages brought about marked changes in the study and classification of arts and sciences. After Charlemagne consolidated power in significant parts of Western Europe, relative order and stability were restored and basic education became more widespread again as cathedral schools were established in major towns and cities. The liberal arts were split into the Trivium (grammar, rhetoric, dialectic) and Quadrivium (arithmetic, geometry, astronomy, and music). Reinvigorating higher studies, Aristotle’s writings and important Islamic commentaries on them were reintroduced to the West from the Byzantine and Islamic East in the twelfth and thirteenth centuries. This also led scholars to revise the liberal arts to accommodate Aristotle’s philosophy (logic, ethics, and physics) and divisions of knowledge. This in turn coincided with the emergence of universities as an entirely new kind of educational structure, where natural philosophy, medicine, jurisprudence, and theology were studied and taught beyond the basic liberal arts (which then returned to their earlier status as elementary studies). Hugo of St. Victor introduced a scheme of seven mechanical arts, corresponding to the seven liberal arts, that consisted of lanificium (the working and weaving of wool); armatura (making arms and armor); navigatio (navigation); agricultura (agriculture); venatio (hunting); medicina (medicine); and theatrica (theatre or drama). However, these were not taught within the universities. Architecture, sculpture, and painting were listed as subdivi-

50. Kristeller, supra note 12, at 504.
51. Id. at 507.
52. This mapped the pre-Scientific Revolution sense of *science* as any kind of systematic study of human activity or natural phenomena.
54. Grant, supra note 53, at 43.
55. See id. at 42–49; Hannam, supra note 53, at 75. In fact the first university, at Bologna, was exclusively a school of law. See Hannam, supra note 53, at 74–75.
56. See Kristeller, supra note 12, at 507.
57. This is curious because the origin of the universities was as an adaptation of the universitas (the “whole” or “entirety”) denoting the collection of all artisans practicing a certain art/trade within a free city for academics. See Grant, supra note 53, at 34–36.
sions, or lesser arts (alternately minor arts), within the mechanical art of armatura.58

Traditionally illiterate artisans began receiving basic education such that they could write descriptive accounts of their art.59 The rise of the monastic traditions and their emphasis on artisanal activities provided another source of literate artisans. An example of this was the twelfth century Benedictine monk Theophilus. His treatise On Divers Arts gave a comprehensive treatment of the manner of preparing materials and working them into various artifacts.60 Theophilus did not provide a set of principles for each art that might qualify it as a techné, however, but instead related only the practical techniques to be used (similar to the ancient Greek technémata).61 In the English translation of this work, Theophilus refers to these mechanical arts as “useful arts,” while emphasizing the virtue that could come from their skillful practice.62

By the end of the Middle Ages, art lost its techné sense and denoted any skills or techniques used to manipulate mental or physical objects, essentially just signifying any human artifice.63 The term artista came into use to designate any craftsman or the student of liberal arts.64 Thomas Aquinas and other major thinkers were interested in the arts but focused mainly on theology and philosophy instead.65 “Beauty” continued to signify moral worth as there was no independent or secular aesthetic theory for objects or processes that were simply pleasing to humans.66

Yet even as art reduced to mere craft—the ability to “do” even in the absence of a theoretical framework—the medieval guild system emerged to introduce some degree of rigor and control.67 The guilds employed a version of Aristotle’s “practice-then-theory” education model. Their origins are murky, and they had a complicated relationship with the city in which they operated.68

58. The visual arts remained in the artisan’s guilds. Painters were often associated with druggists who prepared the paints; sculptors with goldsmiths, and architects with masons and carpenters. See Kristeller, supra note 12, at 507–08.
61. Twentieth century translators/editors of the Treatise interchangeably refer to the work as describing art and technology. Id. at xxv–xxx. But neither the term nor concept technology existed during the period in which Theophilus wrote. More importantly, there was no hint of our modern sense of a scientific approach or knowledge in Theophilus’ treatise. However, he was very much engaged in the older sense of “science” as systematic study (often codified in treatises).
62. It is rewarding “to give one’s attention to the practice of the various useful arts.” Id. at 47; see also Long, supra note 59, at 86.
63. See Kristeller, supra note 12, at 508.
64. See id.
65. For Aquinas, a wide range of activities were included in the arts, such as shoemaking, cooking, and juggling. See id. at 508–09.
66. See id. at 499.
68. See Satya Datta, Women and Men in Early Modern Venice: Reassessing History 45 (2003); Richard J. Gov, Venetian Vernacular Architecture: Traditional Housing in the Venetian Lagoon 91–99 (1989); Francesca Trivellato, Guilds, Technology, and Economic
local government, and in others they were the corporation that constitu-
ted the government.69 They were clearly tied to the rise of urbanism in the
eleventh and twelfth centuries and, in this regard, may have been a
mechanism for self-preservation of artisans liberated from feudal man-
ors.70

To the extent guilds controlled artisanal know-how and innovation,
they could provide members a kind of collective bargaining mechanism
against feudal lords.71 Acting in tandem with the rising merchant class
to create new communities and governance structures, the guilds created
“free cities” that could exist outside of the feudal system.72 But the im-
portance of controlling know-how led to obsessive levels of secrecy.73 The
guilds’ power in local government also allowed them to enact positive
law codifying their de facto monopolies of the various arts and use the
police powers of the state for enforcement.74

A prime example of this was the Venetian glassmakers.75 Their guild
was an administrative unit of the government structured as a corporate
entity.76 This gave it some rights of legal personhood, such as the right to
hold property and appear in court.77 But the corporate form also required
shared governance by its members. At the same time, the guild was un-
der the control of a magistracy chosen by, and representative of, the
commune of Venice.78 It included the guild proper (the arte) and a reli-
gious or educational component (the scuola).79 Guild members were re-
quired to hear governing regulations every year that controlled a wide
range of glassmaking aspects from what wood could be used in the fur-

69. The emergence of the corporation as a metaphysical entity into which individuals subsumed
some of their rights in exchange for benefits and protections of the collective entity was a powerful
development in human ordering. See ELLEN GOODMAN, THE ORIGINS OF THE WESTERN LEGAL
TRADITION: FROM THALES TO THE TUDORS 202 (1995). Originally it had nothing to with business. See
id. The new universities generally organized as corporations. See GRANT, supra note 53, at 34--39;
HANNAM, supra note 53, at 74--75. They often dominated the town in which they were established.
Similar to modern business corporations, they sometimes used their significant economic clout to leva-
tage favorable treatment from local government under threat of decamping to another town. See
HANNAM, supra note 53, at 74--75.

70. See GRANT, supra note 53, at 33; Long, supra note 68, at 862.
71. Long, supra note 59, at 88--91.
72. Id.
73. Some artisans, such as Theophilus, resisted this urge to secrecy and sought to disseminate
know-how through publication. See id.
74. See Ted Sichelman & Sean O’Connor, Patents as Promoters of Competition: The Guild Ori-
75. See Long, supra note 68, at 870--71.
76. Id.
77. GOODMAN, supra note 69, at 202.
78. Long, supra note 68, at 871.
79. Id. at 870--71.
naces to which days were legal workdays.\(^8\) The power of this system lay in the fact that only guild members could make glass in Venice.\(^9\)

The Venetian glass guild also showed that at least some arts were returning to true technē arts. The glassmakers possessed multiple kinds of valuable information that contributed to the production of glass considered to be the finest in Europe.\(^10\) These included recipes and ingredient lists that could be written down; know-how that consisted of processes, observations, and handling of materials that might be beyond codification; and plans and know-how for constructing important related devices such as furnaces.\(^11\) Thus the master glassmakers possessed systematic and rigorous knowledge (both codified and non-codifiable know-how) that elevated craft to technē art.

C. Renaissance “Ingeniatiors” and the Roots of Innovative Design and Engineering

The late Middle Ages and early Italian Renaissance produced a new kind of “architect-engineer”: the literate ingeniator who combined “genius” and technical skill to invent and reduce to practice amazing new buildings, machines, and public works projects.\(^12\) This development involved three aspects. First, an environment was created by wealthy princes, patrons, and Church leaders in which educated, generalist artisans were given authority over massive, complex building projects such as elaborate palaces, fortresses, and Gothic cathedrals.\(^13\) Second, “divine madness” was secularized away from its troubled roots in supernatural spirits and demons into “genius” (meaning visionary inspiration and not our modern usage as synonymous with intelligence).\(^14\) And third, the resurgent technē arts were modified to allow this “irrational” genius into what was otherwise a strictly rule-based design and production process.\(^15\) Combined, these set the stage for the “ingenious” artisanal and technical innovation that we prize today.

This new concept of “genius” then became a hallmark of these new architect-engineers that enabled them to invent entirely new kinds of machines and techniques.\(^16\) “Genius” was a form of poiesis that was foreign to traditional technē art. The terms used—ingeniator, ingénieurs,

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80. Id. at 871–72.
81. Even “free cities” in the Middle Ages often had completely regulated economies, meaning that no activity could be done without express permission (as license or privilege) of the sovereign. See Edward S. Irons & Mary Helen Sears, The Constitutional Standard of Invention—The Touchstone for Patent Reform, 1973 Utah L. Rev. 653, 679; Frank D. Prager, A History of Intellectual Property From 1545 to 1787, 26 J. Pat. Off. Soc’y 711, 714 (1944); Sichelman & O’Connor, supra note 74, at 1268–69.
82. Long, supra note 68, at 872–73.
83. Id.
85. AUYANG, supra note 84, at 13–14.
86. Long, supra note 68, at 849.
87. AUYANG, supra note 84, at 10–16.
ingegnere, and genius—all derived from the root geni that also gives us genie.89 From ancient times, genies or daemons could influence people by putting ideas into their head, demonstrated by Plato’s divine madness or the origins of the term inspiration as literally “taking in spirits.”90 The ingeniator could be inspired with visions of entirely new machines, buildings, or processes.91 During the secularizing Italian Renaissance, the term lost most of its supernatural aspect.92 This legitimized it beyond earlier suspect linkages with those possessed by demons or otherwise insane. Genius became the mysterious—but not necessarily supernatural—font of creative imagination. It seemed to be a native talent, and thus un-teachable, which put it at odds with the traditional model of techné. Yet, its value for innovation in all manner of arts was clear.

While the ingeniators were prized for their genius, they could not be mere dreamers. They also had to have the technical skill to reduce their fanciful inventions to practice. Leonardo da Vinci is the prime example of this successful hybrid of inspired dreamer, rational thinker, and skilled maker. The demonstrated success of the ingeniator to imagine and execute innovative machines and objects—especially in the field of military hardware and fortifications—brought a level of respect, wealth, and autonomy previously unheard of for artisans.93 Equally important, the successful ingeniator was educated such that he could communicate and promote his works through writings and direct conversations with powerful patrons. This was particularly advantageous in a Europe divided into many principalities such that a successful free architect-engineer could seek the best deal from different potential patrons. Da Vinci ultimately received the title Ingegnere Generale.94 Later, in seventeenth century France, ingeniator would become ingénieur and signify educated technical officers. It was ultimately adopted as engineer in English.95

Another example of the ingeniator was the Florentine Filippo Brunelleschi. Famous for his design and construction of the Duomo on Florence’s cathedral, his original training was as a goldsmith.96 Because

89. AUYANG, supra note 84, at 14–15.
90. The image of the angel and devil sitting on a person’s two shoulders and whispering conflicting advice is still part of popular culture. When Descartes later undertook his mission to put knowledge on sure footing by first doubting everything, he postulated an evil daemon who created an illusion of the world for a being that is nothing but pure thought.
91. Ingegnator was in use at least since Vitruvius’ De Architectura in Ancient Rome and was applied to the new architect-engineers as early as the twelfth century. See AUYANG, supra note 84, at 14. For example, Ailnoth (fl. 1157–1190), who worked on the Tower of London, was called an ingeniator.
93. Further details on the European engineers of the medieval and Renaissance periods can be found in GILLE, supra note 84.
94. See AUYANG, supra note 84, at 14.
95. See id. The related term engine originally meant genius and ingenuity before becoming confused as the name for certain products or processes of ingenuity, such as the external and internal combustion “engines.” This is a bit like the term “Frankenstein” becoming used for Dr. Frankenstein’s creation during the twentieth century. Id.
96. See LONG, supra note 59, at 96.
that trade was part of the silk guild, he became a member of the *Seta de Arte* (silk guild).\textsuperscript{97} But he later became proficient in a number of other fields. This cross-training allowed him to act as general contractor, architect, engineer, and/or inventor, as the job required.\textsuperscript{98} During his career, he invented new hoisting devices, boats, and, allegedly, linear perspective in visual arts (also credited to da Vinci). At the same time, being a Renaissance man in the guild era was not without risks: as director of the Duomo project he was expected to join both the woodworkers and stoneworkers guilds; he refused and was jailed for eleven days.\textsuperscript{99}

Just as the reintroduction of Aristotle’s writings and Islamic commentaries in the twelfth and thirteenth centuries had provided a jolt to Western thought, the retransmission of Plato’s writings in the second half of the fifteenth century arguably triggered the humanistic movement of the Renaissance, which in turn elevated and liberated the visual arts.\textsuperscript{100} One effect of this was to further legitimize the newly secularized “genius” across the arts as Platonic mysticism embraced non-rational inspiration. Humanism also promoted a new individualism, while was in part reflected through the flowering of arts in which individual genius was expressed. For example, poetry shifted from a position of prestige below grammar and rhetoric in the liberal arts to a higher one with some independence outside the liberal arts because of the role that genius played in it. By the sixteenth century, contemporary vernacular poetry was as prestigious as classical Latin literature and a number of “Academies” for its pursuit opened in Italy. The capacity for expressive genius in the visual arts of painting, sculpture, and architecture separated them from the other mechanical arts. They were still not as prestigious as the liberal arts, but they now occupied their own class between the liberal and mechanical arts.\textsuperscript{101}

Despite the ascendancy of neo-Platonic thought during the late sixteenth century, Aristotle’s notions of imitative arts and arts of pleasure were revived. The new art of opera recombined music and poetry (as they had been linked in antiquity), with dance also considered part of music.\textsuperscript{102} A new generation of courtiers, gentlemen, and princes sought to develop “refined” tastes and pursuits, leading to expanded liberal arts education and the “amateur” tradition.\textsuperscript{103} “Taste” and “sentiment” were

\textsuperscript{97} This underscores some of the convoluted nature of the development of guilds.
\textsuperscript{98} Brunelleschi benefited from a well-placed family and a political system in which power was being expressed through visual and constructive arts. He engaged with the Florentine elite in a way that the average illiterate artisan could not. His social status required and enabled him to take positions and commissions that were viewed as superior to that of an ordinary craftsman. See LONG, supra note 59, at 99–100.
\textsuperscript{99} Id. at 96.
\textsuperscript{100} See HANNAM, supra note 53, at 214; Kristeller, supra note 12, 510–21. While excluding logic, the new humanities system added history, Greek, and moral philosophy to the established Trivium.
\textsuperscript{101} This was memorialized in fresco on the Campanile of Florence, where painting, sculpture, and architecture are grouped by themselves between representations of liberal arts, on the one hand, and mechanical arts, on the other.
\textsuperscript{102} See KRISTELLER, supra note 12, at 511.
\textsuperscript{103} See id.
seen as things not strictly rational, yet not entirely arbitrary. Good taste was distinguished from bad, and one could improve his own through training.

The broader reach of literacy helped advance the visual arts, just as it helped the rise of the *ingeniator*. In fact, many *ingeniators* like da Vinci were superb, innovative visual artists or writers as well. Many of them engaged in natural philosophy too, advancing *epistemé*. A few of the new journalists argued for including the visual arts in the liberal arts and Vasari coined the phrase *Arti del disegno*. Visual artists began leaving their craft guilds in Florence to join the new *Accademia del Disegno* (“Academy of Drawing/Design”), patterned on the longstanding literary Academies. Visual artists in other cities soon followed suit.

### D. New Arts and New Sciences of the Early Modern Period

The new printing press also helped elevate the literary and visual arts. Gutenberg’s moveable type press, developed in the mid-fifteenth century, was itself quite an artisanal innovation. While it was primarily intended for books and pamphlets, it also worked well for illustrations and engravings. Printers initially used it to publish affordable copies of existing “classic” books, such as the Bible. But they soon discovered a demand for new works (“novels”) and developed a system to procure new works, resulting in the new role of “publisher.” “Printer patents” or “printer privileges” were issued by sovereigns to incentivize the first printers to set up local commercial operations. Perhaps the best way to think of these new sovereign grants is as rights and incentives to engage in the semi-automated manufacture of books and other print-based copies of what were formerly only handwritten manuscripts. Thus the rights were not so much about the *content* as about the right to manufacture these entirely new kinds of *copies* of content. Exclusive “copy rights” soon followed to incentivize the publication of new works by existing publishers. The explosion in the number of households owning books,

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104. *See LONG, supra* note 59, at 122–29. Of note are Leon Battista Alberti, Roberto Valturio, and da Vinci. Some of them also linked the mechanical arts and political praxis, because the well-designed city needed architects to design it.

105. *See Kristeller, supra* note 12, at 514.

106. The Academy curriculum replaced the guild workshop tradition with more systematic, *epistemé*-based education that included geometry and anatomy.

107. Grammar, rhetoric, and poetry were liberal arts, but the writing of books was not itself a liberal art.

108. Trained as a goldsmith, Gutenberg’s core innovations were twofold: first, he developed the “matrix” device that allowed metalworkers to make metal letter type blocks much more quickly than by other methods; and second, he successfully modified and combined the components of traditional agricultural presses, new oil-based inks, and typesetting frames to allow for “moveable type” (that is, type that could be quickly reset or re-ordered in the frame). *See LONG, supra* note 59, at 144.

109. In the earliest days, a “novel” could be any work printed for the first time in a region. Thus, the work itself could have been quite old. Only later did the modern sense of the “novel” as exclusive-ly a work of fiction emerge.

110. The term and concept of “copyright” appears to have originated in Venice, where the first known copyright was granted to Marcus Antonius Sabellicus for his history of Venice in 1486. *See*
and the perceived selectivity of quality publishers for new works, resulting in enhanced prestige for “published” works and their authors. \(^{111}\) In some cases, artisans became their own publisher-printer. Albrecht Dürer, for example, set up his own print operations to distribute affordable copies of his popular secular images, expanding his fame far and wide.\(^{112}\)

The shifting sense of the visual arts and the *sui generis* status of the *ingeniator* brought a new dimension to debates over what constituted art versus science. The perceived prestige of a field was as important as where it was classified and systems categorizing them proliferated. \(^{113}\) Theology was the “queen of the sciences” with natural philosophy as her “handmaiden.” Math and other parts of the Quadrivium were increasingly classified as “sciences.” \(^{114}\) The mechanical arts occupied the lowest levels, while medicine and jurisprudence occupied widely varying positions. Historian Heikki Mikkeli describes a leading view on distinguishing arts and sciences at the time, from Jacob Zabarella, professor at Padua and instructor of Galileo:\(^{115}\)

*For Zabarella,* [s]cience deals with what already exists, but art is concerned with creation. The subject-matter of a science is immutable, but the subject-matter of an art is the formation of things as yet non-existent, but which can be made by human beings. The contemplative philosopher is not interested in initiating anything, but rather wants to comprehend and arrange the forms of existing, eternal things. Moreover, the ultimate purpose of the contemplative science is the pursuit of knowledge for its own sake, but in the productive arts the end-result is an actual product.\(^{116}\)

LONG, *supra* note 59, at 11. However, many copyright histories focus more on the development of a private ordering system of “copy rights” within the Stationers Company as the exclusive chartered group of publishers under the British Crown from the sixteenth century until the Statute of Anne in 1710. See, e.g., LYMAN RAY PATTERSON, COPYRIGHT IN HISTORICAL PERSPECTIVE 4 (1968).


112. See id. Similar to Brunelleschi and da Vinci, he had broken free from the guild system and so could develop his own reputation. He realized that he could make more money through prints rather than commissioned pieces. While the initial work for a print was as laborious as that to complete a commissioned work, he could produce and sell hundreds of copies of prints at marginal extra effort. The high volume of his output—all prominently adorned with his “AD” mark—multiplied his fame amongst the emerging middle class and wealthy or royal art patrons. Benefiting from the humanist movement, he was able to create images of nature, topical scenes, and even portraits (including himself), rather than only religious scenes, which proved enormously popular.


114. “Science” simply meant “*scientia*” as systematic studies or collections of usually codifiable knowledge.

115. Many scholars attribute the initial development of the hypothetico-deductive “scientific method” made famous by Galileo to Zabarella. The latter had described it in the difficult Latin scholastic Aristotelian terminology of the universities, whereas Galileo was able to reframe it in reasonably accessible vernacular terminology. See Sean Martin O’Connor, *Regressus* and the Scientific Revolution: A Defense of Zabarella’s Contribution to Scientific Methodology (May 1995) (unpublished M.A. Thesis, Arizona State University) (on file with Arizona State University Library system).

While the classification of individual fields was a matter of hot debate, the basic ideas of art and science had not changed much in nearly 2000 years.  

The epistemé sense of science was oriented towards the comprehension of necessary truths and the unchangeable aspects of the world. Thus it did not, and could not, seek to “do,” “make,” or “change” anything. But the broader sense of science as simply the “systematic study” of anything continued. The linking theme between them was the contemplative nature of the activities. To “make a science” of something was to step back and observe, collect all available information about, and then synthesize into principles the subject matter. 

Art, by contrast, was oriented towards manipulating the changeable aspects of the world. In many cases it produced something other than itself, such as bricks, boats, or buildings. In other cases, its “doing” was the end itself, such as in performing music or dance. It also existed in the manipulation of mental concepts, such as numbers, for practical ends.

Another challenge for the distinction between arts and sciences was the continuing belief that a field had to be one or the other. No one seemed to acknowledge that fields could have art and science components. For example, one can “make a science” of mathematics by studying it as an object of contemplation, or one can use mathematics to perform the calculations needed to design and build a house.

As the cultural leadership of Europe passed from Italy to France in the seventeenth century, the terms beaux arts and belle lettres captured visual arts and writing that were primarily focused on style rather than function. The arts had traditionally been mediums for practical objects, or for conveying moral or religious themes. But in the secular age, the medium itself became the focus. How innovative or talented was the artist? How pleasing was the work’s style? This complicated debates over the place and functions of the visual arts.

The mechanical arts were also transformed in this century as educated intellectuals became intrigued by the potential of new machines and processes developed by the ingeniators. While primarily known today as the fathers of the Scientific Revolution, Francis Bacon in England, Galileo Galilei in Italy, and René Descartes in France, also sought to revive the rigor of techné arts. Bacon and Galileo led efforts to explain the workings of nature with mathematical precision through carefully designed experimental inquiry, but they needed to become artisans to de-
sign and build new “scientific” instruments such as the telescope. In contrast to the Aristotelian natural philosophy focus on *sophia*, Bacon and Galileo sought to elevate the prestige of the mechanical arts. They also introduced a “practical application” goal for the new sciences, because the ability to develop such applications would demonstrate the correctness of the scientific principles they discovered.

E. The Beginnings of a European “Progress Project”: the “Querelle” and the “Encyclopédie”

The success of the new sciences that Bacon, Galileo, and Descartes developed generated a critical distinction between quantitative and qualitative measurements of “progress” in the *Querelle des Anciens et Modernes* (Quarrel of the Ancients and Moderns). Taking place in England and France during the late seventeenth century, it pitted the “Moderns,” who believed that contemporary arts and sciences had advanced beyond those of the Classical period, against the “Ancients,” who believed that classical arts and sciences still dominated. A central insight of the debate was that the output of some fields could be quantified and compared over time, while that of others could only be assessed on a qualitative basis. Progress in the former could be demonstrated because an attribute of a produced artifact was measurably stronger, faster, etc. Progress could not be demonstrated in the latter because its artifacts were valued subjectively based on “taste” or “sentiment.”

The *Querelle* has its limitations as a model for thinking about arts and sciences. First, it continued the paradigm of classifying entire fields as either quantitative or qualitative, when most have elements of each. Second, the quantitative/qualitative distinction should not be equated

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123. See, e.g., Jean Le Rond d’Alembert, *Preliminary Discourse to the Encyclopedia of Diderot* (Richard N. Schwab trans., Univ. Chicago Press 1995) (1751), available at http://quod.lib.umich.edu/d/did2222.0001.083?view=text;rgn=main (“[Bacon] invites scholars to study and perfect the arts, which he regards as the most exalted and most essential part of human science”).

124. See id. (“Hostile to systems, [Bacon] conceives of philosophy as being only that part of our knowledge which should contribute to making us better or happier, thus apparently confining it within the limits of the science of useful things, and everywhere he recommends the study of Nature.”); Dear, *supra* note 38, at 594–96.


126. Galileo participated in the debates over the nature and relative status of emerging beaux arts. See Kristeller, *supra* note 12, at 516. Bacon contemplated the role of imagination in poetry. See id. at 520. Hannam argues that the humanists were not progressive, as is often held today, but rather regressive in that they believed in the supremacy of the ancients. Hannam, *supra* note 53, at 211–21. He also argues that Galileo is actually targeting humanists, with their truly slavish attitude toward the ancients, in the character of Simplicio in the *Dialogue Concerning the Two World Systems*, rather than targeting Scholastic Aristotelians as normally presumed. Id. at 218–19.

with the art/science distinction.128 While this may be tempting given the popular modern senses of “art” and “science,”129 it is not how those involved in the Querelle would have used the terms. Such modern uses also carry counterproductive and misleading semantic baggage that diminishes art, extends science to things it should not be, and creates a gap that has improperly been filled by technology.130 The notion of quantitative measures of “progress,” however, became a powerful central theme in the Enlightenment.

Finally, the seventeenth century also saw the emergence of the term “useful arts.” Like the early stages in the development of the liberal arts and the fine arts, there was originally considerable murkiness in the usage of “useful arts.” As noted above, Theophilus has been translated as referring to the mechanical arts he discussed in On Divers Arts as “useful arts” in the twelfth century. But this was long before the visual arts emerged as any kind of separate field. Nonetheless, it is critical to see that Theophilus is focusing on the actual practical techniques involved in creating art works (both practical and decorative). Thus, there remained even through the development of aesthetic considerations and compositional techniques the necessity of practical techniques to manipulate natural materials and forces to produce paints, dyes, metal alloys, plaster, putty, etc. Accordingly, even as the fine arts began emerging as a separate field based primarily on aesthetics, and not on practical utility, there would endure a need to discuss the practical artisanal techniques and materials that an artist employs to produce the physical embodiment of his aesthetic vision.

While there may have been English, Latin, or other European language uses of “useful arts” (or cognates in other languages) in the centuries following On Divers Arts, I will begin with some examples from the seventeenth century that seem to show a convergence towards a concept of the set of arts consisting of the mechanical arts minus the fine arts (even as early exemplars seem to include practical aspects of what we today would consider fine arts). In 1627, Michael Stanhope used the term in his Nevves out of York-shire to discuss the profitable artisanal manufacturing going on there: “And whence comes this their prosperity, and encrease of potency, if not from a generall circumspection, & sagacity in their affaires, cherishing all manner of usefull Arts, and advantagious knowledge, and not suffering any vnprofitable weeds, I meane idle persons, to harbour amongst them?”131 A few years later, John Preston ill-

128. Id.
129. For example, I suspect that this is what the marketers at the cosmetics company Aveda had in mind when they developed the corporate tag line “The Art and Science of Pure Flower and Plant Essences.” See Aveda, http://www.aveda.com (last visited Feb. 21, 2015).
130. See infra text accompanying note 156. For the origins and evolution of the term technology, see O’Connor, supra note 5, at ch. 6. See also W. Brian Arthur, The Nature of Technology: What It Is and How It Evolves 107–30 (2009) (using the term technology for what would have been called the mechanical arts); Auyang, supra note 84, at 12–13 (same).
131. Nevves Out of York-shire; or, an Account of a Journey, in the True Discovery of a Soueraigne Minerald, Medicinall Water, in the West-Riding of Yorke-shire, Neere an
ustrated his use of “useful art” by reference to Greek mythological figures for the practical harnessing of natural materials and forces: “Those that brought any speciall helpe, and comfort to the lives of men; as they that did invent usefull Arts, as Bacchus [wine], Ceres [agriculture], Vulcan [fire], Aesculapius [medicine]; . . . .”\textsuperscript{132} In 1638, Franciscus Junius suggested the coming battle between those favoring the progress and arts of their contemporary “moderns” and those favoring that of the “ancients” in the classical Greco-Roman period\textsuperscript{133} when he admonished contemporary artisans to go beyond a superficial understanding of the “useful arts” and employ more of a techené art rigor in his multi-volume \textit{The paintings of the ancients in three bookees}:

To let them therefore along, wee doe rather wonder at their impudence who presume to meddle with these grave and serious Arts, before they have tasted naturall and morall Philosophie, Historie, Poésie; not to speak of the Mathematickes; for our moderne wits are so deeply plunged and drowned in their secure confidence, that they mean to doe well enough without the Mathematickes; yea the best of them are content with a superficiaall knowledge of such usefull Arts, not considering that a sleight and carelessse manner of studying helpeth very little.\textsuperscript{134}

The following year, Thomas Fuller used the term to capture the mechanical arts involved in ship building as her argued that such skills were a crucial European military advantage over the Turks that should not be squandered for personal financial gain:

And though the Turks either [lack] ingenie or industrie, either care not or cannot be good shipwrights themselves; yet the spite is, as long as there is gold amongst the Turks there will be drosse amongst the Christians, I mean some who for base gain will betray the mysteries of our usefull arts unto them.\textsuperscript{135}

Note that Fuller also used the transitional variant of “ingenious” that still shows the “genie” root for what might be called supranatural inspiration, to distinguish it as a secularized supernal inspiration from gods or demons. He also uses the term “mysteries” that has longstanding use down to this day in Britain to designate trade secrets. A decade later, John Dury employed “useful arts” to designate career skills needed by Church and government workers in \textit{The reformed school}: “Thirdly from thirteen or fourteen, till nineteen or twenty; the things which are to be taught them, and wherein they shall be exercised, are all Usefull Arts and Sciences, which may fitt them for any employment in Church or Com-

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\textsuperscript{132.} \textsc{John Preston}, \textit{Life Eternall or, A Treatise of the Knowledge of the Divine Essence and Attributes} (London 1631). \hfill \textsuperscript{133.} \textit{See infra Part II(E)}. \hfill \textsuperscript{134.} \textsc{Franciscus Junius}, \textit{The paintings of the ancients in three bookees} (London 1638). \hfill \textsuperscript{135.} \textsc{Thomas Fuller}, \textit{The historie of the holy vvarre} (London 1639).
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mon wealth." In 1666, Samuel Parker used the term in discussing Pla-
tonic philosophy to argue for the greater value of pioneer innovations
over incremental or follow-on innovation: “the world surely is much
more beholding to those that first invent useful Arts and Sciences, than
to those that only improve them . . . .” The following year, Thomas
Sprat used the term to talk about practical mechanical arts in his The his-
tory of the Royal-Society of London for the improving of natural
knowledge:

And we do hereby make and constitute the said Society by the
name, &c. to be a Body corporate, to be continued under the same
name in a perpetual succession; And that they and their successors
(whose studies are to be employed for the promoting of the
knowledge of natural things, and useful Arts by Experiments. To
the glory of God, and the good of mankind) shall by the foresaid
name of President . . . .This was the last Particular in this Subject
which I undertook to make good. That our Church can never be
impair’d by the growth of the useful Arts of Life. But now I come
neerer to it, I find that I may safely omit it; For the thing itself is so
manifest, that there can be no ground of raising a question about it.
If our Church should be an Enemy to Commerce, Intelligence,
Discovery, Navigation, or any sort of Mechanics; how could it be fit
for the present Genius of this Nation?”

A little more than a decade later, Edward Cocker referred to writing and
engraving as “useful arts”: “By the sacred Influence of Divine
Providence, I have been instrumental to the Benefit of many by Vertue of
those useful Arts, Writing and Engraving . . . .” It is not clear whether Cocker meant “writing” and “engraving” in their aesthetic expression
aspects, or rather in their practical technique aspects, such as because he employed writing and engraving for the practical end of producing substantive and informative treatises on various topics. Finally, at the end of the century, two authors, including one
who is presumably an American as his work was published in Boston,
employed “useful arts” in contexts that indicated they were practical arts.
Translating Virgil’s Pastorals, Georgics, and Aeneis, one Mr. Dryden
seemed to reference the then ongoing debate between the “Ancients”
and “Moderns”: “In short, [the Ancients] invented the most useful Arts,
Pastorage, Tillage, Geometry, Writing, Musick, Astronomy, &c. Whilst
the Moderns, like Extravagant Heirs, made rich by their Industry, in-
gratefully deride the good Old Gentlemen, who left them the Estate.” It

137. Samuel Parker, A Free and Impartial Censure of the Platonick Philosophy Being a Letter Written to His Much Honoured Friend Mr. N.B. (Oxford 1666).
139. Edward Cocker, Cocker’s Arithmetick (1678).
140. The Works of Virgil Containing his Pastorals, Georgics and Aeneis (Trans. Mr. Dryden, London 1697).
is unclear whether Dryden means to give a nonexclusive list of the useful arts (“pastorage, tillage, . . .”) or whether the useful arts are their own category in a list of activities that also include the others.\footnote{In other words, the difference between: “the useful arts that include pastorage, tillage . . .;” or “invented things like i) the most useful arts, ii) pastorage, iii) tillage . . ..”} Samuel Sewall talks about the “useful arts” as helpful things, together with animals and plants, that settlers brought to colonize America: “They who remove from one Land to another, there to dwell; that settlement of theirs is call’d a Plantation. Especially, when a land, before rude and un-furnish’d, is by the New-comers replenished with usefull Arts, Vegetables, Animals.”\footnote{Samuel Sewall, Some Few Lines Towards a Description of the New Heaven as It Makes to Those Who Stand Upon New Earth (Boston 1697).}

At the outset of the eighteenth century, “useful art” continued to be employed to designate practical techniques that did not include the fine arts. In 1725, Daniel Defoe, notable today as the author of \textit{Robinson Crusoe}, also authored nonfiction books including \textit{A General History of Discoveries and Improvements, in useful ARTS, Particularly in the great Branches of COMMERCE, NAVIGATION, and PLANTATION, in all Parts of the known WORLD}.\footnote{Daniel Defoe, A General History of Discoveries and Improvements, in useful ARTS, Particularly in the great Branches of COMMERCE, NAVIGATION, and PLANTATION, in all Parts of the known WORLD (London 1725---26).} Battie Langley suggested the practical or artisanal side of geometry as it applied to certain “useful arts” in his \textit{Practical Geometry: Applied to the Useful ARTS of Building, Surveying, Gardening and Mensuration}.\footnote{Batty Langley, Practical Geometry: Applied to the Useful ARTS of Building, Surveying, Gardening and Mensuration (2D Ed., London 1729).}

The aesthetics-based modern system of the Fine Arts also developed in the eighteenth century.\footnote{See Paul Oskar Kristeller, \textit{The Modern System of the Arts: A Study in the History of Aesthetics (II)}, 13 J. Hist. Ideas 17, 17---23, 25---31 (1952).} Following the \textit{Querelle}, debate over the \textit{beaux arts} centered on questions of taste and sentiment: what was “good taste” and how could it be developed in people? Might the educated lay person be a better arbiter than a professional artist of the value of a work? In 1746, Abbé Charles Batteux codified a system of the Fine Arts in almost its current form.\footnote{See Charles Batteux, \textit{Les Beaux Arts Réduits á un Meme Principe} (1746). Batteux included painting, sculpture, poetry, music, and dance as his five \textit{beaux arts}. In England, the arts and sciences had been separated in the Royal Society by the early eighteenth century, while authors including Wotton reiterated the \textit{Querelle} distinction between fields that could be shown to have progressed beyond the Ancients and those that had not. Kristeller, \textit{supra} note 145, at 25--26. Shaftesbury then became one of the founders of modern aesthetics with his work on fields in the fine arts, even though he still conflated moral and artistic beauty as the Ancients had done. \textit{Id.} at 27. Other authors distinguished “arts of necessity” from “arts of elegance” (corresponding to the distinction between practical or mechanical arts and the fine arts). \textit{Id.} at 29. The latter were sometimes referred to as the “mimetic arts,” “imitative arts,” or even “polite arts.” \textit{Id.} at 29--30 nn.230---31. In the second half of the eighteenth century, the notion of “fine arts” appears to have been taken for granted, in a system that was divided into necessary arts, polite arts, and a third set that were both necessary and polite. \textit{Id.} at 30. In Scotland, Hutcheson distinguished between the senses of morality and beauty, influencing Hume and Diderot, while Reid added the notion of “common sense,” setting the stage for the “three faculties of the soul” of Kant and Cousin. \textit{Id.} at 28--29.} Working from the poetic theories of
Aristotle and Horace, he developed a theory of the Fine Arts linking them as imitative arts with pleasure as their end. While Batteux’s system was highly influential across Europe, it was criticized for its reliance on the notion of imitative arts that seemed both over- and underinclusive for the beaux arts.

A few years later, Denis Diderot, Jean le Rond D’Alembert, and the other French Encyclopédistes and philosophes would adopt most of Batteux’s system but replace dance with architecture. This set of arts—painting, architecture, sculpture, music, and poetry—have constituted the core of the Fine Arts ever since. The Encyclopédie entry on Taste, for example, seems to take the notion of the Fine Arts for granted, while the entry on Beautiful discusses them and explicitly references Batteux. Kristeller argues that the Encyclopédistes solidified the modern system of the arts because they identified them as those arts that are informed mainly by genius, taste, and sentiment, and not by the five measures of the traditional techné arts (teachable, certifiable, exactitude, controllable, and reliable). In the eighteenth century, the term “aesthetics” would come into currency as the name for this essential attribute of the Fine Arts.

Discussion of the Fine Arts was only a small part of the Encyclopédie entries relevant to the arts however. The major entry “Art” and most of the discussion of “arts” throughout the Encyclopédie were focused instead on the traditional mechanical arts that remained after the Fine Arts had been separated out; these were the “useful arts.” The entries demonstrate the continued vitality of the techné sense of art even after the emergence of aesthetics and identification of the Fine Arts.

147. Kristeller, supra note 145, at 20–21. By contrast, the mechanical arts were practical applications that have function and utility to satisfy human necessities as their end. Batteux also created a new division of arts that combined pleasure and usefulness as ends, placing eloquence and architecture in this category. Finally, he gave theater its own status as a combination of other beaux arts.

148. While the Querelle had liberated quantitative fields from any requirement of grounding in ancient systems, commentators writing about qualitative fields still felt compelled to do so.

149. See Kristeller, supra note 145, at 23. There is a discrepancy between d’Alembert’s listing of the Fine Arts (the modern five) and that listed on the Map of Human Knowledge that accompanied the Encyclopédie. The latter adds engraving and elevates poetry to the overarching subdivision of Imagination within which all the other Fine Arts are subordinated.

150. See Kristeller, supra note 12, at 497.


153. See Kristeller, supra note 12, at 496–498; Kristeller, supra note 145, at 17–23. d’Alembert, for example, describes eloquence as an art governed by taste or sentiment, which cannot be taught, rather than skill or art. D’ALEMBERT, supra note 123. Thus eloquent speakers are born, not made, and those who aspire to it can only emulate those who have it.

154. See Kristeller, supra note 12, at 496.
To d’Alembert was given the responsibility of preparing an overview of the ambitious scope of the *Encyclopédie* in the *Preliminary Discourse*. The subscription-based work would be issued volume by volume over time and would “set forth . . . the order and connection of the parts of human knowledge.”155 Such order and connection was visually represented in a “Map of Human Knowledge” (the “Map” as reproduced in Figure 1 below) that accompanied the *Encyclopédie*.

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155. D’ALEMBERT, *supra* note 123 (emphasis added). This distinguishes it from later encyclopedias that usually organized around alphabetical sequences of entries on various topics. RICHARD YEO, *ENCYCLOPAEDIC VISIONS: SCIENTIFIC DICTIONARIES AND ENLIGHTENMENT CULTURE* xii (2001). d’Alembert authored the first two sections of the *Preliminary Discourse*; the third section was an updated version of Diderot’s *Prospectus*, used to solicit interest in the project. The *Encyclopédie* was one of the most well-known and ambitious intellectual undertakings of the eighteenth century. See O’Connor, *supra* note 3, at 36.
This was hardly the first time that philosophers had sought to order and display all of human knowledge. At the opening of the sixteenth century, Gregor Reisch produced a book in the Latin encyclopedia tradition that sought to encompass the full “circle of learning.”


157. GREGOR REISCH, MARGARITA PHILOSOPHICA (FREIBURG, 1503).
Philosophica set out a system of arts and sciences as branches of philosophy and included a “tree of science” map (reproduced in Figure 2 below). The two major branches within it were theorica and practica. Of note, Hugh of St. Victor’s seven mechanical arts formed one subdivision within practica (see very bottom of map).

FIGURE 2

158. YEO, supra note 155, at 132–33.
Francis Bacon had divided up all of human knowledge into three categories of “Imagination,” “Reason,” and “Memory.” Imagination correlated to the Aristotelian *poeisis* activities that produced new things than had not existed before. Reason contained the mental activities of logic, mathematics, and other reasoning functions. And Memory included not only history, but also the craft knowledge of artisans. I am not aware of a chart or map of this produced by Bacon, although one may exist.

Ephraim Chambers set out a different path for categorizing human knowledge in a “tree of science” branching chart, the “View of Knowledge” (see Figure 3 below), in his 1728 *Cyclopedia*. But Chambers confessed to being a bit confused about the distinction between arts and sciences because “‘the precise Notion of an Art and Science, and their just, adequate Distinction, are not yet well fixed.’” Accordingly the various liberal arts, mechanical arts, and sciences are in an odd jumble in his chart. But the core distinction between “Natural and Scientifical” and “Artificial and Technical” is clearly the art as applied activities vs. science as contemplative study distinction. In the View itself, Chambers’ defines “Artificial and Technical” as “consisting in the Application of Natural Notices to further Purposes.”

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160. YEO, supra note 155, at 135 (quoting EPHRAIM CHAMBERS, II Cyclopedia, SCIENCE (LONDON, 1728)).
The *Encyclopédists* decided to follow Bacon, and so the *Encyclopédie* divided all human “knowledge” into his same three divisions, but they ordered them in the reverse as Memory, Reason, and Imagination.\(^{162}\) Also following Bacon’s interest in the intellectual value of the mechanical arts, the *Encyclopédists* sought to create “a grammar of the arts” that would use shorthand descriptions for non-codifiable tacit knowledge or muscle-memory-based know-how as well as more traditional codifiable knowledge.\(^{163}\) D’Alembert described the *Encyclopédie* as a “*Reasoned Dictionary of the Sciences, Arts, and Trades* . . . to contain the general principles that form the basis of each science and each art, liberal or mechanical, and the most essential facts that make up the body and substance of each.”\(^{164}\)

D’Alembert was particularly focused on “discoveries” as one of the connecting points between arts and sciences.\(^{165}\) The concept was apparently quite important as he penned two separate entries for it: one as a noun, Discovery, and the other as a verb, Discover, Find.\(^{166}\) Distinct from our modern sense of “discovery” as an uncovering or identification of something already existing, “discovery” for d’Alembert was a subcategory of “inventions,” which in turn were any newly created physical or mental objects.\(^{167}\) Accordingly, d’Alembert praised Descartes’ “inventive genius” and referred to Newton as having “invented calculus,” in the same way as he referred to the inventions of the wristwatch and the telescope.\(^{168}\) He also invoked Aristotle’s *poiesis*, as the creation or invention of new things, when discussing the Fine Arts.\(^{169}\) Crucially, he reserved the

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162. Thus, while Bacon put “imagination” as the first type of mental activity humans undertook, the *Encyclopédists* placed “memory” first. This may be due to their Lockean view of human nature as proceeding from direct sense impressions to reflective manipulations of the resulting mental ideas. They rejected Descartes’ rationalist account that we begin from innate ideas and move outwards to the world. See D’ALEMBERT, supra note 123; Denis Diderot, _Observations on Bacon’s Division of the Sciences_, in D’ALEMBERT, supra note 123.

163. See Denis Diderot, _Art_, in _THE ENCYCLOPEDIA OF DIDEROT & D’ALEMBERT COLLABORATIVE TRANSLATION PROJECT_ (Nelly Hoyt & Thomas Cassirer trans., 1965) (1751), http://hdl.handle.net/2027/spo.did2222.0000.139.

164. D’ALEMBERT, supra note 123. By “reasoned dictionary,” d’Alembert meant a “systematic” dictionary, i.e., one based on a rational system and not simply an alphabetized sequence of definitions. *Id.*

165. “If one reflects somewhat upon the connection that discoveries have with one another, it is readily apparent that the sciences and the arts are mutually supporting, and that consequently there is a chain that binds them together.” *Id.*


167. Jean Le Rond d’Alembert, _Discover, Find_, in _THE ENCYCLOPEDIA OF DIDEROT & D’ALEMBERT COLLABORATIVE TRANSLATION PROJECT_ (Dena Goodman trans., 2013) (1754), http://quod.lib.umich.edu/d/did2222.0002.899/-discover-find?rgn=main;view=fulltext. I am deeply indebted to Professor Dena Goodman, a director of the Translation Project and professor at The University of Michigan, for providing me with an advance translation of this entry.


169. D’ALEMBERT, supra note 123. Further, “Imagination acts no less in a geometer who creates than in a poet who invents.” *Id.*

170. “[W]e could relate [all the Fine Arts] to Poetry by taking this word [Poetry] in its natural signification, which is simply invention or creation.” *Id.* d’Alembert was referring to the already chang-
word “discovery” for only the most important inventions.\textsuperscript{171} He also provided a test for distinguishing important discoveries from the more commonplace inventions. Discoveries must be “curious, useful, and difficult to find, and which, consequently [have] a certain degree of importance.”\textsuperscript{172}

According to d’Alembert, the arts developed before any other categories of human knowledge because they were necessary for human survival (e.g., healing and agriculture). D’Alembert noted the importance of individuals being able to learn arts from each other.\textsuperscript{173} Art originally constituted the manipulation of naturally occurring materials to satisfy human needs. But over time it became the executable tasks of any field so long as they followed principled rules—essentially 
\textit{techné} art.\textsuperscript{174}

Science followed as humans had more leisure to engage in “idle speculations” that involved examining such materials for “less evident properties.”\textsuperscript{175} For both Diderot and D’Alembert, “science” was any activity where “the object of a discipline is only contemplated from different approaches, the technical collection and disposition of observations relative to that object are called ‘science.’”\textsuperscript{176} An artisan could “make a science” of his field by taking the subject of what he normally practices and making it the object of contemplation; he moves from being the internal, subjective actor to the external, objective observer.\textsuperscript{177} D’Alembert added
a third set of activities that “derive practical use from the speculative study of their object.” 178 Intriguingly, this last set seems to capture the emerging concept of technology, but the term was not in wide currency and d’Alembert did nothing more with the concept. 179

D’Alembert classified the different categories of arts within each of the three major divisions of human knowledge (Memory, Reason, and Imagination). The mechanical arts minus the fine arts became the “useful arts” and were classed within Memory (effectively as tacit knowledge handed down from artisan to artisan). 180 In the Map, the useful arts can be found within the division of Memory, underneath the subdivision of “Natural History” in the section “Uses of Nature.” The arts of “thinking,” “remembering,” and “communicating” were classed within Reason (under the “Science of Man” subdivision in the Map). From the modern cognitive science perspective, mental activities within the category of Reason used the “procedural knowledge” (muscle memory) and direct sense impressions included in the category of Memory and generalized them into abstract “declarative” or propositional knowledge. 181 Careful logic was the hallmark of the knowledge category of Reason. The fine arts were classed within the knowledge category of Imagination. By contrast to Reason, Imagination was a reflective capacity by which we combine our existing ideas into new ones. 182

Imagination often relied on genius, which for the philosophes was the capacity to respond immediately and intuitively to one’s environment. 183 The genius was a personality type who was deeply sensitive and wont to flights of fancy that allowed for more sublime truths than those produced by careful rational thinkers (albeit with many more errors along the way). In this way, both it and its earlier “divine madness” and secularized inspiration versions were different from our modern popular usage that signifies high I.Q. or intelligence. While the Enlightenment is terms in this way (“science” for the contemplation of a field as object; “art” for the use of a field as subject). See D’ALEMBERT, supra note 123 (“[We could say] that several of our sciences are arts when they are viewed from their practical side.”). Thus, the use of logic in reasoning is logic as art; the study of logic as an object is logic as science. See id. But it would be a mistake to equate art with “practice,” and science with “theory.” There is a theory and practice element to an art as well as for a science. Peter Dear explains this nicely when discussing twin aspects of theorica and practica that early modern writers ascribed to any given field. Theorica was the apparatus of a field, such as tools and methods, and the study of them; practica was the actual use of these tools to achieve a specific goal. Dear, supra note 38, at 393.

178. D’ALEMBERT, supra note 123.
179. See id.
180. Id.
181. See supra Part II.
182. D’ALEMBERT, supra note 123 (Imagination “consists of the ideas which we create for ourselves by imagining and putting together beings similar to those which are the object of our direct ideas.”).
183. See Jean-François de Saint-Lambert, Genius, THE ENCYCLOPEDIA OF DIDEROT & D’ALEMBERT: COLLABORATIVE TRANSLATION PROJECT (John S.D. Glaus trans., 2007) (1757), http://quod.lib.umich.edu/d/did/did2222.0000.819?view=text;rgn=main. d’Alembert occasionally used an older sense of genius in his entries, signifying an “excellent quality,” as well as a sense that genius is a “feeling that creates.” See D’ALEMBERT, supra note 123.
sometimes referred to as the “age of reason,” it would be a mistake to infer that imagination and intuition were disfavored. Like the philosophes’ reverence for the uncodifiable “skill” (procedural knowledge) of the artisan, the respect they had for the non-rational genius was palpable in their writings. Each aptitude had its place in a well-functioning society. D’Alembert and the other philosophes’ notion of genius may also have set the stage for the Romantic notion of the author as a passionate seer guided by inspiration and intuition to find greater truths than those possible by incremental rational analysis. Genius was not teachable and thus was not an art. Its central role in the emerging Fine Arts may have facilitated the modern sense that they are unteachable and purely intuitive. For the philosophes, however, the skill of the fine artist in existing techniques was very much teachable. It was only genius that was unteachable.

Likewise, for the philosophes, works of the Fine Arts were assessed qualitatively through taste, sentiment, and the emerging field of aesthetics. Thus, they could not be placed into a “progress” narrative. Summarized by the old fashion industry saying “hem lines go up; hem lines go down,” there was no arrow of progress for taste-based fields. Or, as economists hold, there is no accounting for taste, it is simply an inherent starting point for personal preferences. While earlier writers needed to separate out the visual fine arts from the mechanical arts, d’Alembert sought to keep them from being merged into the liberal arts, which he saw as rule-based and practical for mental operations such as logic and mathematics. The fine arts, by contrast, were for pleasure only and primarily centered on genius and taste.

184. “There are few errors in Locke and too few truths in Shaftsbury; the former however has nothing but expansive intellect, penetrating and correct; but the latter is a genius of the first order. Locke has seen; Shaftsbury has created, constructed, strengthened.” de Saint-Lambert, supra note 183.

185. For example, the genius was great at pioneering bold new ideas and acting “on the fly,” but, being accordingly error prone, was poor at managing established projects. “Men of genius . . . are better made to overthrow and establish states and to maintain or re-establish order than to follow it.” Id. (emphasis in the original). In this way, geniuses resemble the modern notion of the entrepreneur. They were also better suited for philosophy and the Fine Arts than for government as errors in the latter could directly harm others.

186. This is likely no accident in that Rousseau was originally a contributor to the Encyclopédie before breaking off from the philosophes on ideological grounds concerning this very point. See D’ALEMBERT, supra note 123.

187. D’Alembert follows J.P. de Crousaz, who is considered to have written the first French treatise on aesthetics, Beauty, in 1714. See Kristeller, supra note 145, at 17.

188. Barton Beebe argues for a notion of “aesthetic progress” in the eighteenth century that influenced the framers of the Constitution and early statutes and case law. See Barton Beebe Examines Intellectual Property Law and Aesthetic Progress at the Inaugural Desmarais Lecture, N.Y.U. LAW (Feb. 3, 2014), http://www.law.nyu.edu/news/barton-beebe-inaugural-desmarais-lecture. I disagree. While the Encyclopédia entry on “Taste,” for example, argues that taste can be refined in persons, this is a matter of established “high” versus “low” taste and not a matter of limitless measurable potential in the way that “progress” in quantifiable fields was described. See d’Alembert, Diderot, Montesquieu & Voltaire, supra note 151.
Diderot’s Prospectus and entry on Art are paean to the useful arts, articulating both what we would call procedural knowledge and techné art. While some workers were mere hired hands who did not understand why their craft worked, others were true artisans who mastered both the principles and practice of their art. Importantly, though, such “principles” did not need to be couched in the emerging terms of the new sciences. Rather they were simply abstractions that operated as high-level guidelines for the field—such as the theorica that Dear discusses. Diderot criticized earlier authors for not engaging directly with artisans in their workshops. He and the other Encyclopedists not only visited the shops, but also tried the various arts and crafts with their own hands. Diderot explored the “shorthand” language that experienced artisans can use with each other. While this appears to codify procedural knowledge, it does not enable those unskilled in the art to understand the technique, let alone practice it.

Diderot’s definition of “art,” like d’Alembert’s, was directed to the useful arts and mapped onto the traditional notion of a techné art. Also like d’Alembert and nearly two millennia of precedent, Diderot distinguished “art” from “science” by asking whether there was a subject of action or an object of contemplation. For Diderot, a useful art was that which transformed a natural material by hand or machine for practical human ends. For each art, the Encyclopedists thus sought to document: (1) the details of the material to be worked and the processes to transform it; (2) “the principal things that are made from it, and the manner of

189. The Prospectus reviewed here is the amended version appearing as Part III of the Preliminary Discourse. See D’ALEMBERT, supra note 123.
190. Diderot, Art, supra note 163. Art was considered so important that it was published as its own separate monograph as well as in the Encyclopédie.
191. Diderot was in fact the son of an artisan and had a fascination with craft operations. See D’ALEMBERT, supra note 123, at pt. III n.26. An unattributed Encyclopédie entry on “Craft” likewise sought to dignify the craftsman above the lowly position society had placed him in. See Denis Diderot, Craft, THE ENCYCLOPEDIA OF DIDEROT & D’ALEMBERT: COLLABORATIVE TRANSLATION PROJECT (Stephen J. Gendzier trans., 1967) (1765), http://quod.lib.umich.edu/d/did/did2222.0001.301?view=text;rgn=main.
192. D’ALEMBERT, supra note 123.
193. See Dear, supra note 38, at 393.
194. Diderot singles out Ephraim Chambers and the latter’s English Encyclopedia in particular.
196. Id.
197. Art is “a system of instruments, or of rules which were all directed toward the same object.” Diderot, Art, supra note 163. The entry was classified as “Applied Natural History,” linking it to the useful arts section of the Map. Importantly, the entry in the second edition of the Encyclopédie appended a section on the fine arts, underscoring that the “art” Diderot focused on was not the fine arts.
198. “If the object leads to action, we give the name of ‘art’ to the compendium of rules governing its use and to their technical order. If the object is merely contemplated under different aspects, the compendium and technical order of the observations concerning this object are called ‘science.’” Id. This again maps to Dear’s exposition of both arts and sciences as having theorica and practica components.
199. Id. at 83. This suggests an early root for the “machine or transformation” test relied on by the Federal Circuit in In re Bilski. 545 F.3d 943 (Fed. Cir. 2008). While this test was rejected by the Supreme Court as the sole test for patent eligibility, it captured a longstanding attribute of useful arts (and hence patent eligible inventions). Bilski v. Kappos, 561 U.S. 593, 603 (2010).
making them;” (3) the details of the tools and machines used; (4) the steps of workmanship through illustrated plates; and (5) the terms of the art.200 While it is unclear whether the manipulation of natural forces could also be the subject of an art, Diderot referenced the patented steam engine of Savery as an art (without tying it to a material product of nature).201

Going beyond d’Alembert, Diderot recognized that each art included *theorica* and *practica* elements.202 The latter were “habitual and unthinking” and may equate to procedural knowledge.203 Both elements needed to interact for progress to occur in an art.204 My metaphor for this is a person striding forward: one leg is the speculative aspect of an art, the other is its practical aspect. Each one can only move ahead so far without the other catching up and then leading in turn.

Like d’Alembert, Diderot sought to elevate the useful arts by calling for a new kind of artisan-scientist—similar to the modern *technologist*—who could use scientific insights to develop entirely new arts rather than incremental improvements in existing ones.205 Although what he really seemed to want was a return of the *ingeniator* who weaved together imagination (*genius*), memory (procedural and declarative knowledge), and reason (logic) to discover entirely new problem solving methods.

In the wake of the *Encyclopédie* project, the concept of the “useful arts” seemed to finally cohere around the mechanical arts minus the fine arts. In 1774, W. Kenrick published a fascinating piece arguing for “useful artists” to be accorded the same respect, and given the same rights to “secure” property in their inventions, as authors and engravers. Entitled, *An Address to the Artists and Manufacturers of Great Britain*, it clearly followed Bacon’s and the *Encyclopedists* call for elevation of useful artisans.206 The subtitle is quite telling: “Respecting an Application to...
Parliament for the further Encouragement of *New Discoveries* and *Inventions* in the Useful Arts; to the facilitating future *Improvements* in the *Produce, Manufactures* and *Commerce* of these Kingdoms.*

Kenrick's ultimate goal was to get Parliament to pass a version of the Statute of Anne directed towards inventions in the useful arts. Why? Because the Statute of Monopolies—the only positive law in England to address inventions and “patents” (in the broader sense of the Crown “prerogative” to grant exclusive privileges for all manner of commercial activities)—was a backhanded concession by Parliament to allow patents by the Crown *only* for new manufactures, and that for only 14 years. Most other Crown patents were now prohibited. But the process for obtaining Crown patent protection was expensive, complex, and quite uncertain. Kenrick and others envied the relative ease of the registration system for literary works under the Statute of Anne, and desired something similar for inventors.

More directly on point for present purposes, Kenrick distinguished *useful* from *polite* arts. The latter included literary works, engravings and etchings (which had come under the Statute of Anne because of their central role as illustrations or plates, especially in “scientific” books), fine art, and the emerging new category of “decorative arts.” The last category would play an increasingly important role in the industrializing West and mass production of both *objets d’art* and utilitarian objects that incorporated aesthetic design elements, ornamentation, or embellishment. Kenrick appears to designate fine artists as capital A “Artists”—a convention that would certainly take hold in the nineteenth century—while referring to (useful) artisans as “useful artists,” “artisans,” or, frequently, “artificers.”

In this way, he seems to exemplify the challenge stemming from the emerging privileged sense of “Art” as fine art, and its accompanying appropriation of the term “art.” Terminology was desperately needed to designate all the other “artists” working outside the relatively narrow area of the fine arts. But, as Kenrick admits, the polite arts “make a more splendid and imposing appearance; they assume a dignity and importance,” over the useful arts, which may explain why they were being elevated above the practical arts and their disproportional claim to the universal term “art.”

Notwithstanding, Kenrick argues passionately for the importance of advances in the useful arts as better leading to “political happiness” than the fine or decorative arts. While Kenrick close English language version of the Map of Human Knowledge in the latter. CROKER'S ENCYCLOPEDIA.

207. *Id.* (emphasis in original).

208. *See infra* Part II(G). Kenrick references the reproductions of ancient *objets d’art* by Wedgwood and Bentley. *See KENDRICK, supra* note 206, at 26. Kenrick’s argument for equivalent treatment of literary property and useful arts inventions centers around the close connection between the manual but decorative arts of engraving, etching, and mezzo tinto scrapers, on the one hand, and the manual but practical useful arts (woodworking, metal work, machinery, etc.), on the other.

209. *See, e.g.*, *id.* at 1–3.

210. *Id.* at 22.

211. *Id.* at 21–30.
never defines the “useful arts,” it is clear that it is the set of mechanical arts that excludes the polite arts (and thus fine and decorative arts are outside the useful arts). Inferring from the subtitle and elsewhere in the monograph, agriculture and commerce join manufacturing within the useful arts.

By 1787, the year the U.S. Constitution and its IP Clause were drafted, the “useful arts” were closely allied with commerce, manufacturing, and agriculture. Societies were being established to encourage development of these economically valuable trades. One example is the “Pennsylvania Society for the Encouragement of Manufactures and the Useful Arts,” which promoted manufacturing in Pennsylvania. In setting out its purpose, the Society’s leaders cited the fact that the people of Pennsylvania “possess[ed] within [them]selves the materials of the useful arts, and articles of consumption and commerce.”212 Likewise, Tench Coxe, an American thinker who was influential on George Washington and other Founding Fathers, published An Address to an Assembly of the Friends of American Manufacturers, in which he mentioned “citizens, who are expert at manufactures and the useful arts.”213

Pivotal in my story, however, is the treatment of “useful arts” in British author E.A.W. Zimmerman’s A Political Survey of the Present State of Europe, published that same year in London.214 In the Preface, he both solidifies the sense of useful arts I argue for here and makes a connection to a new sense of the term “technology” (which had emerged in its first incarnation during the seventeenth century as solely, and surprisingly, the name for treatises on grammar and language):215 “Besides chemistry, natural philosophy, and natural history, a new branch of scientific knowledge, viz. technology, or the theory and accurate description of useful arts and manufactures, was much cultivated in Germany.”216 “Useful arts” are again associated with manufactures. But “technology” is introduced in one of two powerful new ways in which it would be used in the nineteenth century: (1) a kind of literal reading of its constituent parts: techné + ology or a science (systematic study) of techné; and (2) the practical application of principles discovered through the “new sciences” (that would ultimately become “Science” in the modern popular sense as the physical or natural sciences such as physics, biology, chemistry, etc.).217 In the use, “technology” is not the processes or artifacts of the useful arts, but rather is the external study of such processes and artifacts. Ultimately, however, “technology” would become the term

212. The Plan of the Pennsylvania Society for the Encouragement of Manufactures and the Useful Arts 4 (Aitken & Son 1787).
213. Tench Coxe, An Address to an Assembly of the Friends of American Manufacturers 7 (Aitken & Son 1787).
216. Zimmerman, supra note 214, at iii.
217. See infra Part V(B).
for the processes and artifacts of the useful arts starting slowly in the
nineteenth century and then fully displacing “useful arts” in the early
twentieth century. Thus, in the ultimate complication for terminology
and conceptual underpinnings of the patent system, just as “(useful) arts”
had become nearly as unified or systematized as “fine arts,” it was about
to be replaced by “technology.” But whereas the collapse of “fine art”
to “Art” did not fundamentally alter the notion of what constituted the
full breadth of fine arts, the displacement of “art” and “useful art” with
“technology” would improvidently both narrow and expand the territory
of the “useful arts” that the patent system was built upon.

F. The Romantic Period

The emergence of aesthetics as a unifying theory of the Fine Arts,
together with the “Counter-Enlightenment” of the Romantic period,
narrowed art to the Fine Arts and the artist to the nonrational, expressive
artiste (the antithesis of the techné artisan). By the early nineteenth
century, Kant and others had incorporated aesthetics as a major compo-
nent of philosophical systems, even as the useful arts—so important to
Galileo, Bacon, and the philosophes—were once again left behind. In-
tellectuals focused on the “scientific” or “philosophical” principles
(meaning contemplative laws of nature) behind artisanal achievements
such as the steam engine, neglecting practical advances in, for example,
boilers, valves, and pipes that made them possible. At the same time
there were mid-level practical principles that were neither uncodifiable
know-how nor laws of nature, such as that the pressure from a boiler
could be harnessed by a reciprocating piston attached to a gear or wheel
to create force or motion. This principle could be applied in many prac-
tical ways.

218. This, again, is like the transfer of the name “Frankenstein” to the monster that Dr. Franken-
stein creates. See supra note 95.

219. For example, Sulzer published General Theory of the Fine Arts in the early 1770s. Kristeller,
supra note 130, at 38–39. Goethe first rejected, then adopted, a comprehensive system of the fine arts,
even as he continued using the techné sense of “art.” For example, he rejected poetry as an “art” be-
cause it was based on genius, not rule-based skill. Id. at 40–41. He also provided an early example of
presentist errors based on the changing sense of art: Hippocrates had contrasted “Art” with “Life,”
meaning human artifice compared to natural phenomena, which Goethe misinterpreted to contrast the
imagination-based Fine Arts with the “real” world. See Kristeller, supra note 12, at 498–99. This is sim-
ilar to modern popular (mis)usages such as “art imitates life” (or “life imitates art”).

220. See Kristeller, supra note 145, at 24. For example, Victor Cousin built the foundation of
modern value theory on three pillars of the Good, the True, and the Beautiful. Id. Unfortunately, the
developing modern sense of aesthetics-based “beauty” led to increasing misreadings of ancient and
medieval texts. The Greeks’ purely moral sense of “beauty” (right actions) was replaced by the purely
aesthetic sense. See Kristeller, supra note 12, at 499–500.

221. See, e.g., Horniblow v. Boulton, [1799] 8 T.R. 95 (K.B.) 99 (finding Watt’s patent for a
steam engine to claim a manufacture and not a philosophical principle, the latter which would have
been prohibited); Neilon v. Harford, [1841] 8 M. & W. 806 (S.C.) 824 (holding that a patent for inter-
posing a heated receptacle between a blower and a furnace such that the air sent into the furnace
would be warm, not cold, was not invalid as simply a scientific principle; whereas a patent for only a
scientific principle (with no particular application) would be invalid).
The Romantics rejected scientific rationalization of nature and industrialization in favor of the natural and the emotive. Passions were celebrated. The solitary *artiste*, adopted from the *philosophes’ genius*, was a heroic figure leading change through vision and intuition in the emerging “Great Man” approach to history in which many major events and changes were attributed to particular individuals instead of groups. He no longer merely imitated nature, but created entirely new things just as Prometheus had done, bestowing them as gifts upon his less inspired fellows. Absolute originality and personal expression became his touchstones. The *author* was no longer an authority directing the production of works, but a font of assertive self-expression and creativity. The *genius* component of art became all-encompassing and *artistes* were seen as born, not made. The elevation of Romantic *artistes* to cultural heroes led to the self-importance of capital-A “Art.”

Meanwhile, the new terms introduced for the increasingly successful practice of science-based artisanal innovation in the seventeenth century began to take root. “Technology” captured both a science of techné arts (techné + ology) and the application of scientific principles to speed up artisanal innovation. And some commentators at long last explicitly held that particular fields could have both science and art components. “Engineer” emerged in French as a modification of *ingeniatore* and *ingegnere*, and quickly spread to England and elsewhere, displacing any continued need for *techné* artisans to call themselves “artists.”

While engineering involves *genius*, and is etymologically rooted in it, the newly named “engineers” seemed to have little interest in being confused with *artistes*. The terms art and artist were accordingly yielded to the Romantics. Those who considered themselves “scientists” focused on the “scientific progress” component of the Enlightenment, rejecting the qualitative and noncodifiable. Thus, Diderot’s dream of a “gram-

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222. The “novel” thus obtained its modern meaning as a work of creative self-expression, rather than simply a work that had never been published before.

223. See Jacob Bigelow, *Elements of Technology* 1–6 (1829). Bigelow’s work is described on the title page as taken from lectures on the “application of the sciences to the useful arts.” Its Introduction reinforces the longstanding senses of *science* and *art*. The former are “those departments of knowledge which are more speculative, or abstract, in their nature, and which are conversant with truths or with phenomena, that are in existence at the time we contemplate them.” *Id.* at 1. The latter are “departments of knowledge, which have their origin in human ingenuity, which depend on the active, or formative processes of the human mind, and which without these, would not have existed.” *Id.* Notably, the term *technology* is never used in the entire Introduction; rather all discussion is in terms of *science* and *art* and the interaction of the two. Zimmerman’s earlier 1787 reference, described above, had “technology” described in a way that underscored its newness.

224. “[W]e find both a science and an art involved in the same branch of study. For example, chemistry is a science depending on the immutable relations of matter, which relations must have existed, had there never been minds to study them. Yet these laws of matter would not have become the subjects of science, had not mankind invented the art of separating their agents, and making them cognizable to the senses.” *Id.*


mar of the arts” was dead. The new order of arts and sciences was based on the divisions of arts (Fine Arts), sciences (theoretical and experimental basic science), and engineering (applied science and technology).228

G. The “Arts and Crafts” Movement

Inspired by Romanticism, the Arts and Crafts movement in nineteenth century England sought a (re)unity of the arts and revival of an idealized master artisan.229 Its intellectual forefathers, John Ruskin and William Morris, rebelled against neo-classicism, Royal Academy Fine Arts elitism, Enlightenment scientific progress, and industrialization’s crass commercialism. They embraced medieval gothic forms of decoration and design.230 Like the ancients proponents in the Querelle, they saw past masters and works as superior to those of the present. But their past was the medieval, not the Classical. They extolled the “ordinary” art and “joy in labor” of a mythical craftsman creating utilitarian wares and buildings for timeless ordinary folk.231 And they rejected the coolly analytic logic of Adam Smith and the industrialists that reduced the craftsman to a rote factory hand and produced shoddy mass-produced wares.232 Like Galileo, Bacon, and the philosophes, Ruskin and Morris hoped to elevate a segment of the useful arts and its artisans to the prestige of the Fine Arts and liberal arts,233 although they rejected the role of science,

229. While the beginnings of the movement originated in the 1830s, the name “Arts and Crafts” did not formally appear until the launch of the Arts and Crafts Exhibition Society in the late 1880s (replacing the term the “combined arts”). See Alan Crawford, W. A. S. Benson, Machinery, and the Arts and Crafts Movement in Britain, 24 J. DECORATIVE & PROPAGANDA ARTS 94, 100 (2002).
231. Id. at 17–18, 20. Later Arts and Crafts leaders embraced this ideal and also hoped that “artful” works would civilize the average person, particularly those in the emerging middle class, causing them to reject shoddy mass-produced goods in favor of hand-crafted ones. See Crawford, supra note 229, at 98–100.
232. See Eileen Boris, Art and Labor xi (1986); Naylor, supra note 230, at 11–12. The term “manufacture” itself underwent a transformation from its literal meaning of production by hand (“manu-” + “factor”) to the modern sense of mechanized industrial production. According to Smith, a narrowly defined, semi-skilled task would become the “sole employment of [the worker’s] life.” Adam Smith, The Wealth of Nations 10–14 (Prometheus Books ed. 1991) (1776). Smith maintained the mechanical or techné sense of “art,” using it to discuss the processes of manufacturing. Id. He also advocated the “speculative” philosopher who “does no thing” (produces no physical object) but through his broad knowledge and observations can imagine putting together disparate elements from different fields to create a new kind of useful machine. Id.
233. The movement temporarily revived Diderot’s dream of a “grammar of the arts” as it sought a “grammar of the Industrial Arts, Architecture and Industry.” Naylor, supra note 230, at 176. While its leaders usually included architecture—a fine art—in the arts covered by the movement, they were primarily focused on the “lesser arts” or “minor arts,” an indeterminate set of mechanical arts that were concerned with decoration and design. See id. at 120. Alan Crawford, Ideas and Objects: The Arts and Crafts Movement in Britain, 13 DESIGN ISSUES 15, 16, 19 (1997) [hereinafter “Crawford, Ideas and Objects”]. For example, the Central School, founded on Arts and Crafts ideals in the late nineteenth century, contained five major departments: (1) fine metalwork (largely focused on gold, silver, and jewelry); (2) furniture; (3) dress design, embroidery, and needlework; (4) stained glass; and (5) book design and printing. See Naylor, supra note 230, at 180. Morris and Ruskin sought to position their
technology, and quantitative “progress.” They idealized an “all round” artisan who could design and build wares with time-honored, apprentice-based techniques, pitting themselves against machine-based, industrial production that relied on both scientific progress and a sharp division of labor. Ultimately, however, this vision could not compete against the economic and social conditions of the industrializing West.

Two factors kept Morris’ and Ruskin’s views from being relegated to the fringe at the outset: (1) a visceral public reaction against factory work conditions, and (2) the lagging of British manufactures behind better designed Continental wares. The former led to a grounds swell of popular support for the emerging Arts and Crafts movement. The latter led to government support for the creation of new “design schools” that effectively made design a formal profession. However, Ruskin’s Romantic inclinations led him to reject the teachability of design, leading to one of the tensions in the movement: was design a techné art or a genius art? Many Arts and Crafts leaders emphasized learning-by-doing and apprenticeship approaches to training (including a revival of guilds), suggesting that design was indeed teachable, if not codifiable.

Notwithstanding the early movement’s opposition to machines and commercialism, later leaders allowed some mechanization and profit-mindedness. They also limited the scope of Arts and Crafts manufactures, conceding “the heavier and ruder productions of industry” to the techno-industrialists and retaining only those objects “in which Art and handicraft are happily blended.” Yet as the movement wore on, and espe-

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234. See Crawford, W. A. S. Benson, supra note 229, at 107; see also Crawford, Ideas and Objects supra note 233, at 16. Anticipating the current rise of “DIY” (“do-it-yourself”) and “maker” approaches discussed below in Part II(I), Morris and Company began making their own dyes from scratch for their fabrics, rather than using commercially available ones. NAYLOR, supra note 230, at 105. William de Morgan would take this even further by mastering all the crafts required to make his pottery from scratch. Id. at 151–53.

235. See id. at 15–18. The field was further legitimized by journals and exhibitions. See id. at 18–22, 113–120; Crawford, Ideas and Objects supra note 233, at 19. Various factions also sought to strengthen patent and copyright laws to better protect and incentivize design innovation. See NAYLOR, supra note 230, at 19–20. Later Arts and Crafts leaders, such as Benson, used both trade secrets and patents to protect their innovations. Crawford, W. A. S. Benson, supra note 229, at 106, 110–11. The United States would later modify its patent laws to add a new kind of patent, the “design patent” which protects only the ornamental features of a manufacture. See 35 U.S.C. § 171 (2012).

236. See id. at 16, 23–32, 93–95.

237. See id. at 15–18. The field was further legitimized by journals and exhibitions. See id. at 18–22, 113–120; Crawford, Ideas and Objects supra note 233, at 19. Various factions also sought to strengthen patent and copyright laws to better protect and incentivize design innovation. See NAYLOR, supra note 230, at 19–20. Later Arts and Crafts leaders, such as Benson, used both trade secrets and patents to protect their innovations. Crawford, W. A. S. Benson, supra note 229, at 106, 110–11. The United States would later modify its patent laws to add a new kind of patent, the “design patent” which protects only the ornamental features of a manufacture. See 35 U.S.C. § 171 (2012).

238. See NAYLOR, supra note 230, at 22 (“[T]he very words ‘School of Design’ involve the profoundest of art fallacies. Drawing may be taught by tutors, but Design only by Heaven; . . . .”). Under scoring this notion, Walter Crane later declared that “Art is not Science.” Id. at 145.

239. NAYLOR, supra note 230, at 113; Crawford, supra note 229, at 104.

240. NAYLOR, supra note 230, at 176. This blurred the matter, though, as in many cases, British industry combined hand and machine production too. Crawford, W. A. S. Benson, supra note 229, at 107.

241. NAYLOR, supra note 230, at 148.
cially as it was adapted in the United States, even “Art” wares became mass-produced and machines were no longer anathema.\footnote{242} The role of the designer was reduced to introducing good design into mass-produced goods.\footnote{243} This led to a second tension in the movement: whereas some leaders prioritized the idiosyncratic styles and imperfections that came along with the procedural knowledge of handicraft,\footnote{244} others pragmatically emphasized good design for both machine and hand manufactures.\footnote{245} The latter proved to be the future.\footnote{246}

Even as one faction led directly to the modern consumer products designer, another faction obstinately looked to an idealized, rural crafts past. For better or for worse, the latter became the enduring symbols of the phrase “Arts and Crafts”: “a progeny of cranks and eccentrics, the ‘arty crafty’ with their aura of the homespun and the country dance.”\footnote{247} Partly, this originated from the good intentions of the “home industries” initiative, which sought economic development through the revival of traditional crafts in distressed rural economies.\footnote{248} Left behind by urban industrialization, these communities might capitalize on the popularity of the Arts and Crafts style by producing the kind of quirky, nostalgic handicrafts that could not be mass-produced. The challenge was whether a market would endure for period-based craft styles.

\section*{H. Design Beyond the Arts and Crafts Movement}

In the United States, the Arts and Crafts movement was adapted for the peculiarities of American culture. Because the early factory experiences in the United States were not as grim as those of England,\footnote{249} there was less resistance to machine production.\footnote{250} This sensibility led to hybrid operations such as Rookwood Pottery, Tiffany Studios, and Roycroft,
which operated on a mass-production scale, even as they maintained an artisanal culture.251 The burgeoning middle class was increasingly able to afford these consumer-oriented art wares.252 But, as in England, “Arts and Crafts” quickly became limited in the public mind to a decorative/design style.

The middle class was not able to afford handcrafted furniture, lighting, and homes.253 And the self-sufficient frontier American, who would have embraced the Arts and Crafts DIY (“do-it-yourself”) ethic as he built his own furniture and houses, was transforming into the company man working long hours at the factory and looking for easy style and comfort in his off hours.254 This drove the success of department and catalogue stores such as Sears Roebuck and Macy’s. Also popular were unfinished, mass-produced art wares, to be painted or ornamented by the consumer, and affordable objects d’art, that enabled middle class homemakers to apply their personal expressive touches to their homes.255

The U.S. Arts and Crafts movement was also transformed by its role in education. Mechanical arts were introduced into public schools alternatively to: (1) develop aesthetic values in working class children;256 (2) create consumers who could recognize and reject shoddy products;257 or (3) “Americanize” immigrants.258 Elementary school teaching itself became “women’s work” because it was “nurturing” and women were “better” at teaching aesthetic values to children.259 Domestic crafts such as basket weaving became a popular therapy for the physically and mentally disabled.260 American psychologists and education reformers John Dewey and G. Stanley Hall sought to implement their child development theories through arts and crafts.261 The Progressives promoted new vocational-technical schools to educate tradesmen through a mix of “learning

251. BORIS, supra note 232, at xiii.
252. Such purchases were also fueled by the “House Beautiful” and “Healthful Home” ideals beginning at that time. See id. at 53.
253. See id. at 56.
254. See id. at xiv-xx. The initial profusion of American Arts and Crafts workshops, societies, and guilds—producing decorative, “democratic” art such as chairs, vases, and rugs for the middle class—later became niche organizations as the consumerist mindset of the mid-twentieth century took hold. See id. at 32.
255. This trend began in the 1870s when pottery manufacturers sought to establish “art pottery” lines by employing fine artists to paint unfinished pottery. See BORIS, supra note 232, at 101–102; NAYLOR, supra note 230, at 149–50. Over time amateurs were employed and ultimately the unfinished pottery was sold directly to consumers to decorate with their own “personal touch.” This business model is alive and well today, and includes businesses that provide the space and materials for decoration. Major chain stores today that also cater to this demographic include Michaels Arts and Crafts and Jo-Anne Fabric and Craft Stores. Small studios where consumers can decorate pre-made pottery, etc. also exist in most cities.
256. BORIS, supra note 232, at xv, 34–37, 82–98.
257. Id. at 86–87.
258. Id. at 88–89.
259. Id. at 91–98.
260. Id. at 103–04.
261. See id. at 84, 89–91. Particularly, the view that the child recapitulates the development of humanity.
by doing” apprenticeships and academic classes. But the unitary craft vision of the Progressives and Arts and Crafts leaders quickly dissolved into a “heads and hands” system in which vocational-technical schools produced workers while general education high schools produced managers (increasingly by way of a follow-on college degree). The subject matter of vocational-technical schools was not characterized as “arts and crafts” anyway, but rather as “vocational,” “technical,” or “trades.” “Arts and crafts” were taught in “home economics” courses introduced as the female counterpart to male “shop” classes. Arts and crafts were marginalized even at the college level: “Basketweaving 101” became a shorthand for the alleged useless and easy courses introduced in the later twentieth century that students could take in place of “tough” and “useful” courses in science, technology, engineering, and math (“STEM”).

German designers transformed parts of the British Arts and Crafts movement into the Bauhaus movement of the early twentieth century. They were most interested in attempts to integrate art and machines, in line with their modernist and Futurist orientation. The Werkbund school became a battle of design ideologies, while gaining fame for its “type” furniture that had both style and machine production efficiency. The Germans revived the techné arts by adapting Ancient Greek principles of orderly, rational design that provided as much a role for the engineer as for the “artist.” The German word for “art” (kunst) maintained the sense of techné art (as well as fine art). Gropius and the Bauhaus school followed with their assertion that “architecture was both a science and the highest form of art.” But this should not be misread with today’s American connotations of art and science; the Germans followed

263. See Boris, supra note 232, at 90–91; Matthew B. Crawford, Shop Class as Soulcraft: An Inquiry into the Value of Work 30–31 (2009). For decades, stigma has attached to both vocational-technical schools and shop classes in general education high schools. Many vocational-technical schools closed over the past two decades. However, the ones that remain have seen a recent resurgence in interest and relative respect. See Linda Matchan, Drills and Skills: Why Some Educators are Putting a New Emphasis on Woodworking Class, BOS. GLOBE, Jan. 4, 2011, http://www.boston.com/lifestyle/family/articles/2011/01/04/why_some_educators_are_putting_a_new_emphasis_on_woodworking_class/.
264. See Boris, supra note 232, at 87.
266. See Crawford, W. A. S. Benson, supra note 229, at 117. Otto Wagner, for example, stated that “all modern forms must correspond to new materials and new requirements of our time, if they are to fit modern mankind.” Naylor, supra note 230, at 185.
267. See id. The Werkbund shared a broad view of “art” with the British Arts and Crafts: “art” was more than just the fine arts and must include the crafts (lesser arts) and “embrace the whole of life.” Id. at 187.
268. Id. at 188. Architecture for example could be “controlled and rational, pure and predictable; . . . its creators concerned not with self-expression but with the eternal concepts of space, structure and harmony, concepts which could be expressed by the use of predetermined orders.” Id.
269. Id. at 188–89. In France, Le Corbusier expressed a similar sentiment: “Architecture is governed by standards. Standards are a matter of logic, analysis and precise study.” Id. Note that “architecture” often encompassed design of furniture and machines as well.
the traditional senses of science as systematic study of a field as object and of art as the manipulation of objects for practical ends as subject. Regrettably, however, even the progressive Bauhaus succumbed to the genderization of arts.

Finland was also influenced by the Arts and Crafts movement as its leaders sought a design identity to help manufacturers compete in the market and as the public responded to shoddy goods and poor factory working conditions. Nordic “functionalism” emerged from the rapid urbanization and small apartments of early twentieth century Helsinki and other cities. Furniture needed to be stackable and have multiple functions. But Finnish designers refused to allow functionalism to dictate aesthetically unappealing objects. Alvar Aalto and his Artek company worked with the largest department store, Stockmann, to create a design department for consumers. The scarcity of materials after World War II led to creative uses in products designed for “Everyday Beauty.” The importance of designers resulted in celebrity status for them and their designs, which went worldwide after the 1952 Helsinki Olympics.

Meanwhile, other Scandinavian countries followed suit with variants on the well-designed, clean lines, multi-purpose functionality, and mass production with inexpensive materials approach. Ultimately, this included anthropometric research and a realization of the British Arts and Crafts ideal that household objects should be rethought to maximally fulfill their utilitarian purpose.

I. “Art” Becomes Synonymous with “Fine Art” in Popular Usage

By the mid-twentieth century, the loss of the techné sense of “art” in popular culture was complete. Similarly, despite the efforts of Arts and

270. Gifted female students who had won competitive scholarships to study architecture were shunted to “feminine” arts such as weaving. See Alice Rawsthorn, Female Pioneers of the Bauhaus, N.Y. TIMES (Mar. 22, 2013), http://www.nytimes.com/2013/03/25/arts/25iht-design25.html?r=0. In later years, this was remedied and ultimately women trained in “male” domains such as metal-working and industrial design. See id.

271. This paragraph is summarized from notes taken during a 2013 visit to the permanent exhibit at the Finnish Design Museum in Helsinki.

272. Id.

273. Id.

274. Examples include Eero Aarnio and his 1966 “egg chair,” Marimekko colorful print clothes, and Littala glassware.

275. See NAYLOR, supra note 230, at 191–92. This is perhaps most famously typified today by IKEA of Sweden.

276. Id. at 192–94.

277. Richard C. De Wolf, Registrar of Copyrights and the author of a major copyright treatise in the early twentieth century, noted the transformation of the term amongst the public and even many lawyers. RICHARD C. DE WOLF, AN OUTLINE OF COPYRIGHT LAW 15–16 (1925) (“[T]he word art was not so closely associated as it now is with the fine arts.”). Hendrik Willem Van Loon published a popular history of “The Arts” that encompassed only the fine arts and the “minor arts” (similar to the decorative arts covered by the Arts and Crafts movement) and did not even bother explaining why it did not include the mechanical or other useful arts. See generally HENDRIK WILLEM VAN LOON, THE ARTS: WRITTEN AND ILLUSTRATED (1939). By the 1950s, Kristeller would have to explain in detail the origins and development of the techné sense of “art” just to remind readers that it had even existed (for over two thousand years). See Kristeller, supra note 12, at 496–510. Similarly, in 1966, art critic
Crafts advocates, “arts and crafts” were narrowed down to amateur or primitive decorative projects that women, children, or invalids might do to while away the time and creatively “express themselves.” “Art” meant all and only “capital A” Arts (the Fine Arts), plus new so-called minor or entertainment creative arts such as movies, television, and photography.

Beginning in the late 1960s, however, the hippie and “back-to-the-land” movements turned away from techno-industrial capitalist “progress” and in some ways recapitulated the Arts and Crafts movement. Whereas in the 1950s, machine-made goods and foods were often seen as superior to hand-made ones, counter-culture types of the ’60s and ’70s sought “authenticity” (similar to the rough tool marks that Ruskin and Morris favored to show the hand of the artisan). “Natural,” “organic,” and simpler ways of living became favored. Yet none of this brought back the techné sense of art. If anything, it seemed to reinforce the homey sense of “arts and crafts” as hippies and then mainstream middle class young adults crocheted belts and tie dyed t-shirts for personal use or casual sales and exchanges.

By the 1980s, however, affluent yuppies—liberal and conservative alike—sought out high-end artisanal, hand-crafted goods. Catalogues with expertly written brand backstories about master craftsmen promoted a lifestyle (for those who could afford it) not so different from the affluent of the turn of the century who had outfitted their homes from Benson, Tiffany, and Morris and Company. This led to a resurgence of demand and respect for “craftsmen” and “artisans.”

Out of both the counter-culture and high-end artisanal trends emerged the DIY and “Maker” movements in the 1990s. These interrelated trends are not limited to handicrafts, home decorative arts, or “Old World craftsmanship.” Nor are they limited to the Fine Arts or to a nostalgic return to the “simpler” activities of yesteryear. Instead, they are as much based on cutting edge advances in machines and materials, such as 3D printing (squarely within the current popular sense of technology), as they are on old school artisanal techniques. Even where the focus is on

Raymond Williams had to explain that “An art had formerly been any skill; but Art, now, signified a particular group of skills, the ‘imaginative’ or ‘creative’ arts. Artist had meant a skilled person, as had artisan; but artist now referred to those selected skills alone. . . . Art came to stand for a special kind of truth, ‘imaginative truth,’ and artist for a special kind of person.” Raymond Williams, Culture and Society 1780-1950, xiii (1966).

278. Williams, supra note 277, at xiii.

279. Consider this in the context of American cars, Wonder bread, and “scientifically formulated” baby formula in the 1950s and 1960s.


“traditional” products like foods and beverages, the new makers are as apt to experiment with new tools, methods, and materials as to use existing ways. Makers enthusiastically use new knowledge about natural phenomena emerging from scientific research. Thus, they engage in technology in its sense of the application of science to art to accelerate innovation. In fact, many successful technology entrepreneurs and VCs are now turning to “start-ups” focused on artisanal premium products such as coffee, chocolate, and cheese.

Makers and DIY enthusiasts of all stripes, however, are primarily engaged in art. Many have adopted the term “artisanal,” rather than “artist,” likely because this evokes the skilled craftsman and not the Romantic artiste. But this is an unfortunate byproduct of the transformation of the term art to mean only the fine arts (and related aesthetics-based arts).

The techné sense of art that this Article uncovers is, nonetheless, still alive and well in authoritative definitions of “art.” The first five senses of art in the Oxford English Dictionary (“OED”) are variations on the fundamental theme of skill in practicing the methods of any kind of field. In one sense it is “skill in the practical application of the principles of a particular field of knowledge or learning.” In another, art is equated with the “useful arts” and strongly suggests the techné sense of art in its two parts. The fine arts sense of art corresponds to only the sixth through eighth senses. Further, only sense eight suggests art as

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282. See, e.g., ANDERSON, supra note 281.
285. “1. Skill in doing something, esp. as the result of knowledge or practice. . . . 2. Skill in the practical application of the principles of a particular field of knowledge or learning; technical skill. . . . 3. . . . a. A practical application of knowledge; (hence) something which can be achieved or understood by the employment of skill and knowledge; (in early use also) a body or system of rules serving to facilitate the carrying out of certain principles. . . . b. A practical pursuit or trade of a skilled nature, a craft; an activity that can be achieved or mastered by the application of specialist skills; (also) any one of the useful arts . . . . c. A company of craftsmen; a guild. . . . 4. With modifying word or words denoting skill in a particular craft, profession, or other sphere of activity. . . . ” See OXFORD ENGLISH DICTIONARY (online ed. 2014).
286. Id. at sense 2.
287. Id. at sense 3(b).
288. “6. Skill in an activity regarded as governed by aesthetic as well as organizational principles. . . . Any of various pursuits or occupations in which creative or imaginative skill is applied according to aesthetic principles (formerly often defined in terms of ‘taste’ . . . . the various branches of creative activity, as painting, sculpture, music, literature, dance, drama, oratory, etc. . . . . a. The expression or application of creative skill and imagination, typically in a visual form such as painting, drawing, or sculpture, producing works to be appreciated primarily for their beauty or emotional power. Also: such works themselves considered collectively. . . . b. The theory and practice of the visual arts as a subject of study or examination; (also) a class or lesson in art.” Id.
“works” (meaning artifacts). The OED links this sense to the definition of “work” which includes senses for various works of fine and creative arts among many other senses. Indeed, the bulk of senses for denoting artifacts resulting from the broad definition of arts is within the definition of “work” instead. The fuzzy, mysterious sense of art does not even directly appear in the OED. Rather, the remaining two categories of senses pertain to learning (as in the “liberal arts”) and cunning or human agency.

Nonetheless, in American popular usage “art” is hopelessly enmeshed in the fine arts. Just think about what is covered in the “arts” section of a newspaper or in a television local newscast. While there is little chance of fully reviving the techné sense of art, the current interest in artisanal goods is at least making it easier to explain that earlier sense of art without seeming completely crazy.

III. THE ROLE OF “ART” IN EARLY PATENT SYSTEMS

The Italian Renaissance produced the first invention patents, driven by the new ingeniators. While English rulers are reported to have granted exclusive rights to artisans as early as the thirteenth century, these were “patents of importation” to incentivize an artisan skilled in an art not yet practiced in England to establish it there. In Florence, Brunelleschi’s status allowed him to petition the government for a grant of exclusive rights for a new cargo boat he claimed to have invented. Operating outside of the guilds, he would not be able to rely on the regulations normally protecting practice of an art. Plus, his invention was embodied in the boat itself—not the methods of producing it—so that secrecy would have had limited value. In 1421, he was awarded the exclusive right to build

289. Id.
290. Id.
291. See id. at senses 9–16.
292. Origins of this sense may be from misinterpretations over time of words and phrases such as mystery and art and mystery which were used to signify orders or guilds of tradesmen and skill at practicing their trade. But mystery in these usages did not mean mystical or a puzzle or hidden knowledge, but rather simply a kind of office—like ministry or ministerial—in practicing a trade or skill. See OXFORD ENGLISH DICTIONARY (online ed. 2014). There may also be a connection with an alternate definition of mystery that signifies a skillful trade or operation that is kept secret, as had often been the case during the height of the guild system in Europe. See OXFORD ENGLISH DICTIONARY (online ed. 2014). But this had nothing to do whether the practice was fuzzy or mysterious to those to whom it was shown.
293. Id. at senses 10 and 11–12, respectively.
294. See, e.g., LONG, supra note 59, at 10; P.J. Federico, Origin and Early History of Patents, 11 J. PAT. OFF. SOC’Y 292, 293 (1929). Patents of importation took two forms. The first granted exclusive rights to a foreign artisan to relocate to England, set up shop, and train local apprentices. The second granted exclusive rights to an Englishman who would travel to the foreign land, master the art, and then bring it back to England. In both cases, British apprentices would have to be trained to continue the art. Similar grants are reported to have issued elsewhere. While the value of such patents may seem suspect, they are justified when one takes into account the centrality of procedural knowledge for mechanical and early mechanical arts. It was simply impossible to transmit the art by codified knowledge alone.
and operate any new kinds of boats on the Arno River for three years.\textsuperscript{295} Crucially, Brunelleschi was not seeking an incentive to create, but rather an incentive to disclose or to commercialize.

While Florence did not immediately follow up this grant with others, Venice was establishing an administrative process to grant similar rights to \textit{ingeniators} outside the guild system in the mid-fifteenth century.\textsuperscript{296} This led to the first true patent system, ultimately codified in the Venetian Patent Act of 1474.\textsuperscript{297} It exclusively used the terminology of art, and the arts provided the sole patent eligible subject matter.\textsuperscript{298}

Venetian artisans spread out across Europe bringing the legal innovation of a patent system with them. In the seventeenth century, England appears to have added key aspects of the Venetian system to regularize its existing \textit{ad hoc} patents of importation.\textsuperscript{299} England contributed the term “patents” as well: exclusive grants of public record from the Crown were included on the “patent rolls” that recorded every other issuance of “open letters” (\textit{litterae patente}) from the Crown (including titles, land, or other privileges); over time, the term “letters patent” was shortened to “patents” and came to primarily signify the open letters granting exclusive rights to inventions.\textsuperscript{300} Like the Venetian grants, British “patents” were directed to an art (or “mystery”),\textsuperscript{301} and not to “technology” or “science”. Further, \textit{arts} were methods, not artifacts.\textsuperscript{302} Because of this, key concepts in Anglo-American patent law have always centered on “art”: “prior art,” “person having ordinary skill in the “art,” “state of the art,” “teaching in the art,” etc.

\textsuperscript{295}. See Frank D. Prager, \textit{Brunelleschi’s Patent}, 28 J. PAT. OFF. SOC’Y 109, 109--10 (1946) (reprinting text of grant). In the grant, he was described as “a man of the most perspicacious intellect, industry and of invention” who had invented a new boat that could haul loads more cheaply than existing boats. He “refuse[d] to make such machine available to the public, in order that the fruit of his genius and skill may not be reaped by another without his will and consent . . . .” But, if he would be granted “some prerogative” on his invention, then “he would open up what he is hiding and would disclose it to all[,]” and would further be motivated “to even higher pursuits, and stimulated to more subtle investigations.”

\textsuperscript{296}. See Sichelman & O’Connor, supra note 74, at 1269--70.

\textsuperscript{297}. See id. Note that the Venetians did not refer to “patents,” and the name of the statute was given to it by later English speaking commentators. The statute itself has no title in its text.

\textsuperscript{298}. Technology as a term and concept did not yet exist. \textit{Science}—as a purely contemplative affair making a systematic study of a field or phenomena as object—had nothing to do with the practice of artisanal techniques, inventions, machines, or other practical matters.

\textsuperscript{299}. See Sichelman & O’Connor, supra note 74, at 1270.

\textsuperscript{300}. See CHRISTINE MACLEOD, \textit{INVENTING THE INDUSTRIAL REVOLUTION: THE ENGLISH PATENT SYSTEM, 1660-1800}, 10--11 (1988). Under the Tudors these grants became secret, albeit still with the purpose of luring in foreign artisans. Under Elizabeth I, the grants became open again. However, they became a powerful and controversial piece of patronage that she, and later King Charles, used to reward favorites. When the grants extended to existing commodities such as salt, they became quite unpopular and Parliament passed the 1624 Statute of Monopolies limiting them to new manufactures and to those issued to corporations.

\textsuperscript{301}. See supra note 292.

\textsuperscript{302}. While the Statute of Monopolies technically precluded method patents, over time English jurists found ways to allow patents on methods through what today we might call “product by process” claim interpretations. See Bilski v. Kappos, 561 U.S. 593, 628 (2010).
Standard patent and copyright histories place the antecedents of U.S. IP law in Britain,303 but a place must be made for the influence of the French *philosophes*.304 The *Encyclopédie* has “became almost synony-
mous with [the] Enlightenment,”305 and “is generally agreed [to be] the most influential work published in the eighteenth century”306 as “the epitome of the [French Enlightenment] *philosophes* achievement.”307 It was also the “greatest publishing venture” of the eighteenth century giv-
en its ambitious number of volumes, lavishly illustrated plates, and wide subscription base.308 Madison, a key drafter of the IP Clause, owned a copy, and referenced it five times in the preparation of his memorandum “Of Ancient & Modern Confederacies.”309 Thomas Jefferson, Benjamin Franklin, John Adams, William Short, and John Randolph all held copies as well.310 And while some conservatives in America were alarmed by the antireligious views (and possible all-out atheism) in the *Encyclopédie*, and others held a dim view of French culture, the French Enlightenment was the ascendant intellectual trend of the time.311 Americans shared ideas about the rights of man with French thinkers, clearly influential to the framing of the Constitution,312 and were deeply indebted to Lafayette and the French forces for the victory against the British in the Revolutionary War.

303. See, e.g., ROBERT MERGES ET AL., INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE (6th ed. 2012). I explain elsewhere that this Anglo-centric focus is likely due to path dependence emanating from early U.S. jurists reliance on British cases to help interpret the patent and copyright statutes (but not the IP Clause itself). See O’Connor, supra note 3, at 2.

304. This section is a summary of my arguments in The Overlooked French Influence on the Intellectual Property Clause. See O’Connor, supra note 3.

305. YEO, supra note 155, at xii.

306. ABRAHAM WOLF, A HISTORY OF SCIENCE, TECHNOLOGY, AND PHILOSOPHY IN THE EIGHTEENTH CENTURY 38--59 (1939) (“With all its imperfections, the *Encyclopédie* was the greatest achievement of its kind, and the most potent influence on the Age of Enlightenment.”). See also PAUL MERRILL SPURLIN, THE FRENCH ENLIGHTENMENT IN AMERICA: ESSAYS ON THE TIMES OF THE FOUNDING FATHERS 108 (1984) (“The *Encyclopédie* was also an arsenal of philosophic thought in the Age of Reason.”); id. (quoting IRA WADE, AN ANTHOLOGY OF EIGHTEENTH CENTURY FRENCH LITERATURE (1930)) (“This great work, wrote Ira Wade, ‘organized definitely the knowledge of the eighteenth century; it created a close organization of the more liberal thinkers of the century; and lastly, it welded the political, social and religious doctrines and theories into a compact whole.’”).

307. HANNAM, supra note 53, at 3.

308. See SPURLIN, supra note 306, at 116--18.

309. Id. at 117. Madison received a copy from Jefferson in 1785, while the latter was minister to France. See Letter from Thomas Jefferson to James Madison (Sept. 1, 1785), in JEFFERSON ABROAD 24--27 (Douglas L. Wilson & Lucia Stanton eds., 1984). Further, Madison was part of a committee of the 1783 Continental Congress that made the first recommendation for a Library of Congress. As part of that, Madison and the committee created a list of 300 books that should be in that Library. First on the list was the abridged follow-up to the *Encyclopédie*, the *ENCYCLOPÉDIE MÉTHODIQUE, OU PAR ORDRE DE MATIÈRES*, published by Charles-Joseph Panckoucke. See Loren Eugene Smith, The Library List of 1783 (1969), CGU Theses & Dissertations. Paper 87, available at http://scholarship.claremont.edu/cgu_etd/87.

310. SPURLIN, supra note 306, at 117. As Governor of Virginia, Jefferson also bought a copy in 1780 for the use of the public. Id.

311. See id. at 117--20.

312. Thanks to Geoff Turnovsky for reminding me of this connection.
The *philosophes* were highly supportive of “literary property,” but their views on protection for inventions were less clear. Diderot was opposed to secrecy among artisans, and he espoused the openness of the stated norms of the new sciences for the arts. But the disclosure he sought could be achieved through a patent system. Further, the *philosophes* advocated for attribution rights, which are often protected through IP or neighboring rights. Diderot also presaged arguments over attribution for inventions in the arts based on the alternately collaborative, competitive, and incremental nature of progress.

Regardless of the *philosophes’* views on formal IP systems, the intellectual framework and definitions of terms developed in the *Encyclopédie* may clear up many longstanding mysteries of the IP Clause. Nearly every term in the Clause has vexed commentators and courts. I adopt the De Wolf/Lutz “parallel construction” view as a starting point. This divides the IP Clause into two parallel grants: (1) “Congress shall have Power . . . To promote the Progress of Science . . ., by securing for limited Times to Authors . . . the exclusive Right to their . . . Writings”; and (2) “Congress shall have Power . . . To promote the Progress of . . . useful Arts, by securing for limited Times to . . . Inventors the exclusive Right to their . . . Discoveries.” The relevant definitions from the *philosophes* and the *Encyclopédie* are:

1. *Progress*. Quantifiable advancement in a field of human endeavor.
2. *Science*. Systematic study and/or contemplation of a field.
3. **Useful Arts.** Any mechanical art, except for fine or decorative arts, that manipulates physical materials or forces for practical ends.  

4. **Authors.** D’Alembert distinguished between **authors** and **writers**: the former conveying substantive, usually scientific, content, while the latter were **belletrists** concerned primarily with producing aesthetically appealing verse or text.  

5. **Writings.** For **authors**, these would be limited to books, illustrations, maps, charts, etc. that express the results of scientific inquiry (in the sense of systematic study or contemplation, not modern “Science”).  

6. **Discoveries.** The most important inventions, which must be curious, useful, and/or difficult to find.  

Plugging these definitions into the IP Clause results in the following interpretation: (1) Congress can promote the **progress of science** by securing exclusive rights, for limited times, in the **writings** of **authors** seeking to convey substantive **science** content; and (2) Congress can promote the **progress of useful arts** by securing exclusive rights, for limited times, in the **discoveries** of inventors.  

### IV. Confusion Stemming from Shifts Between “Art” and “Science”/“Technology” as the Focus of the Patent System

Early American patent law cases and treatises seemed clear that “art” was the subject matter of the patent system. Further, the Patent Acts of 1790 and 1793 both referred exclusively to the “useful arts” and “arts”—rather than “science” or “technology”—in their titles and provisions. But as the nineteenth century progressed, it became less clear

the rubric of “science.” This use might be salvaged to some degree if it were limited to the technical definition of “knowledge”—“justified true belief” (as opposed to belief or opinion)—but there is no indication that commentators such as Rich use the term this way. Plus, if knowledge = science, then what is “scientific knowledge”?  

325. See supra Part II.  
326. See Jean Le Rond d’Alembert, **Writer, Author**, THE ENCYCLOPEDIA OF DIDEROT & D’ALEMBERT COLLABORATIVE TRANSLATION PROJECT (Erik Anspach trans., 2011), http://quod.lib.umich.edu/d/did/did2222.0001.683?view=text;rgn=main. For example, d’Alembert classes Voltaire and Racine as **writers**, while Descartes and Newton are **authors**. This accords well with Kenrick’s views as well. See supra note 206. Both d’Alembert and Kenrick seem to hold Newton’s writing style and skill in quite low regard, even as they obviously respect him deeply as a thinker and scientist.  
327. See id.  
328. See supra Part II.  
329. Regardless of the status of literary property for published works, or of exclusive natural or common law rights for disclosed inventions, there was general consensus that authors and inventors had natural or common law rights to **unpublished** writings and **undisclosed** inventions. But this was as much based on early notions of privacy or secrecy rights, rooted in the liberty and autonomy of individuals: i.e., the individual could not be forced to disclose his private thoughts or personal effects. Oddly, Diderot appears to be the only thinker of the time suggesting forced disclosure of trade secrets in some instances.  
whether just the “useful arts,” or a combination of that and “science,” were the object of the patent system. Following the profound shifts in the terms “art” and “science”—and the rise of “technology”—leading into the twentieth century, patent cases and commentary lost “art” as the object of the patent system. This Part documents those changes.

A. Nineteenth Century Cases and Commentary Continue Mechanical Arts Sense of “Useful Arts.”

Thomas Fessenden’s 1810 treatise used a number of key terms in line with the times:331 “authors” were the authority under which discoveries, inventions, and improvements in the arts were made;332 “reflection” and “philosophical study” meant scientific inquiry;333 and, interchangeably, “useful arts,” “arts,” and “mechanical arts” meant the mechanical arts minus the fine arts.334 Fessenden suggested that patents be restricted to practical applications of scientific principles—a novel idea that may have set the stage for the later technological arts test.335

Early U.S. patent cases seemed confused as to whether “science” and the “useful arts” should be separate or combined subject matter(s) for exclusive rights in the IP Clause. *Pennock v. Dialogue* implied that “science and useful arts” was a unitary goal that Congress was to promote.336 But *McClurg v. Kingsland* ruled that Congress’s power was plenary under the IP Clause, and so it did not matter what constituted “science” or the “useful arts.”337 In a dissent to the copyright case *Wheaton v. Peters*, Justice Thompson gave what appears to be the first articulation of the IP Clause as comprised of two separate powers: one for patents to promote useful arts; and the other for copyrights to promote science.338 Notwithstanding the unitary/distributive/plenary IP Clause preamble debates, no court or commentator was proposing that “science” was the exclusive object of the patent system under the IP Clause; rather the only question was whether something in addition to the useful arts was its object.

331. See FESSENDEN, supra note 249.
332. See, e.g., id. at ix, xxvii.
333. See, e.g., id. at xxix.
334. See, e.g., id. at ix (“The course of [the Author’s] inquiries led him to observe that the authors of the most useful discoveries, inventions, and improvements in the arts, but rarely meet with the reward either of fame or profit, which their industry and ingenuity merit.”).
335. See, e.g., id. at 79.
336. 27 U.S. 1, 19 (1829). However, the Supreme Court was not consistent on this point. Compare Whitney v. Emmett, 29 F. Cas. 1074, 1082 (Baldwin, Circuit Justice C.C.E.D. Pa. 1831) (No. 17,585) (using the phrase “to promote the progress of the useful arts”), with Ames v. Howard, 1 F. Cas. 755,756 (Story, J., Circuit Justice C.C.D. Mass 1833) (No. 326) (using the phrase “to promote the progress of science and useful arts”), and Blanchard v. Sprague, 3 F. Cas. 648, 650 (Story, Circuit Justice C.C.D. Mass. 1839) (No. 1518) (using the phrase “to promote the progress of science and the useful arts”).
337. 42 U.S. 202, 206 (1843).
338. 33 U.S. 591, 684 (1834) (Thompson, J., dissenting).
Later nineteenth century IP treatises maintained the focus on "art." Walker’s 1883 patent law treatise expressly tackled the meaning of the terms “art” and “discovery” in the IP Clause. The “useful arts” were distinct from both “science” and “fine arts.” “Discoveries” was simply synonymous with “inventions.” He was ambiguous as to whether the Clause was unitary or distributive. Finally, Walker also followed Fessenden in suggesting that scientifically informed advances in the arts should be the focus of the patent system without using the term “technology.” This again indicates that the new concept of “technology” was advancing rapidly, likely because of the impressive results of the nineteenth century industrialists.

Merwin’s treatise of the same year provided an interesting account of “discoveries” as a class of inventions establishing practical applications of newly discovered scientific principles. Like Fessenden and Walker, however, he did not use the term “technology,” but rather continued using “useful arts” or “arts” for the subject matter of patents. “Invention” and “discovery” were still treated as synonyms under the Clause. As an alternative, however, he also gave a definition of “discovery” that echoed the Encyclopédie definition (the “most important inventions”), even as he seemed unaware of the exact origins.

Robinson’s massive 1890 treatise stood in a class all its own. He adopted a unitary approach to the IP Clause preamble. But he blamed...
the Clause for the expectation that patents and copyright should be treated as similar doctrines, when they have different historical and theoretical foundations. He used “art” and “arts” only for the useful arts (or as he called them, the “industrial arts”) and not the “fine” arts.

Through the late nineteenth century, the Supreme Court continued using the established senses of “art” and “science.” Baker v. Selden, an 1879 copyright case, provides a great example through its famous quote: “Where the truths of a science or the methods of an art are the common property of the whole world, any author has the right to express the one, or explain and use the other, in his own way.” While this quote is of course important for its role in explicating the idea-expression dichotomy in copyright law, it reveals the art-science worldview of the Court. “Truths of a science” suggest the purely contemplative epistemé science that was transitioning from Enlightenment “science” to modern basic research natural sciences. The focus was on eternally true natural laws, like an updated version of Aristotle’s strict epistemé. This was not, then, the broad sense of “science” as any systematic study of a field. It seems to indicate the narrowing view of “science” to our current capital S “Science.” “Methods of an art”—in this case bookkeeping—suggests techne art that was practical and could be taught so that others could practice

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348. ROBINSON, supra note 347, at 35 (“The progress of science and art is promoted by securing to inventors these exclusive privileges . . . .”).

349. Id. At the same time, he acknowledged some similarity in that inventors can be creators (and “discoverers”), and authors can be “discoverers” compiling, abridging, or editing what others created.

350. See, e.g., id. at 44.

351. Baker v. Selden, 101 U.S. 99, 100–01, 105 (1879). The Court also distinguished the useful arts from taste-based arts, implicitly referencing the old Aristotelian category of arts of pleasure: “[T]hese observations [that copyrighted matter cannot preclude practice of the underlying system] are not intended to apply to ornamental designs, or pictorial illustrations addressed to the taste. Of these it may be said, that their form is their essence, and their object, the production of pleasure in their contemplation.” Id. at 103–04.

352. Id. at 100.

353. In fact, the Baker Court cites Justice Thompson from Clayton v. Stone, 5 Fed. Cas. 999 (Thompson, Circuit Justice C.C.S.D.N.Y. 1829) (No. 2,872), to underscore its sense of “science” in the IP Clause (and Copyright Act) as epistemé science. The Copyright Act was passed in execution of the IP Clause power here given, and the object, therefore, was the promotion of science; and it would certainly be a pretty extraordinary view of the sciences to consider a daily or weekly publication of the state of the market as falling within any class of them. They are of a more fixed, permanent, and durable character. The term ‘science’ cannot, with any propriety, by applied to a work of so fluctuating and fugitive a form as that of a newspaper or price-current, the subject-matter of which is daily changing, and is of mere temporary use. Although great praise may be due to the plaintiffs for their industry and enterprise in publishing this paper, yet the law does not contemplate their being rewarded in this way: it must seek patronage and protection from its utility to the public, and not a work of science. The title of the act of Congress is, ‘for the encouragement of learning,’ and was not intended for the encouragement of mere industry, unconnected with learning and the sciences. . . . We are, accordingly, of opinion that the paper in question is not a book the copyright to which can be secured under the act of Congress.

354. Id. at 105–106 (alteration in original) (emphasis added). “Utility to the public” suggests that a patent should have been sought, if any exclusive rights, for the information—although this would have been an uphill battle. Equally important, “work of science” comports with the sense that the “output” of “science” (especially epistemé science) was written works, such as treatises. But Clayton was written in 1829 under the earlier Copyright Acts that were still limited to maps, books, charts, and engravings—and not extending to all of the fine arts as system for protection of creative works.
it: “the teachings of science and the rules and methods of useful art have their final end in application and use.” Central to an “art” are its methods, not any particular artifacts its practice may produce. Emphasizing the practical application of contemplative scientific knowledge, the Court thus edged towards the concept of technology, without using the term.354

Codification is an instrumental intermediary in both cases. One could have exclusive rights to the particular codification (qua writing) under copyright law, but this did not extend to either the underlying abstract propositional statements/knowledge of science or the procedural memory (know-how) of practicing an art. From the patent side, an issued patent could grant exclusive rights to the practice of a claimed art, but it did not grant exclusive rights over the codification of that practice.355 Expressly adopting Justice Thomson’s earlier distributive interpretation of the IP Clause, the Baker Court ruled that copyrights were limited to “writings” to promote the progress of science.356

Burrow-Giles Lithographic Co. v. Sarony, another copyright case, adopted an older traditional definition of “author” as “he to whom anything owes it origin; originator; maker; one who completes a work of science or literature.”357 This may strike us as odd today, but it was the longstanding definition of the term until the Romantic notion of the author as someone engaged in singular creative expression eclipsed it around the time of this decision. Thus, the Court also refers to “authors” of “inventions.”358 The opinion seems to signal a coming transition in that the Court uses “art” in both its mechanical arts and fine arts senses.

B. The Turning Point: The Supreme Court Seeks to Define “Fine Art”

The clear transition came in the infamous 1892 case of United States v. Perry, in which the Court undertook a much-criticized effort to define “fine art.”359 This may seem wildly ambitious or even foolhardy from a modern perspective—when great minds debate “what is Art?”—but in historical context it may have been reasonable to identify that a subclass of arts was distinguishable from the rest as solely or predominantly hav-

354. “The copyright of a work on mathematical science cannot give to the author an exclusive right to the methods of operation which he propounds, or to the diagrams which he employs to explain them, so as to prevent an engineer from using them whenever occasion requires.” Id. at 103.

355. “The description of the art in a book, though entitled to the benefit of copyright, lays no foundation for an exclusive claim to the art itself. The object of the one is explanation; the object of the other is use. The former may be secured by copyright. The latter can only be secured, if it can be secured at all, by letters-patent.” Id. at 105. This issue is still sometimes raised today, through claims that the patent document itself, as a writing of the inventor and her attorney, is the subject of copyright as well. But this underscores the copyright-patent line: any control of the codification is controlled, if at all, via copyright, not patent.

356. Id. (quoting Clayton, 5 Fed. Cas. At 1003). This was effectively the same as his interpretation of the IP Clause in his Wheaton dissent. See Wheaton v. Peters, 33 U.S. 591, 684 (1834) (Thompson, J., dissenting).

357. 111 U.S. 53, 57–58 (1884) (internal quotation marks omitted).

358. Id. at 60.

359. 146 U.S. 71 (1892).
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ing aesthetic, not utilitarian, ends. After all, aesthetics and value theory had only just permeated the popular culture earlier that century.\footnote{360} Further the Perry Court had a very technical, yet pressing, matter to decide: whether stained glass imported for churches was a commercial manufacture or a “work of art” for purposes of imposition of tariffs.\footnote{361} Thus, the issue of defining “art” must be laid at Congress’ feet in enacting this scheme, which the Court then had to interpret. The Court grappled with essentially three levels of “art:” (1) ordinary handicraft that would not rise to the level of a “work of art;” (2) artisanal work produced by trained craftsmen that would be a “work of art,” but not in the same class as that of a “great master of the art of painting;” and (3) masterpiece works of art by the likes of Rembrandt and Murillo.\footnote{362} It sought to classify works in level (ii) as decorative or industrial arts and not fine arts.\footnote{363} It then created a four-part classification of “works of art”:

(1) The fine arts, properly so called, intended solely for ornamental purposes, and including paintings in oil and water, upon canvas, plaster, or other materials, and original statuary or marble, stone, or bronze. . . .

(2) Minor objects of art, intended also for ornamental purposes, such as statuettes, vases, plaques, drawings, etchings, and the thousand and one articles which pass under the general name of bric-a-brac, and are susceptible of an indefinite reproduction from the original.

(3) Objects of art, which serve primarily an ornamental, and incidentally a useful, purpose, such as painted or stained-glass windows, tapestry, paper hangings, etc.

(4) Objects primarily designed for a useful purpose, but made ornamental to please the eye and gratify the taste, such as ornamental clocks, the higher grade of carpets, curtains, gas fixtures, and household and table furniture.\footnote{364} The controversial part was that the Court asserted objects in (1) as those “alone recognized as belonging to the domain of high art.”\footnote{365} But the Court may not have been making a questionable judgment call about aesthetic value. Rather, its four-part scheme broke along two main factors in much discussion at the time: degree of utilitarian function and of

\footnote{360} See Kristeller, supra note 12, at 496.
\footnote{361} If the former, the tariff applied; if the latter, and based on its importation solely for use in a religious institution, the glass was exempted. 146 U.S. at 72--74. As background context, the tariffs were said to protect a nascent stained glass artisanal industry in the U.S. Id. The issue was driven in part by a provision in the 1874 amendment to the 1870 Copyright Act that required pictorial illustrations such as engravings, cuts, and prints to be “connected to the fine arts” to be eligible for copyright protection. 18 Stat. 79, § 3 (1874).
\footnote{362} 146 U.S. at 74.
\footnote{363} Id.
\footnote{364} Id. at 74--75.
\footnote{365} Id. at 75.
mass production.\footnote{366} Things with utilitarian function suggested they might be more “manufactures”---and thus best protectable under design patents specifically established by Congress for this purpose---than “works of art” protectable by copyright. Mass production also suggested classic “manufactures,” and not individual works of creative expression. In fact, this was the very struggle at the heart of the Arts and Crafts movement: utilitarian objects can and should also be works of art, but only where they were handcrafted by master artisans with equal focus on aesthetics and function.\footnote{367} This provides crucial context for the Court’s taxonomy.

Ultimately, the \textit{Perry} Court may not have realized that it was really grappling with the changing sense of the term “art” itself, as well as with changing perceptions of the Constitutional scope of “authors” and “writings” and what was being promoted by granting exclusive rights. This, after all, was essentially the same Court that was still (quite correctly) referring to patentable inventions as mechanical or useful “art.”\footnote{368} But the Court began mentioning “science” as relevant to patentable inventions during this period as well.\footnote{369} Thus, with some poetic justice, the turn of the century represented the turning point to our modern sense that patents are about science and technology while copyrights are about (fine) arts.

The transition accelerated on the copyright side after the turn of the century. In \textit{Bleistein v. Donaldson Lithographing Co.}, the Court held that lithographed circus advertisement posters were works of (fine) art within the subject matter of the pre-1909 Copyright Act.\footnote{370} It also clarified that it was not attempting to make aesthetic value judgments about “art.” But it evinced the confusion inherent in now having copyright cover “art” at all by extending copyrightable subject matter to include the “useful arts”: “[w]e shall do no more than mention the suggestion that painting and engraving, unless for a mechanical end are not among the useful arts, the progress of which Congress is empow ered by the Constitution to promote. The Constitution does not limit the useful to that which satisfies immediate bodily needs.”\footnote{371} Justice Harlan, dissenting otherwise on the basis that a mere advertisement could not have the intrinsic value required for a work of fine art, agreed that the purpose of copyright law under the IP Clause was to promote the progress of the useful arts.\footnote{372}
This is all quite curious. The Court and dissent seem aware of the sense of “useful arts” as practical artisanal methods and artifacts, but believes that the compound term does not have to be limited to those. The term can also include fine and commercial visual artworks. But given the longstanding earlier sense of “art,” why would the Framers have used the qualifier “useful” at all? One might suggest, from today’s creative arts copyright perspective, that the Court here is using “useful arts” as a way of extending copyright coverage from the fine arts to commercial arts (with the latter commercially “useful” in a way that fine arts might not be). But the Court’s reference to “bodily needs” points away from this. Or, at the very least, if “useful arts” is construed to include both mechanical and commercial arts, where do the fine arts come in then? In what sense are they “useful,” given the convention that useful meant “practical”? Or would they have to then come under “science” (an equally dubious proposition)? The likely account is that the Court has had the ground shifted out from under it by the changed senses of “art” and “science” and is now trying to make sense of the only place the word “art” appears in the IP Clause. Thus began one of the modern IP Clause interpretation trends to simply read out or gloss over the qualifier “useful.”

Ultimately the Court rejected any value call between “low” and “high” art by those “trained only to the law,” and instead made the distinction rely on the intended use of the work. They quoted Arts and Crafts leader John Ruskin for their reluctance to make a value judgment on whether something was “high” or “low” art:

If any young person, after being taught what is, in polite circles, called “drawing,” will try to copy the commonest piece of real work,—suppose a lithograph on the title page of a new opera air, or a woodcut in the cheapest illustrated newspaper of the day—they will find themselves entirely beaten.

Following Perry in part, however, the Bleistein Court ruled that some utilitarian function of the work did not disqualify it from protection, rather the test was whether the “work” was part of an article of manufacture and served merely an ornamental or identifying (as in branding) function for an otherwise purely functional object.

C. Three Waves of IP Clause Interpretation Affecting “Art,” “Science,” and the Patent System

Beginning in the early twentieth century, courts and commentators sought more comprehensive interpretations of the IP Clause than those attempted in the nineteenth century. These interpretations can be divided into three chronological waves, stimulated by particular legislation or

373. Id. at 250--52 (“The antithesis to ‘illustrations or works connected with the fine arts’ [in the Copyright Act] is not works of little merit or humble degree, or illustrations addressed to the less educated classes; it is ‘prints or labels designed to be used for any other articles of manufacture.’”).

374. Id. at 250.

375. Id. at 251.
Supreme Court cases. This Section provides a brief overview of the three waves to show the continued evolution of “art,” “science,” “technology,” and the patent system.376

Setting the stage in the first decade of the twentieth were Continental Paper Bag Co. v. Eastern Paper Bag Co., and the 1909 Copyright Act. In Continental Paper Bag Co., the Supreme Court considered whether the intentional nonuse of a patent promoted the progress of (science and) useful arts.377 The Court seemed indeterminate as to whether the IP Clause preamble was unitary or distributed.378 But it also showed the increasing trend to read out the term useful: “a number of cases which bring out clearly the services rendered by an inventor to the arts and sciences.”379 The House Report on the 1909 Copyright Act treated the IP Clause preamble as unitary—even as the subject matter of copyright was much of the fine arts, with no mention of “science”—and thus as limiting Congress’ power to acts which promoted both the progress of science and useful arts.380 This further confused things, although it might work in the sense that copyrights should cover both scientific and (useful) artistic writings, while patents might then cover both scientific and (useful) artistic processes and products. One can imagine some problems with this in practice, however.

1. The First Wave

The first wave of IP Clause literature is marked by a series of articles, mainly written by IP practitioners, that sought to create a sorely lacking history of IP generally, and the meaning and impact of the IP Clause specifically. George Ramsey introduced the “Pinckney Thesis,” giving Pinckney equal credit with Madison for the various proposals that led to the IP Clause.381 Richard De Wolf then introduced the term “balanced sentence” for the distributive interpretation of the Clause.382 “Writings” were supposed to be “important” works “worthy of protec-

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376. This Section is summarized from Sean M. O’Connor, An Intellectual History of IP Clause Interpretations (on file with author).
378. Compare id. at 422 (“[E]xecuting the purpose of the [IP Clause] to promote the progress of science and useful arts by securing for limited times to inventors the exclusive rights to their respective discoveries . . . .”) (emphasis added), with id. at 423 (“[I]t is urged the non-use of an invention . . . is not to promote the progress of the useful arts . . . .”) (emphasis added).
379. Id. at 424 (emphasis added).
380. H. REPT. NO. 60-2222, at 6–7, 14 (1909). “Writings” and “authors” were as defined in Burrow-Giles, 111 U.S. 53 (1884), Id. at 2–3.
381. George Ramsey, Scope of United States Patent Protection, 1 J. PAT. OFF. SOC’Y 371, 375–78 (1919). It is not clear whether Ramsey was familiar with Judge Nott’s book on Pinckney that had been published a decade earlier; Ramsey was familiar with Nott’s related views as expressed in McKeever. See George Ramsey, Historical Background of Patents, 18 J. PAT. OFF. SOC’Y 6, 17–18 (1936). He adopted the pre-existing rights view of “securing” in the IP Clause, despite Wheaton, and treated the preamble as unitary.
382. Explaining it as a form of grammatical parallel construction “so much used in the days of the colonial worthies,” he broke it out as the two intertwined grants we think of today. De WOLF, supra note 277, at 15. But he provided no support for his claim of its popularity in colonial times.
tion,” even as he acknowledged that courts had failed to do this. He nicely captured the changing senses of “art” and “science,” but introduced the over-inclusive historical claim that the latter simply meant “learning in general.” Karl Fenning published the first article exclusively dedicated to the history and analysis of the IP Clause. P.J. Federico established acknowledged Continental precedents for patents generally, but focused on the British system as the only formal antecedent for the U.S. system.

Also part of the first wave, Frank Prager produced a number of rigorous IP history articles in the 1940s and 50s. He cited French philosophe and Encyclopédie editor Denis Diderot as a staunch supporter of literary property rights, and linked the preambles in four of the pre-Constitution state copyright statutes to Diderot’s statement in the Letter on the Book Trade. Unwittingly, Prager also showed the transition from “art” to “technology” in the patent literature as he used the terms interchangeably with no explication of either. Zimmerman had used the neologism “technology” the same year the Constitution was drafted, and Bigelow had been pushing for its widespread adoption since the early nineteenth century, but it had made little headway at first in the pub-

383. Id. at 2, 24--26 (citing Burrow-Giles Lithographic Company v. Sarony, 111 U.S. 53 (1884)). For the Framers, De Wolf believed that the sole category was books of a scientific nature.
384. De Wolf described it thus: Lawyers, textbook writers and even judges sometimes seem to have the impression that the proposition is the other way about—that science is to be promoted through patent protection and useful arts through copyright. But when the Constitution was adopted, the word science did not have the specific meaning which it has today—that of natural science. It meant learning in general. And on the other hand, the word art was not so closely associated as it now is with the fine arts. One occasionally finds references to the useful arts as being within the scope of copyright protection on account of their having been mentioned in the Constitutional provision referred to. It is doubtful, however, whether the framers of the Constitution had any such idea.
Id. at 15--16.
386. Federico, Origin and Early History of Patents, supra note 294, at 295. He noted that “invention” had a broader meaning in the colonial period, but did not specify what that was. P. J. Federico, The First Patent Act, 14 J. PAT. OFF. SOC’Y 237 (1932).
387. Id. at 732--33. Reprinting a translation of Diderot’s Letter on the Book Trade, Prager praised it as a key turning point in IP history. Diderot’s success, according to Prager, was to establish IP rights within the other Enlightenment rights of man necessary for a free and just society. Prager also cited Quesnay, Turgot, and the Physiocrats as friends of IP because they were also attacking mercantilism.
Id. at 733--34.
388. Prager restated it as “that no one is so clearly the master of his goods as a man is the master of the products of the labor of his mind.” Id. at 738. The Massachusetts statute is typical: “there being no property more peculiarly a man’s own than that which is produced by the labor of his mind.” Id. at 758 (reprinting Massachusetts copyright statute). But this actually seems to more directly flow from the Encyclopédie entry Copyright, written by Michel-Antoine David, one of the Paris publishers of the Encyclopédie: “If there is on earth any state of freedom it is assuredly that of men of letters: if Nature contains anything whose ownership cannot be disputed with those who possess it, it must be these products of the mind.” David, supra note 313. Both Diderot’s Letter and David’s Copyright entry were published well before the state copyright statutes: 1767 for the Letter and 1755 for Copyright, whereas the relevant state statutes were enacted from 1783--86.
389. See, e.g., id. at 713, 714, 720 (using “art” for mechanical arts in the first two cited pages, but using “technology” in the latter one).
lic. Even after the public started using it in the late nineteenth century, the term was disfavored by patent law judges, practitioners, and academics until well into the twentieth century. This could be because the older sense of “art” was so well entrenched—and well functioning—for the patent community’s purposes.

In mid-century, courts and commentators confronted the question of a Constitutional “standard of invention” that required more than mere novelty for patentability. To counter this, and the concomitant challenge that science was in fact the object of patents (rather than the useful arts), Karl Lutz cemented the “balanced sentence” and “science as learning in general” interpretations in the modern patent literature. Following Prager, he now expressly defined “useful arts” as “technology.” At the opposite extreme, Justices Douglas and Black gave a bizarre reading of the IP Clause in their concurrence in *Great Atlantic and Pacific Tea Co. v. Supermarket Equipment Corp.* They interpreted the IP Clause to restrict patents to those inventions that “push back the frontiers of chemistry, physics, and the like” and that made “a distinctive contribution to scientific knowledge.” This misunderstood the sense of “science” at the time of the Framers. Compounding this, and missing the useful arts origins of patents, they further (incorrectly) explained that “The Constitution never sanctioned the patenting of gadgets.” Around the same time, E. Burke Inlow published an oft-cited book that focused on the development of patents as economic policies. While most of it reiterated established colonial and state IP history, as well as IP Clause history, it contributed an argument that “inventions” meant “manufactures,” and

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390. See, e.g., Cuno Eng’g Corp. v. Automatic Devices Corp., 314 U.S. 84, 88–91 (1941) (instituting “flash of creative genius” test).

391. Lutz, supra note 321, at 51–52. In either a typo or an oddly anachronistic sense of the history of IP Clause, Lutz paraphrased DeWolf as claiming that the balanced sentence structure was “much used by sixteenth century writers”, i.e. those in the 1500s. Id. at 51 (emphasis added). Even if he meant the 1600s, this would still be a century off. While giving more detail by linking “science” back to the Latin “scire,” (meaning “to know”), Lutz still failed to give adequate context for this Latin term. Id. His only support was a quote from Thomas Jefferson’s *Letter to Elbridge Gerry*. But Jefferson was using “science” in the way that philosophers had for centuries: to mean the contemplative, systematic study of field (as distinct from the “art” of practicing in a field). Id. at 52.

392. Id. at 54. Of note, he treated the term “technology” as unusual or formal by using it in bracket quotes and relied on its definition in Webster’s New International Dictionary. Id. But, he gave no explanation for why the “useful arts” was simply “technology.” While he adopted the Anglo-centric account of the IP Clause, he claimed that “useful arts” was used as a means to broaden out the British restriction to “manufactures” under the Statute of Monopolies to allow method patents. Id. In some tension to all of this, he made the unsupported claim that “the Convention intended to have patents stick pretty closely to their traditional field as included in the phrase “useful arts.”” Id.

393. 340 U.S. 147, 154–55 (1950) (Douglas, J., concurring). The majority had not mentioned the IP Clause in rejecting the combination patent at issue for failing to meet the invention standard.

394. Id. at 154.

395. Id. at 155.

thus the Clause was supposed to promote the advancement of manufacture.397

Also in mid-century, courts continued to grapple with the copyright subject matter challenge raised by mass-produced decorative objects. Mazer v. Stein abandoned the full balanced sentence interpretation in order to allow such works under some penumbral reading of “science and useful arts.”398 The Court solidified the practice of reading the word “useful” out of “useful arts” and reversing the objects of patents and copyrights such that “science” would now go with patents and “(useful) arts” would go with copyright.399 Justices Douglas and Black dissented on the basis that these objects did not seem to be “writings” under the IP Clause.400

Congress sought to address the standard of invention question as part of its 1952 overhaul of the Patent Act. Section 103 added a statutory standard of “nonobviousness” and Section 101 replaced “art” with “process” for patentable subject matter.401 I view the latter as a most unfortunate development as it formally eliminated “art” from the Patent Act, even as it would have the effect of narrowing this rich historical term to simple “processes.” The sense of techné art would be lost, as well as the sense that an art was a set of methods used as tools by the master craftsman to produce certain objects or outcomes. Thus, the art of glassblowing is not one process, but many. And it is not just about mastering the individual techniques as it is about having the wisdom and judgment to choose which to deploy for any particular production. Going back to the historical origins of patents in both Venice and Britain, the intent was not to import or encourage practice and commercialization of a single technique, but the full art of, say, soapmaking or glassblowing. The historical context is also important because these patent systems predated

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397. INLOW, supra note 396, at 36–58, 133–37. Without evidence, he also suggested that Jefferson drafted the first version of what became the 1790 Patent Act, thus helping to erroneously enshrine Jefferson as an architect of the American patent system.


399. While ostensibly denying the need to review the constitutional power for Congress to create copyright statues under the IP Clause, the Court gave an extended such review in a footnote. Id. at 206 n.5.

400. Similar to their clear disdain for “gadgets” in The Great A. & P., Douglas and Black evinced equal condescension for commercial or popular art as “writings” under the IP Clause: “The Copyright Office has supplied us with a long list of [works of art] which have been copyrighted—statuettes, book ends, clocks, lamps, door knockers, candlesticks, inkstands, chandeliers, piggy banks, sundials, salt and pepper shakers, fish bowls, casseroles, and ash trays. Perhaps these are all ‘writings’ in the constitutional sense. But to me, at least, they are not obviously so.” Id. at 220–21 (Black, J., dissenting).

401. 35 U.S.C. §§ 101, 103 (1952). The change was curious though as it set different meanings for “art” in different parts of the statute. As explained in the House and Senate Reports:

“Art” in [§ 101] has a different meaning than the words “useful art” in the Constitution, and a different meaning than the use of the word “art” in other places in the statutes, and it is interpreted by the courts to be practically synonymous with process or method. The word “process” has been used to avoid the necessity of explanation that the word “art” as used in this place means “process or method,” and that it does not mean the same thing as the word “art” in other places.

H.R. REP. NO. 82-1923, at 6 (1952); S. REP. NO. 82-1979, at 3 (1952). This is fine as far as it goes—Congress has the right to be its own lexicographer—but then what does “useful arts” in the Constitution mean? And what about “art” in different parts of the statute?
the specialized labor factory systems of Adam Smith and the later industrialists. The art in question then was the complete ability to produce the specified glass, soap, machine, etc., not a single technique. But it is true that the Industrial Revolution, as well as advances in natural sciences that made possible broader, abstract inventions such as the steam engine that could be applied across a range of manufacturing arts, had transformed the old patents of importation mindset into one based on stand-alone “inventions.” And yet, patent systems such as that in the United States still required a patent to fit into a certain class of “art.”

The House and Senate reports on the new patent law were essentially identical in their coverage of the IP Clause, hewing closely to the more historically accurate account.402 Thus, both expressly adopted the balanced sentence interpretation and the object of patents as promoting the progress of the useful arts.403 “Science” was learning in general, and its promotion was the object of copyrights. Both reports recited the fact that Madison and Pinckney each submitted drafts of the IP Clause, without going into detail, and (inaccurately) gave significant credit to Jefferson for his role in development of the patent system.

That same year, Robert Coulter published a sprawling three-part article with the deceptively straightforward goal to argue that methods that included “mental steps” were part of the “useful arts” and should not be patent ineligible just because pure mental step processes were not eligible.404 But while trying to cabin “science” to copyrights and “useful arts” to patents, he acknowledged blurred boundaries: books and illustrations could advance the useful arts by providing instructive material; similarly, patented inventions could advance science (even in its narrow sense) by providing instruments for experimentation and observation.405 He seemed aware of the challenges of copyright promoting “science” when it also covered entertainment and fine arts. Likewise, the modern sense of “art” contained more than the mechanical/practical/useful arts.406 Following Prager and Lutz, he therefore equated the “useful arts” with “technology” (or the “technological arts”).407

Giles Rich, one of the architects of the 1952 Act, defined “science,” “discoveries,” and “inventions” in the patent literature as part of an effort to correct misunderstandings of the new “unobviousness” standard of § 103.408 He used the term “useful arts” as if everyone knew what it

403. H.R. REP. NO. 82-1923 at 4; S. REP. NO. 82-1979 at 3.
405. Id. at 494, 498--500; Field of the Statutory Useful Arts I, supra note 404, at 417, 428.
406. Field of the Statutory Useful Arts II, supra note 404, at 498.
407. Field of the Statutory Useful Arts II, supra note 404, at 498.
meant (while using “technology” only once).409 At the same time, he used the term “art” in its fine arts sense, without explaining (or perhaps expressly realizing) the complicated connection. He criticized courts and commentators who adopted the unitary approach to the IP Clause preamble, favoring the De Wolf/Lutz balance sentence interpretation instead.410 Also following De Wolf, he subscribed to the “learning in general” definition of “science,” quoting Dr. Johnson’s Dictionary for support.411 “Invention” and “discovery” were used interchangeably, Rich claimed (without any support), but he then proceeded to read out “discovery” altogether.412

Capping the first wave of scholarship was Arthur Seidel’s effort to analyze all terms in the IP Clause.413 Like Lutz and Rich, Seidel’s focus was the heightened “invention” standard, which was still being used despite enactment of § 103.414 Adopting the balanced sentence interpretation, he nonetheless held the preamble to be simply the “overall objective” of the power, and not a means or limit on that power.415 He did not directly define “useful arts,” but rather juxtaposed Johnson’s Dictionary definitions for “useful” and “arts.”416 Like many others, he subscribed to the “learning in general” definition of “science.” In an interesting twist, he used Johnson’s definition of “inventors” as the basis for the novelty-only patentability standard he advocated: “inventors” create something new, but not necessarily important or genius.417 Seidel paraphrased Johnson to define “discoveries” as “to find anything hidden or to reveal a

409. Rich used the terms “art” or “useful art” everywhere else. Id. at 402. Yet he also used the term “art” in its fine arts sense, without appearing to notice the ambiguity of the term. Id. at 401.
410. Rich makes an odd statement that “If the promotion of both ‘Science and useful Arts’ be ascribed as the object of the patent system, then the copyright system would have no stated object.” Id. at 397. But no one was saying that. Rather, under the unitary preamble view, both patents and copyrights had as their object the promotion of science and useful arts.
411. Id. at 396–97. Rich claimed that the natural sciences we think of as “science” today were instead part of natural philosophy at the time of the Constitution. This is not quite accurate. Natural philosophy was different from the mathematized, experimental “new sciences” of Bacon, Galileo, et al that more directly led to modern physical or natural sciences. See Dear, supra note 38, at 401–02.
412. Rich, supra note 324, at 403. Rich formalized the syllogism that continues to be used to read “discoveries” out of the IP Clause: (1) “discoveries” are the subject matter of exclusive rights in the IP Clause; (2) “discoveries” equal “inventions”; (3) “patents” equal “exclusive rights”; therefore (4) “inventions” are the subject matter of statutory patent rights. Id. at 393–407.
414. Id. at 5–6. There was also concern that the Supreme Court might hold that the heightened invention standard was a Constitutional requirement, thus reinstating it in addition to, or in place of, Section 103’s nonobviousness requirement. See id. at 5–8.
415. Id. at 9–10. Seidel cited the Redendo Singula Singularis common law rule of construction for balanced sentences. Id. at 9 n.10 (citing 53 C. J. 662). Using Johnson, he “translates” the preamble for the patent power as “to advance or forward the course or procession of the helpful trades.” Id. at 10. Seidel argued that if a novelty or invention standard were found in the preamble, it would need to equally apply to copyright, yet no court had called for a high standard for copyright. Id. at 16. This argument is flawed because the progress of science would not be the same thing as the progress of useful arts.
416. Id. at 10 n.11. This suggests that, against Coulter, he did not view the “useful arts” as a unitary categorical term. Rather, they were any arts that happened to have practical uses.
417. Id. at 13–14. Inventors can also make “discoveries” as a subclass of the new things they create.
secret.’’418 Because this did not directly connect with ‘‘inventions,’’ he took the unsupported step that ‘‘It was commonly said that inventors make discoveries, and this included both the creation of something new, and the finding out of something that previously existed.’’419 But even if this all were true, why would the Framers have used the ambiguous ‘‘discoveries’’ when they could have used the unambiguous ‘‘inventions’’?

The first wave of IP Clause interpretation seemed to wind down with the Supreme Court’s 1966 decision in *Graham v. John Deere Co.*420 The Court decisively ruled for the balanced sentence structure (with ‘‘useful arts’’ as the subject matter of the patent system) and § 103’s non-obviousness as the Constitutional standard of ‘‘invention.’’421 There was minimal criticism of the decision, as it was in line with most commentators’ expectations.422 The IP Clause was found to be ‘‘both a grant of power and a limitation,’’ that limited Congress to acts that promoted advances in the ‘‘useful arts.’’423 However, the Court did not define ‘‘useful arts.’’

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418. *Id.* at 15.

419. *Id.* In this way, he tracked Rich’s syllogism to equate ‘‘discoveries’’ (at least in part) with ‘‘inventions,’’ allowing both of them to substitute ‘‘inventions’’ for ‘‘discoveries’’ in the IP Clause. Seidel also used modern dictionary definitions to show that one sense of ‘‘invention’’ was ‘‘discovery.’’ *Id.* Seidel made clear that the ‘‘uncovering’’ sense of ‘‘discovery’’ did not lead to patentable inventions, for example, principles of nature. *Id.*


421. *Id.* at 5–6, 17–18, 37.

422. There were, unsurprisingly, at least a few critiques. See, e.g., Albert B. Kimball, Jr., *An Analysis of Recent Supreme Court Assertions Regarding a Constitutional Standard of Invention*, 1 AM. PAT. L. ASS’N Q.J. 204, 206, 209 (1973) (criticizing the Court for confusing a ‘‘statement of purpose’’ (goal, objective) with a ‘‘restraint’’ in construing the IP Clause preamble); Note, *The 1966 Patent Cases: Creation of a Constitutional Standard*, 54 GEO. L.J. 1320, 1331–32 (1966) (criticizing the Court for its use of Jefferson’s views on the patent system with regard to the IP Clause and early patent acts when Jefferson not only played no direct role in incorporating the patent power into the Constitution, but was also effectively rebuffed by the Framers and first Congress). Some commentators were generally favorable to *Graham*. See Giles S. Rich, *Laying the Ghost of the ‘Invention’ Requirement*, 1 AM. PAT. L. ASS’N Q.J. 26, 27, 37–38, 40 (1972) (favoring *Graham’s* interpretation of § 103 and assessment that the constitutional standard of invention was coextensive with it). One article, on the other hand, represents a minority view favoring Justice Douglas’s concurrence in *Great Atlantic & Pacific Tea Co. v. Supermarket Equipment Co.*, 340 U.S. 147 (1950). See Joel Rosenblatt, *The Constitutional Standard for ‘Ordinary Skill in the Art’,* 54 J. PAT. OFF. SOC’Y 435, 439 (1972) (mistakenly asserting that *Graham* adopted Douglas’s concurrence in *Great Atlantic & Pacific Tea Co.* as ‘‘the’’ constitutional standard of invention). In an indeterminate middle ground was Irons and Sears’s article supporting *Graham’s* affirmation of a constitutional standard of invention, but rejecting the balanced sentence interpretation of the IP Clause (and supporting Douglas’s and others’ high standard of patentability). Edward S. Irons & Mary Helen Sears, *The Constitutional Standard of Invention—The Touchstone for Patent Reform*, 1973 UTAH L. REV. 653, 653 n.1, 656. Of note, Irons and Sears refer to traditional mechanical arts from the Middle Ages as ‘‘technology,’’ showing its continuing displacement of ‘‘arts.’’ With the exception of Rich’s article, the foregoing have rarely been cited in the second wave literature and appear to have dropped out of sight quickly. Burchfiel cited them in his article that inspired Walterscheid. Kenneth J. Burchfiel, *Revising the ‘Original’ Patent Clause: Pseudohistory in Constitutional Construction*, 2 HARV. J.L. & TECH. 155, 163 n.49, 165 n.55 (1989). But even Burchfiel’s article had minimal impact beyond Walterscheid.

2. The Second Wave

As interest in the patent side of the IP Clause wound down in the aftermath of *Graham*, there was new interest in the copyright side as Congress began the first major overhaul of the Copyright Act since 1909. The second wave of IP Clause interpretation thus commenced with a different set of commentators. Two major IP history books in the late 1960s set the stage: Bruce Bugbee’s *Genesis of American Patent and Copyright Law*, and Lyman Patterson’s *Copyright in Historical Perspective*. Neither however broke notable new ground for interpretations of key terms such as “(useful) art” or “science.”

In the early 1970s, *Goldstein v. California* ruled that states had not relinquished all power to grant exclusive rights to authors under the Constitution and found no impediment to state and federal copyrights. The Court adopted a unitary reading of the IP Clause preamble that underscored the changed popular sense of “art” and the reversed roles of “science” and “useful arts.” Adopting *Burrow-Giles*’ definitions of “author” and “writings,” it suggested—without deciding—that “recordings of artistic performances” are within the scope of the IP Clause. The Copyright Act of 1976, however, expressly preempted the field for state copyright statutes, effectively mooting *Goldstein* in this regard.

In the 1980s, two major Supreme Court cases discussed the IP Clause. *Sony Corp. of America v. Universal City Studios, Inc.* considered the IP Clause in the context of a contributory infringement claim based on the sale of home videotape recorders that facilitated unauthorized recordings of copyrighted broadcasts. Limiting its interpretation to the IP Clause’s grant of power, it found that Congress could create “monopoly privileges” only for general public benefit, and not for the private benefit of authors or publishers. *Harper & Row, Publishers Inc. v. Nation Enterprises* acknowledged *Sony*’s “public purpose” interpretation of the IP Clause, but reemphasized the critical role that the “monopoly” grant to

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425. PATTERSON, supra note 110, at v.
426. See 412 U.S. 546, 556–67 (1973). This went directly against Patterson’s claims that the IP Clause and Congress’ legislation under it had completely preempted the field.
427. *Id.* at 555 (“The objective is to promote the progress of science and the arts.”) (emphasis added).
428. *Id.* at 561–62.
430. H.R. REP. NO. 94-1476, at 130–31 (1976), reprinted in 1976 U.S.C.C.A.N. 5659, 5746, 5747. However, the question of whether the text of § 301 in the Act truly did preempt all state common law with regard to literary, musical, or creative property is an open one. See 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT: A TREATISE ON THE LAW OF LITERARY, MUSICAL, AND ARTISTIC PROPERTY, AND THE PROTECTION OF IDEAS, § 1.01[B] (1965). Similarly, the attempt to expressly preempt indicates that Congress accepted *Goldstein*’s interpretation of the IP Clause on this point.
432. *Id.* at 429.
authors served in generating the material in the first place. Of note, the dissenting opinion seemed to reveal the near invisibility of the qualifier “useful” in the IP Clause by this time. In one place, it says “the progress of arts and sciences,” while in another it says “the promotion of science and the useful arts,” before flipping back yet again later to say “to ensure the progress of arts and sciences.” When actually quoting the IP Clause, the term “useful” is of course included, but when paraphrasing it, the term is dropped. This suggests that it was effectively being read out of the IP Clause.

Rounding out the Second Wave, a few articles from the turn of the decade proved influential to third wave scholars. Kenneth Burchfiel published a belated yet scathing critique of the Graham Court’s “revisionist history” in 1989. In particular, he exposed the misplaced reliance by the Court on Jefferson’s views to interpret both the IP Clause and early Patent Acts. While Burchfiel is seldom cited today, he had a profound impact on Walterscheid, who would become a giant in IP Clause history.

Jane Ginsburg showed that the practical focus of both early French and American copyright systems was on works of public instruction (whether styled as “knowledge” or “science”). Intriguingly, while the first French copyright act expressly covered the fine arts (which the U.S. Act did not), the types of works actually protected in France were similar to the “public instruction” works in America.

Margaret Chon gave a postmodernist critique of standard accounts of the IP Clause in 1993, advocating a public domain oriented “progress project” on behalf of Madison and Jefferson. Arguing that the fine arts had effectively been folded into the useful arts (even based on an “applied science” or “technology” interpretation), she adopted a unitary reading of the IP Clause preamble that sought solely to “promote the

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434. Id. at 579 (Brennan, J., dissenting).
435. Id. at 582.
436. Id. at 589.
439. Walterscheid’s written attributions of Burchfiel’s effect on his thinking reminds me of Kant’s references to Hume’s writings as waking Kant from his “dogmatic slumbers.” Walterscheid appears to have held fairly conventional views of the patent system and of the reliability of courts to produce accurate and objective versions of facts and history before reading Burchfiel.
440. Jane C. Ginsburg, A Tale of Two Copyrights: Literary Property in Revolutionary France and America, 64 TUL. L. REV. 991, 996 (1990). For example, her analysis of the works registered in the first ten years of U.S. copyright law showed that they were predominantly “socially useful, instructive works.” See id. at 1001–1005, 1013–1016. She also quoted Jefferson as stating, “[a] great obstacle to good education is the inordinate passion prevalent for novels, and the time lost in that reading which should be instructively employed.” Id. at 1003 (quoting 15 THOMAS JEFFERSON, THE WRITINGS OF THOMAS JEFFERSON 166 (1903)).
441. See id. at 1015–1022. However, the French may have viewed some fine art works, novels, and plays as instructive for the Revolution, Enlightenment values, and general moral instruction. Id. at 1015–1016.
442. Chon, supra note 322, at 98–103, 134–44.
progress of knowledge.” She also cited *Twentieth Century Music Corp. v. Aiken*, and *Feist Publications, Inc. v. Rural Telephone Service Co.* to show that the Supreme Court now interpreted “science” and “(useful) arts” in their modern popular senses.

3. The Third Wave

Edward Walterscheid began the third wave in the mid-1990s. He dominated the IP Clause literature throughout the turn of the century with numerous articles and books. Affirming and deepening Burchfiel’s position, he opened up a number of interesting avenues of research. He posited that the terms “patents” did not appear in the IP Clause because it had only taken on its modern meaning around the time of the Constitutional Convention. “Useful arts” were entire industries, and not specific craft. He recounted the earlier system of patents for importation of craft from foreign markets and claimed that “invention” and “discovery” were originally interchangeable terms for such importation. But later, “discovery” came to have the modern meaning of “invention” (creating something new) while “invention” itself retained a dual meaning of importation along with the addition of the modern sense of creating something new. His explanation for why the Convention committee substituted “science” for “knowledge” in the proposals for the IP Clause did not make a lot of sense: the former was both “shorter” (better with “useful arts”) and more “aesthetically pleasing” for the balanced sentence structure. Walterscheid unearthed an intriguing alternative usage of “discovery” from the proceedings of the first Congress in the sense of “to disclose to another”: “if an Inventor discovers [i.e., discloses] his Secret to any second Person, it is the power of him [i.e., the second person] to prevent a Patent issuing by entering a Caveat in the Attorney Gen-

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443. *Id.* at 115 (citing *Bleistein v. Donaldson Lithographing Co.*, 188 U.S. 239, 249 (1903)). *See id.* at 119–22, 134–44.
444. 422 U.S. 151 (1975).
449. Walterscheid, *supra* note 446 at 50–51; Edward C. Walterscheid, *To Promote the Progress of Useful Arts: American Patent Law and Administration, 1787-1836* (Part 2), 80 J. PAT. & TRADEMARK OFF. SOC’Y 11, 38–59 (1998). But, “science” is only two letters shorter than “knowledge.” And “useful arts” is already longer than “knowledge.” So the substitution of “science” for “knowledge” actually puts the two terms used in the final IP Clause at greater odds with each other. As to “aesthetically pleasing,” who knows what to make of that?
eral’s Office, when if two Persons appear to have discovered the same thing, it is held not to be new within the meaning of the Statute.”

Malla Pollack argued for a new sense of “progress” in the IP Clause that meant dissemination/diffusion of knowledge, rather than advances or increases in it. For example, the fire progressed across the room. Additionally, she argued that the Framers intentionally omitted the terms “patents” and “copyrights” so as not to tie Congress to the technical meanings of those terms at the time.

Historian of science I. Bernard Cohen interpreted the IP Clause as promoting the progress of “those theoretical or general principles of practice that are associated directly with useful inventions or that lead to economic benefits or financial rewards.” He had no explanation for what copyright could have to do with either science or the useful arts, which is surprising given the importance of publication to the scientists he studied. The two powers he located in the IP Clause were different from any that others had discussed in the literature. He equated “discoveries” with patentable inventions, but cited Chamber’s *Encyclopedia* and Johnson’s *Dictionary*, not Diderot’s *Encyclopédie*. He collapsed “discoveries” into “inventions” based on Latin roots to show that both authors and inventors are producing the former, but this leaves no role

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450. Edward C. Walterscheid, *Novelty in Historical Perspective (Part I)*, 75 J. PAT. & TRADEMARK OFF. SOC’Y 689, 703 n.67 (1993) (quoting S. Rep. of the Comm. on the Bill for the Promotion of Useful Arts (Mar. 29, 1790) (alterations in original)). However, he does not suggest this as the meaning of “discover” in the IP Clause. Instead it was part of the old caveat practice, and the quote itself uses the term in two different ways.


452. She relied on contemporaneous newspapers and dictionaries to support this usage with examples including “the ‘progress of a fire’ when a modern newspaper would report its ‘spread.’” Pollack, *supra* note 323, at 799.


454. *Id.* at 240–41. Accordingly, he is then at a loss to find any advances in “science” (written broadly or narrowly) that could be patentable.

455. Cohen disaggregates the preamble from the rest of the Clause: Congress has the powers 1) to promote the progress of science and useful arts, and 2) to secure for limited times to authors and inventors the exclusive right to their respective writings and discoveries. U.S. CONST. art. I, § 8, cl. 8. The first “power” leads Cohen into an interesting discussion of the failure of the federal government to provide significant research funding until after World War II. COHEN, *supra* note 453, at 241. While intriguing, and later echoed to some degree by Walterscheid, this reading makes no sense grammatically as it ignores the connecting term “by.” Curiously, Cohen also repeatedly misquotes the IP Clause by always using the singular “Time” in his quotes rather than “Times.” See *id.* at 238 (“Here the power is explicitly assigned ‘To promote the Progress of Science and useful Arts, by securing for limited Time to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.’”).

456. *Id.* at 306. He claims Chambers’s *Cyclopedia* as “the foremost scientific dictionary in English at the time of the Constitution,” which may be technically true, but only based on the qualifier “in English.” It is also a missed opportunity for Cohen as the French *Encyclopédie* entry on “Discoveries” of course supports an argument he makes that “discoveries” are a class of particularly important inventions (really the principles of practice associated with an invention).
for “writings.” But, he was effective at (re)establishing the broader, older senses of “science” and “art.” He astutely pointed out that the Framers “introduced ‘practical [useful] arts’ rather than simply ‘arts’” so as to stress the practice (versus theoretical) nature of what they had in mind.

John Thomas reacted to the Federal Circuit’s 1998 decision finding no “business method exception” to patent eligibility, in *State Street Bank & Trust Co. v. Signature Financial Group, Inc.* by seeking to limit patentable subject matter to the “useful arts,” which he, like others, equated with the “technological arts.” Pollack likewise sought to exclude business methods based on her notion of “progress” and claims that they were historically disfavored. But her finding of some business method patents undercut her argument that they were forbidden. At the same time, she helped resurrect the notion of art as skills and/or rules to manipulate physical materials.

As 2003 opened, the Supreme Court dashed the hopes of those who opposed the Copyright Term Extension Act (“CTEA”), by ruling that Congress had acted within the scope of its powers under the IP Clause in *Eldred v. Ashcroft.* For present purposes, the Court seemed to accept once again that the Constitutional goal expressed by the copyright system was to promote the progress of science. But it did not commit to whether this acted as a constraint on Congress and, even if it did, Congress could have rationally believed that the CTEA promoted the progress of science.

Over the next few years, Dotan Oliar provided persuasive arguments supporting the interpretation that the IP Clause preamble limits

457. *Id.* at 241. “Inventor” is itself a Latin term meaning “one who finds out, a contriver, author, discoverer.” *Id.* “Inventor” the Latin noun is derived from “invenio” the Latin verb which means, in its strictest sense, “I come upon,’ ‘I find,’ ‘I discover.” *Id.*

458. *See id.* at 307-08. “Science” could include any systematic treatment of the knowledge or skills related to a field of human endeavor. “Art” could include the ability to do any task requiring skill and, perhaps, training.

459. *Id.* at 308.

460. 149 F.3d 1368 (Fed. Cir. 1998).


462. *See Malla Pollack, The Multiple Unconstitutionality of Business Method Patents: Common Sense, Congressional Consideration, and Constitutional History, 28 RUTGERS COMPUTER & TECH. L.J. 61, 62 (2002).* She presented four arguments: First, “common sense” should show that business method patents do not promote progress; second, Congress did not consider whether business method patent protection promotes the progress of the useful arts (and it must do so, she claimed); third, the historical record showed few patents for business methods and the “useful arts” did not include “commerce;” and fourth, given the alleged anti-monopoly fervor during the Convention period, it would be remarkable for the IP Clause to have authorized Congress to create monopolies with no debates in the Convention or ratification process. *Id.* at 75--119.

463. *Id.* at 86--87 (citing NOAH WEBSTER, AMERICAN DICTIONARY OF THE ENGLISH LANGUAGE (1828). Unfortunately, she also said that the mechanical arts were co-extensive with the “technological arts,” limiting the full range of useful arts. *Id.* at 90.

the remainder of the Clause.\textsuperscript{465} Under his reading, the preamble and the body of the IP Clause each act as a grant of power and a limitation on the other. For present purposes, he anachronistically relied on a modern definition of “discoveries.”\textsuperscript{466} His version of the “science as learning/knowledge” thesis nonetheless limited this category to writings that “lean more towards ‘useful’ knowledge and away from more abstract types of knowledge.”\textsuperscript{467} Without adequate justification, Oliar bluntly rejected the balanced sentence interpretation as “dubious,” and the disjunctive preamble version of it as “especially indefensible.”\textsuperscript{468} Oliar applied his results to argue against categorical exclusions, based on the IP Clause alone, for business method patents,\textsuperscript{469} the product of nature ex-
ception in patent eligibility. He also argued that the Framers intended agriculture and commerce to be protectable because they were part of Pinckney’s encouragements proposal. He gave examples of the term “author” being used for “inventor,” but it is unclear how this advances his theory. Arguably, this actually undercuts his position: if “author” included “inventor,” then why were both terms used? The IP Clause could simply read, “To promote the progress of science and useful arts, by securing for limited times to authors the exclusive right to their writings and discoveries.”

Alina Ng’s 2011 book, Copyright Law and the Progress of Science and the Useful Arts, presented a confused take on the IP Clause. She offered that “[w]hile the colonial usage of the term ‘useful arts’ referred to scientific inventions that were to be protected by patent laws requiring proof of novelty, the word ‘science’ was taken to mean an organised system of knowledge that was the product of authorship and was to be protected by copyright laws.” Her definition of “science” is preferable to the “learning in general” one, but it is inadequately supported. Both of these definitions actually point away, though, from the aesthetic socio-cultural productions in the (fine) arts that she sought to advance through copyright. Ultimately, Ng followed many modern courts and commentators to read out the word “useful” so that the preamble simply matches today’s senses of “science and the arts.”

In 2013, the Supreme Court implicitly reaffirmed the full balanced sentence interpretation in Golan v. Holder, adding that “perhaps counter-intuitively for the contemporary reader, Congress copyright authority is tied to the progress of science; its patent authority to the progress of useful arts.” Justices Breyer and Alito dissented on grounds that the IP Clause focused only on incentives to create and the Uruguay Round.
Agreements Act would not lead to the creation of even one new work. However, they agreed with the majority on balanced sentence interpretation, with copyright aligned with “science.”

In the most recent addition to the literature relative to “useful arts,” Emily Michiko Morris begins from the unexamined statement that “Patent protection is limited to ‘technology,’ . . . .” While she acknowledges that the courts have rejected technological arts tests, she nonetheless seems resigned to accept the mid-twentieth century shift by commentators such as Coulter and Rich to “translate” the “useful arts” of the IP Clause into “technology” or the “technological arts.” This, again, is in some ways a trend going all the way back to Fessenden’s suggestion that science-based innovation be the main or even exclusive subject matter for patents. But courts and Congress have explicitly and implicitly rejected this. At the same time, Morris is on the right track, because her definition of technology (for patent eligible subject matter purposes) is “artifice plus action.” There is a lot to like in this. “Artifice” is used to capture the human agency component. “Action” qualifies “artifice” to limit the scope of patent eligible subject matter to works of human agency that also represent an “new operation or activity.” However, this does not provide a good boundary between “technology” and many works of modern fine art that employ active components such that “new operations or activities” result.

Morris is careful to position her “artifice plus action” as more of a unifying principle than a test or bright line rule. But the limits she sets out for it miss the fundamental problem—not her fault—that we are stuck in an age where “technology” has supplanted “art” for essentially all human manipulations of natural materials and forces except those we somehow intuit are works of fine art (which we now simply call “art,” with or without a capital A). For example, anthropologists often now refer to any practical methods or objects devised by humans going all the way back to prehistoric times as “technology.” Useful artisanal meth-

479. Id. at 899–903 (Breyer, J., dissenting).
480. Emily Michiko Morris, What is “Technology”? 20 B.U. J. SCI. & TECH. L. 24, 24 (2014). In another formulation, she says “The patent system is designed to encourage the ‘useful Arts’—or what modern language would refer to as the ‘technological arts.’” Id. at 24–25.
482. Id. at 27.
483. Id. at 25.
484. Id. at 27.
485. Id. at 25.
486. See, e.g., James Coupe & Juan Pampin, Sanctum, HENRY ART GALLERY, https://henryart.org/exhibitions/sanctum (“An interactive art installation, Sanctum employs surveillance systems to generate cinematic narratives with social media content that matches the demographic profile of pass-ers-by.”).
ods and artifacts are now “technology.” But, so many of these are neither part of the systematic study of techné (techné + ology) nor the application of “scientific” principles to artisanal innovation. That this is not some technical semantic point with little practical relevance is the object of Part V.

V. FINDING THE LOST “ART” OF THE PATENT SYSTEM

A. Early Patent Systems

As we saw in Part III, patent systems arose historically to promote artisanal competition. In fully regulated economic systems, such as those in medieval guild cities, only guild members were allowed to practice in the regulated field of art. Master builder-architects such as Brunelleschi, who could oversee complex building projects, were expected to join the various relevant guilds. While the effect of these guild systems on innovation is contested, the government of fifteenth century Venice seems to have been dissatisfied with the amount of innovation in her guilds. Non-exclusive licenses were then issued just to enable nonguild artisans who had innovative ideas to practice the art and sell their goods or services. But such nonexclusive rights may have been inadequate against the economic and social control of the guilds, meaning that even a right to practice would not allow the non-guild artisan to gain a foothold in the market. Accordingly, Ted Sichelman and I have argued elsewhere that exclusive rights—later called “patents” in the British system—were added to give the non-guild artisans a better position from which to introduce their innovations and compete with the guilds.489

Alternately, other early patent systems were designed to establish foreign arts into the domestic market. While Venice had many expert craftsmen and arts already established when she created her patent system, other places in Europe did not.490 Accordingly, while a patent system directed primarily at empowering nonguild innovators (whether domestic or foreign) against the powerful guilds was sufficient in Venice, other principalities needed to recruit foreign artisans (often from Venice!) or encourage domestic artisans to master and bring back a foreign art.491 Thus, these systems often focused on so-called patents of importation that gave exclusive rights simply for the artisan to establish the existing foreign art in the domestic economy, regardless of whether he invented the art.492 The fact of local novelty meant an art established elsewhere was still an important kind of innovation in the domestic economy.
The major patent systems in Venice, Britain, and the Netherlands all emerged before the so-called Scientific Revolution of the seventeenth century.493 While there were some educated artisans in the medieval period, and increasingly so in the Renaissance, many artisans remained illiterate and untutored in either the basic liberal arts (including the "scientific" subjects of the Quadrivium) or natural philosophy.494 Amongst the educated, the vast majority likely had only the basic liberal arts education of the cathedral school—whose efficacy and accuracy has been questioned by historians.495 A small segment, including da Vinci and Michelangelo, had some university training.496 But given the limits of the natural philosophy, and more importantly, the practical applicability of scholastic Aristotelianism that dominated the universities at that time, it was unlikely that even university-educated artisans were engaged in anything like "technology" in the sense of science-based invention. At most, advances in mathematics seemed to have helped da Vinci and Michelangelo in developing various innovations such as linear perspective in the visual arts.497 Alternately, however, a kind of proto-technology in the sense of systematic study of technē may well have been at work here. But notwithstanding the etymological accuracy of this sense of "technology," it is the furthest from the modern popular sense of the term. Fundamentally, though, nothing about the early patent systems suggested, much less required, any kind of "scientific" or natural philosophical explanation, justification, or description of an invention for it to be patentable.498

B. The Scientific Revolution

The Scientific Revolution certainly had an impact on inventors and patent systems, or perhaps the other way around. Recent historical work paints a more integrated development of the "new sciences" between artisans and educated intellectuals than was previously thought.499 But this research underscores how much of the new sciences seem to have been driven by advances in practical engineering and artisanal techniques, and not the other way around from theoretical or conceptual advances as one thought. In fact, the educated inventors of the time—da Vinci and later

493. Id. at 1268.
494. EDWIN S. HUNT & JAMES MURRAY, A HISTORY OF BUSINESS IN MEDIEVAL EUROPE, 1200-1550, at 50 (1997).
495. GRANT, supra note 53, at 19-20.
496. See supra Part II.
497. See id. Despite da Vinci's modern popularity in science, technology, and art circles, recent historians argue that he was in one important way not a proto-scientist at all: he never published or even seemed to disclose ideas from his "scientific" writings. HANNAM, supra note 53, at 7. Whether he used his training in mathematics and natural philosophy to inform his invention is important in understanding his genius and skill today, but it likely played little role in the decisions of those who hired him to design and build things. Those patrons were primarily concerned only with whether he would invent and reduce to practice for their benefit ingenious machines, buildings, or fortifications.
498. The Venetian system did employ a "test" sometimes termed experientia, and other times rendered as experiment. But this was simply a practical demonstration that the invention worked according to the claims of the inventor. See Sichelman & O’Connor, supra note 74, at 1277.
499. See generally LONG, supra note 122.
even Galileo himself with his telescope and patented water pump—do seem to have used new mechanical inventions they or others developed to suggest new theories and approaches to natural philosophy that would ripen over time into the "new sciences."

Thus, in the earliest part of the Scientific Revolution, there was still neither capital S "Science" nor "technology" in its application of scientific knowledge to practical problems sense. At most, there was "technology" in its sense of systematic study of various techné (which however were not called techné but rather arts). Again, Bacon, one of the premiere architects of the so-called Scientific Revolution, is as focused on advancing the arts (in the sense of mechanical arts) as he is on developing new forms of natural philosophy as the "new sciences." He also engaged in the Querelle and thus can be assumed to be aware of the contours of its intellectual debates, as well as the issue of the migration of the visual arts away from the mechanical arts and into either their own new category of beaux arts or possibly all the way into the liberal arts. His resolute focus on practical and useful arts and his tripartite scheme of Memory, Reason, and Imagination (followed with some changes by the Encyclopédists) laid the groundwork for the category of "useful arts" as those workings of natural materials for practical (i.e., physical well-being) ends, separate from arts with purely taste or sentiment ends.

But Bacon may also represent a different kind of turning point towards the "application of scientific knowledge" sense of "technology" as he moved from using mechanical innovations as impetus to develop new theories to using those new theories to develop new mechanical inventions. This practical application of new "scientific" knowledge was part of his meta-theory of the new sciences that their correctness could—and should—be demonstrated by their ability to be successfully applied to solve difficult practical problems. At the same time, this imported a not entirely welcome pragmatic justification for the new sciences, largely absent from Greek epistémē and later medieval natural philosophy. Science would become valuable—and fundable—only to the extent that it led to practical applications. This debate continues to the present day.

That said, there appear to have been no immediate major change to the various patent systems during the early days of the Scientific Revolution. For example, the seminal British Statute of Monopolies in 1623/4, passed after the 1620 publication of Bacon’s equally seminal Novum Organum, did not restrict patents to science-based inventions, but only to new "manufactures." There was still no requirement of "scientific"

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501. See supra notes 120–23 and accompanying text.
502. See supra note 124–30 and accompanying text.
503. See supra notes 140–42 and accompanying text.
504. See LONG, supra note 122, at 1.
506. Suchelman & O’Connor, supra note 74, at 1280.
knowledge or basis for patentable manufactures and they could be invented (and patented) by either the educated or the completely illiterate. Throughout the later seventeenth century, the most major change to patent systems due to the Scientific Revolution were periods during which royal scientific academies were charged with reviewing patent applications for novelty and feasibility (especially in France). But this did not mean that inventions had to represent an advance in the “sciences” to be patentable. To the contrary, they were still very much limited to advances in the (useful) arts, and patents of importation (based on local novelty only) were still being granted. “Technology” as a term and concept was still not in any relevant use.

C. Post-Scientific Revolution Debate

The eighteenth century saw the complications of introducing science-based inventions into the patent systems. Questions of the line between a principle or law of nature and its application arose. Given the broad applicability of many of the emerging scientific laws and relationships, plus the economic value of a broader patent grant, it must have become tempting to push for more abstract patents that captured as much of the practical application of such a law or principle as imaginable. At the same time, the new scientific orientation towards abstract, general, or even universal natural laws or principles may have influenced the patent systems themselves to consider “inventions” of a broader scope. Further, the relatively easy semantic switch between describing something as a “process” rather than a “principle” may also have lured inventors and their advocates into broad patent applications trying to capture the totality of a new scientific law or principle. Famous cases such as Boulton v. Bull resulted.

Famous eighteenth and nineteenth century science-based patented inventions, and cases arising from them, receive the most attention from historians of science, technology, and law (respectively); but that does not mean the patent systems of the times were limited to such inventions. Further, even with the interest in science-based inventions at the time—as suggested by nineteenth century patent treatise writers—the language of patents was still very much that of “arts.” As demonstrated in Part IV above, it took until well into the twentieth century for “technology” to

508. The OED gives the earliest usages of the word “technology” as actually describing written works, especially treatises. These could be about an art, but were used as much for liberal arts subjects such as grammar as for any mechanical arts. OXFORD ENGLISH DICTIONARY (online ed. 2014). In the mid-seventeenth century, the French introduced technologie as the technical nomenclature or terminology of a particular art or subject. Id. It would not be until the late eighteenth century that the modern senses of technology as systematic study of techné art fields such as mechanics, or as the application of scientific principles to practical applications, would emerge. Id.
509. Compare “the steam produced from boiling liquid water expands with great force” with “use the expansive force of steam from boiling water to move a mechanical apparatus.”
even begin to displace “art” in cases and commentary. Most importantly, there were still no statutory requirements for patentable inventions to be science or technology-based (even after the latter term came into popular use in the late nineteenth century). The adroit tradesman, artisan, or even amateur who invents a novel and useful process, manufacture, machine, or composition of matter—by trial or error or other non-scientific basis—is just as entitled to his patent as the science-educated inventor. Nor does the invention need to be something “technical,” “technological,” or “scientific” in its nature.

At the same time, patent systems were long based on the premise that the invention be at least locally novel, and ideally represent an “advance” in the art.\footnote{511 This is not universally true across the history of patents of course. The much-criticized practice of granting patents in the form of legal monopolies which gave exclusive rights to some art already practiced by the public to one individual or company—so-called “odious monopolies”—has cropped up occasionally. This happened most notably during the reigns of Queen Elizabeth and her successors in sixteenth and early seventeenth century England resulting in the Statute of Monopolies.} Measuring an “advance” in an art that is already being practiced locally suggests the \textit{Querelle} distinction between “progress” fields that can be measured quantitatively and “taste” or “sentiment” fields that can only be measured qualitatively. Quantitative measures are of course mathematical, which further suggests “technical” or even “scientific.” But the products of a field can be measured quantitatively without the artisans practicing in it knowing much more than basic mathematics and the skills of their art. In other words, a skilled metallurgist before the Scientific Revolution could produce a metal quantitatively stronger than existing ones—as measured by its ability to withstand more force in the form of weight placed on it—without having any knowledge of science. At the same time, an artisan or even amateur can develop an entirely new art that is not measurable directly against existing arts, but can still be quantitatively shown to address practical needs faster, cheaper, more effectively, etc. Thus, even adding in a requirement that an invention “advance” an art, need not entail a requirement that inventions be science-based to be patentable.

\textbf{D. The Danger in Substituting Terms}

The move to a “technology” orientation (or even worse, “science” orientation) for patents risks the exclusion of perfectly valuable and useful advances in various mechanical arts. A “technological arts” test sends us down a rabbit hole of trying to determine what “technology” is, which is frustrated by the fact that popular use of this term is quite vague; “technology” is some sort of active “technical” or science-based processes and the artifacts that result from them. It is the impressive machinery that surrounds us in the modern developed world. It is computers, and airplanes, and automobiles, and gene therapy, and monoclonal antibodies, and . . . . The only way to get rigorous about the scope of “technology” is to limit it back to one of the formal definitions such as the applied
science or systematic study of techné fields senses. But this would unnecessarily exclude many valuable traditional (and current) patent eligible inventions such as the proverbial better mousetrap.

Further it is not clear how important it is to have this term/concept today anyway. One can imagine its value in the late eighteenth and nineteenth centuries, when those employing the “scientific method” in all manner of traditional mechanical arts might want to distinguish what they did from what traditional artisans did. And from the reverse, the Arts and Crafts leaders may have been proud to distinguish themselves as just those traditional artisans rejecting the industrializing “technology.” But it is now well understood that much innovation comes from those trained in STEM fields (science, technology, engineering, and mathematics). The language of invention is often that of the STEM fields. But it need not be exclusively. And there is not great value in distinguishing inventors who take a “technological” approach from those who take any other sort of productive approach. In other words, since “technology” is, in its proper usages, a descriptor of approaches to artisanal fields and problem-solving, it is not really about the subject matter of anything, much less that of patentable inventions.

Conversely, the linkage of “science” and patents—directly or through the medium of “technology”—generates a risk of increased “upstream patenting” on scientific principles or information. Such risk is essentially what was debated in recent major patentable subject matter cases including Laboratory Corporation of America Holdings v. Metabolite Laboratories, Inc., Mayo Collaborative Services v. Prometheus Laboratories, Inc., and Association for Molecular Pathology v. Myriad Genetics, Inc. In particular, these cases turned on questions regarding the scope of the three traditional exclusions from patent eligibility under Anglo-U.S. patent law for (1) laws of science/nature, (2) naturally occurring physical phenomena, and (3) abstract ideas. While the cases each played out slightly differently as to which exclusions were invoked, the unifying theme of those opposed to the various patents in suit was that such patents improperly covered building blocks or principles of science and not practical applications thereof. Reserving judgment here on the correctness of the various particular holdings, it is enough to say that the Pasteur’s Quadrant approach to bridging basic and applied science/technology research (use-based rather than curiosity or pure research), combined with the sense that “technology” is the object of the patent system, may be contributing to the confusion and controversy here. The confusion at the heart of this is amplified by commentators who seek to limit the scope of patent eligible subject matter so that it

512. Although the most recent trend is to emphasize “STEAM” fields instead, STEM plus “arts” for “creativity” and “sensitivity” (essentially a continuation of the unfortunate limiting of art as fuzzy, intuitive aspects of the fine or entertainment arts).
515. 133 S. Ct. 2107 (2013).
does not include “science,” but rely on a misguided sense of science as an applied discipline or at least with practical goals.\textsuperscript{516}

\textbf{E. A Better Way Forward}

The key to restoring some order to the scope of patent eligible subject matter is to revive the concept of “useful arts.” Building from the Map of Human Knowledge in the \textit{Encyclopédie}, we can focus on “uses of \(x\),” where \(x\) is some natural material or force. We can then limit patent eligible subject matter to those inventions that progress or advance the use of natural materials or forces for practical (useful) ends. In practice, this should keep in the vast majority of what we already consider to be patent eligible subject matter, while giving a principled way to exclude things we generally already believe should not be patent eligible. For example, the boundaries of these \textit{Encyclopédie} useful arts also already exclude laws of nature, naturally occurring physical phenomena, and abstract ideas, and so no ad hoc judicial exceptions would be needed for them.

As Michael Risch has pointed out, the utility doctrine is “surprisingly useful,”\textsuperscript{517} but its current diluted interpretation (anything that does anything likely has substantial utility) may stem from its separation from the underlying art. In other words, “useful” probably does not just modify “arts” in the IP Clause—as some commentators have argued—but rather “useful arts” should be seen as a conceptual category. It is neither an exclusive nor originalist category frozen in time. Instead it is simply any and all arts that involve the use of natural materials or forces for practical ends. This is quite different from any art that happens to be “useful” in some undefined—or too broadly defined—way.\textsuperscript{518} The historical context in which the neologism “useful arts” arose must be taken into account, as well as the understanding that “useful arts” indeed \textit{was} a neologism at the time and not simply the grammatical juxtaposition of two ordinary words. Again, its importance was to signify the new category of mechanical arts remaining \textit{after} the visual arts were moved to the then new category of the \textit{beaux arts} (fine arts).\textsuperscript{519} Because the visual arts had been included in the mechanical arts (alternately manual, vulgar, or visceral arts) for literally millennia, any use of these established terms in the IP Clause could have misleadingly suggested that Congress could create exclusive rights for discoveries in the visual arts as well as all the other mechanical arts.

\begin{itemize}
\item \textsuperscript{516} See, e.g., ROBIN FELDMAN, THE ROLE OF SCIENCE IN LAW 153 (2009) (“Much of science is dedicated to manipulating nature, whether the subject is resisting cancer or resisting gravity.”).
\item \textsuperscript{517} Michael Risch, \textit{A Surprisingly Useful Requirement}, 19 GEO. MASON L. REV. 57, 58 (2011).
\item \textsuperscript{518} The fine arts could satisfy the “art that happens to be useful” test, broadly construed, as they are useful for aesthetic purposes. Likewise, the liberal arts can be useful for all the various ends they encompass.
\item \textsuperscript{519} See supra Part II.
\end{itemize}
A more difficult problem I will take up elsewhere is that the early importance of using patents to encourage development of useful arts was based on the intent to produce artisans actually skilled in the art, in the sense of tacit "muscle memory" or procedural knowledge. Essentially, the focus was as much or more on uncodifiable knowledge as on that which could be transmitted through text and images. In fact, one could imagine that patents of importation would have been unnecessary if all they sought was codifiable knowledge. The sovereign seeking such knowledge could simply offer payment for a codified version of the knowledge (formula, recipe, etc.). The importance of developing actual artisanal skill or craft is underscored by the facts that: (1) a number of early British and some American colonial grants expressly required the training of local artisans, and (2) up until the eighteenth century no extensive disclosure of the invention was required in the patent document. Together, these facts also suggest that disclosure of codifiable knowledge was not a main objective of early patent systems. But the switch to required specifications of codified knowledge is in some ways directly at odds with a patent system set up to develop actual (uncodifiable) artisanal skill or craft in local artisans.

Finally, the question of "advances" or "progress" in the useful arts brings us back to the issue of how to measure or otherwise demonstrate the same. As suggested above, following from the Querelle and my arguments that "progress fields" are those whose outputs can be quantitatively measured, progress must be shown quantitatively. But more guidance can be gleaned from the *Encyclopédie’s* definition of "discovery," as a likely inspiration for the use of this term in the IP Clause (rather than the more straightforward "invention"). In particular, d’Alembert’s explanation that these “most important inventions” were those that were “curious, useful, and difficult to find, . . .” underscores the utility requirement while adding a kind of non-obviousness: things that are curious are usually those that are unexpected, while those that are difficult to find are generally not obvious. It also adds diligence or reduction to practice: something that was difficult to find, generally entails significant effort, or lots of good luck. While non-obviousness starts as a mid-nineteenth century American judicial doctrine, it was not supposed to be an entirely new creation or requirement, as by definition the court are only supposed to be interpreting the patent statute. Thus, the sentiment of curiosity or unexpectedness as an important factor in the deservingness of an invention for a patent may have much earlier roots. Reduction to practice and diligence are much easier to trace all the way back to the

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520. Some commentators have speculated that this is where the early patent terms of 14 and 21 years come from. As multiples of seven, which was the number of years of a standard apprenticeship, the period of exclusivity would last through at least two generations of apprentices. This would both keep the master’s apprentices from competing with him too soon (limiting the value of his patent grant) and keep the master training successive generations of apprentices in order to keep his grant.

521. *See supra* text accompanying notes 145--50.

522. d’Alembert, *supra* note 166.
original Venetian patent system. Further, while d’Alembert set out the three concepts in conjunctive form, he indicated later in the entry that these are factors that can be weighed in a more disjunctive manner. Thus, for example, a high level of curiosity might tilt toward calling something a “discovery” even if it was not so difficult to find. Accordingly, these factors could be used as heuristic devices in interpreting existing doctrines of patentability—utility, nonobviousness, and enablement—that are all aimed at ensuring that an invention is enough of an advance in its art to warrant a patent grant.

In sum, using the constructs of “useful arts” and “discovery” from the *Encyclopédie*, we can recover the lost “art” of the patent system. Doing so will help us keep patents out of the realm of science, while not unfairly prejudicing the system against non-technological inventions. By contrast, continuing the relatively recent trend to replace “art” with “technology” (or even worse, “science”) as the object of the patent system will only further confuse the functioning of the system and create further conflict with activities that traditionally have been outside of it. Finally, nothing about this revival of “useful art” (or “discovery”) should jeopardize the patent eligibility of “technology”-based inventions.

VI. CONCLUSION

In conclusion, the patent system has largely lost the “art” it was founded around. This mirrors the loss of the mechanical arts sense of “art” in the general public and the literature. But the central importance of this sense of “art” for all manner of activities means that a void was created. “Technology” has filled that void, but it brings along a “science” component that is outside of many mechanical arts, past and present. “Science” itself is increasingly brought into areas that is does not really belong in, and increases the confusion that “science” should be about creating (and monetizing) practical applications for human needs. This can be fixed by reviving the concepts of “useful arts” and “discoveries” that appear in the IP Clause.