Making Art / Discovering Science

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Here is one way that, in ordinary speech, we mark the distinction between science and art. We say that scientists *discover* things—the relationship between the volume and pressure of air was *discovered* by Boyle; nuclear fission was *discovered* by Hahn, Strassmann, and Meitner; the structure of DNA was *discovered* by Watson and Crick. We say, however, that artists *invent*, *compose*, *construct*, or *make* things—Mozart *composed Così fan tutte*; Botticelli *made La Primavera*; Philip Roth *invented* Nathan Zuckerman. In ordinary speech, all genuine art is made up and no genuine science is made up.

Again, in ordinary speech, the difference between these categories is fundamental: it's an important way we have to distinguish science and art in the stream of culture, to assign them to different institutions, to give us confidence in our distinctions, to hold them to different standards, and to assign them to different schemes of value. The categories also mark out different kinds of relationship between the named responsible people, and what it is they are said to be responsible for. And it picks out different existential standings for the

objects of science and of art—as between things that exist independently in the world and things we bring into being through the workings of our creative imaginations. So, for example, and again in common speech, we think that the double-helical structure of DNA existed before Watson and Crick's *discovery* of it in 1953, and that there was an inverse relationship between the pressure and volume of gases before Boyle discovered that in 1662. That's one thing it means for something to be objective: this bit of culture is *about the object* and not at all *about the knowing human subject*. What scientists discover is real and independent of their skill and imagination, though, of course, it's routine to celebrate their skill and imagination in coming to see what was there to be seen and that no one had seen before. But, in ordinary speech, we do *not* say that they brought those things into being, and, when some sociologists and historians, departing from ordinary modes of speech, say that scientists invent or construct, other scholars—especially scientists, but not just scientists—can get very angry.

With art, it's much the opposite. We would find it absurd to say that *La Primavera* was there in the world, waiting for Botticelli to *discover* it and to make known its independent and always existence, nor that when the curtain rose on the first performance of *Così*, that what the Viennese audience witnessed in January 1790 was music *discovered* by Mozart and words *discovered* by Da Ponte. Scholars never, to my knowledge, say this, but one could imagine that, if anyone did, it might make *others* very angry—as if the imaginative creativity properly belonging to art was being denied, as if something inauthentic, unoriginal, or even immoral was being done.

There are obvious implications for conceptions of the author in art and in science. Sociologists have for a long time been interested in what's called "simultaneous discovery" in science: it happens quite often that two or more scientists independently come upon the same truth at about the same time, but the notion of simultaneity in connection with imaginative arts is either superficial or absurd—or it

points to something unethical going on. So the unique individual belongs to the idea of art in a way that he or she does not to the idea of science. And that was the sentiment behind Claude Bernard's nineteenth-century aphorism: "Art is I; science is we." So the art-science distinction can go from the identity of the author to the nature of the product. Again, in ordinary speech, if it's done by a unique and irreplaceable individual, then it may be art; if it's done by a collective, or even if it's done by someone who might be interchangeable with other people, then it may not be science, but it surely isn't art.

So discovery and invention—drawing back a veil from what *is* and bringing what *wasn't* into existence are among the ways through which we mark out science from art, the objective from the subjective, the passive from the active author—or, indeed, the author from someone who, however ingeniously, holds up a mirror to reality. Indeed, when Stendahl said in 1830 that "a novel is a mirror walking along a highway," one thing he was saying was that the author ought not to be held morally responsible for what the mirror showed, but he was at the same time making a subtle gesture toward the artfulness of realism. The mirror, it has been said, is a "metaphor for the author's art."[1]

I said that these distinctions belong to "ordinary speech," even if they also belong to some ordinary speech in academic inquiry—in the humanities, in the social sciences, and in philosophy. Much of the uneasiness, and some of the hostility, surrounding what's been called "social constructivism" has traded upon the essential differences held to exist between the practices and the objects of science and of art or between those of science and of everyday knowledge. Some of the so-called, and much despised, relativists have said that we should treat scientific knowledge *as if* it was "constructed" (or "invented") and some scientists and their admirers responded to this as a denigration of scientific knowledge: science, it was heard, was *merely* constructed, something *arbitrarily* claimed, *just* made up, a figment of

the imagination, and, therefore, *not* a discovery of truths preexisting in nature. Treating science as if it was art was taken as *lèse majesté*.

I offer here one concrete example of how to think of science as invented, and then I explore some issues about other ways in which the products, practices, and authors of science and those of art are commonly distinguished, and how, on occasion, it may be both difficult and misleading to distinguish them by way of discovery/invention. In the usual sociological idiom, it's said that we should think of scientific knowledge as invented rather than discovered, but, with a paradoxical-sounding gesture toward ordinary ways of speaking, I suggest we say that science *invents what it discovers*.

Consider the concrete example of the theory of evolution by natural selection, just as a way of opening up a window on how one might—from a certain angle of vision—see *all* scientific representations as invention. Suppose you fall in with the modern scientific consensus and you accept as fact and well-supported theory that species evolved over immense stretches of time and that natural selection among spontaneously occurring small-scale heritable variations has been the engine of that evolution. If you think that, then you certainly think that this state of affairs existed before the 1859 publication of Darwin's *Origin of Species* and that it will persist as long as there is life on Earth. That is, evolution by natural selection—whether you think of it as fact or as well-supported theory—was something that Darwin discovered about the world, not something he invented.

No sociologist should argue with that—it is an account of what's commonly believed about the relationship between the unique person called Darwin and his best-known scientific claim, so it is, at least, a "social fact." But I can point out a set of things about Darwin and natural selection, and I offer these *also* as facts. First, the theory that Darwin "discovered" is embodied in a composed *text*, structured as what Darwin called "one long argument"—and arguments are human inventions. The text seeks to persuade; it has rhetorical ele-

ments, a narrative plot, a set of key metaphors—notably about "artificial" and "natural" selection—and a linguistic-conceptual problem about what it might mean for there to be selection without a selecting agent. The book is a composition in the English language, and no one could mistake its literary style or linguistic conventions as coming from any other setting than Victorian Britain. If you knew a range of other Darwin texts but not the *Origin*, you would have a good chance of guessing from style and organization alone who wrote it.[2]

Nevertheless, all this does *not* evidently belong to an ordinary way of speaking: in the ordinary way, you may say that there are "literary" bits in the *Origin*, and you may say that there are some places where Darwin explicitly invites an "aesthetic" appreciation of an evolving organic world, just as it is quite common to say that certain scientific theories or proofs or experiments or models are "elegant" or "beautiful." But again, in this ordinary way, the theory of natural selection belongs to science, and a contemporary novel like, say, George Eliot's 1860 *The Mill on the Floss* belongs to the imaginative arts. You can't easily say that these ordinary sortings are *wrong*, since they proceed from institutional realities and they have all kinds of institutional accompaniments. To be vulgar about it, a novel doesn't count for tenure in the biology department, and an account of speciation doesn't count for tenure in the comparative literature department. In the United States, you apply to the National Science Foundation or the National Institutes of Health to fund the biological work and to the National Endowment for the Humanities if you want time off to write a novel. Physics gets published in physics journals, and poems get published in poetry magazines.

Moreover, the discovered theory that is actually articulated in the *Origin* includes some elements that modern scientific readers do *not* want to say ever existed before Darwin "discovered" them, nor do they think they ever will describe organic processes—mainly because they are now widely considered to be *wrong*, not discoveries at all. The *Or-*

igin notably contains references to the direct action of the "external conditions of life"; to the "inherited effects of use and disuse"; and to what Darwin called the "laws of growth"—developmental constraints causally connecting changes in one part of an organism to changes in other parts. "I am convinced," Darwin wrote, "that Natural Selection has been the main but not the exclusive means of modification."[3] So when it's said that Darwin *discovered* the theory of evolution by natural selection, most modern commentators have in mind a set of scientific beliefs that take in some things he claimed in 1859 and not others, and this so-we-say "discovered" theory sometimes has added to it scientific beliefs that were not available to him, notably twentieth-century genetics. Darwin, one might say, did not "discover" what scientists now mean when they refer to "evolution by natural selection"; that has been, and remains, an ongoing collective accomplishment which has then been attributed to Darwin—taken as the founder of a scientific lineage. He "discovered" what is sometimes called the "essence" of the modern theory of evolution by natural selection, but the *Origin* itself was an artful invention.[4]

So there are some considerations that allow us to say that the *Origin of Species*—the book that is celebrated as "containing" the discovery of natural selection—was doubly *constructed*, both by its author and by subsequent readers and celebrants, just as much as *The Mill on the Floss* was, and continues to be, constructed. There is a lot to support that claim, but there still seems something wrong about it. Despite useful stress on the "common context" of Victorian culture, Darwin and George Eliot were perfectly aware of distinct contemporary genres and traditions—the one called natural history and the other literature. Darwin was intending to write natural history and Eliot to write a novel. The *Origin* undeniably has aesthetic elements, but it is *about* species change, just as you can say that *The Mill on the Floss* contains information about flour production but is *not about* milling grain—and just as you might also say that *Hamlet* contains information about

Danish court conduct but is not a tract in Scandinavian practical politics. That is to say, their intentional references differ; the appropriate context for reading and understanding them differ. Their publishers placed and marketed the books accordingly and, although Eliot read the *Origin* (she was much influenced by it) and Darwin read *The Mill on the Floss* (he didn't much like it), the reviewers of each were, in the main, drawn from different populations; they evaluated the book according to different standards; they presumed different responses among readers; they situated their significance within different intellectual traditions. None of those distinctions is, however, absolute. You *can* respond to the *Origin* as a constructed and evocative work of art—and some people do—and you can read *King Lear* to learn some practical lessons about the problems associated with taking early retirement. It's their different intentions, and the different responses that those intentions invite, that identify the one as science and the other as art. A common saying goes "I don't know what art is, but I know it when I see it," or "I know what I like," and, as with a lot of clichés, there is truth in it.

But there are other examples where the question of the science-art distinction appears both more focused and more consequential. One of these is closely related to the concluding passages of Darwin's *Origin*, where he wrote that "There is grandeur in this view of life. . . . From so simple a beginning, endless forms most beautiful and most wonderful have been, and are being, evolved."[5] For many modern readers, finding nature beautiful is quite a different thing from finding out how nature *is*, how it's put together and how it works and changes. Its beauty is at most an accidental add-on, a coincidental effect of nature on the mind, little to do with proper science. We think there's no guarantee that scientific representations of nature are found to be beautiful. But that contingent and (for us) frankly inessential relationship between judgments of what is true about nature and judgments of its beauty is itself a contingent historical product.

Consider the nineteenth-century German biologist Ernst Haeckel (1834–1919) and especially a series of disputes over his representations of embryos and other organic forms that raged from the late 1860s through the first decade of the twentieth century. Haeckel, like many biologists and geologists of the time, was a fine draughtsman, and this was a useful teaching and demonstrative skill, even if scientists typically relied on professional artists, engravers, lithographers, and printers to produce the representations that appeared in printed articles and books.

An early convert to Darwinism, Haeckel between 1868 and 1874 published a series of pictures of embryos—of different species and at various stages of development—that were enlisted in evolutionary arguments.[6] Embryology was shown to be a powerful—maybe the most powerful—support for the fact of evolution of species from a common ancestor. Haeckel's tag was "Ontogeny recapitulates phylogeny": that is, the development of each individual passes through the adult forms of species in its evolutionary lineage (see fig. 1).[7]

But Haeckel's pictures soon attracted critics who disputed both their originality and their objectivity. One criticism was that Haeckel had copied and adapted pictures made by other scientists, and a more serious criticism was that he had passed off the very same woodcut as a representation of the embryos of three different species. Haeckel quickly admitted that he had done so, and he apologized for the carelessness, though the evolutionary argument made—of *very great* embryological similarity between different species—was, he said, unaffected.

Other criticisms were more problematic and more pertinent for the science-art distinction. Basically, Haeckel was said to be making pictures that did not correspond to biological reality. The pictures added some structures, made others disappear, accentuated the size and appearance of still others. They had too much imagination and too much theory about them. They were "schematic," not the sort of

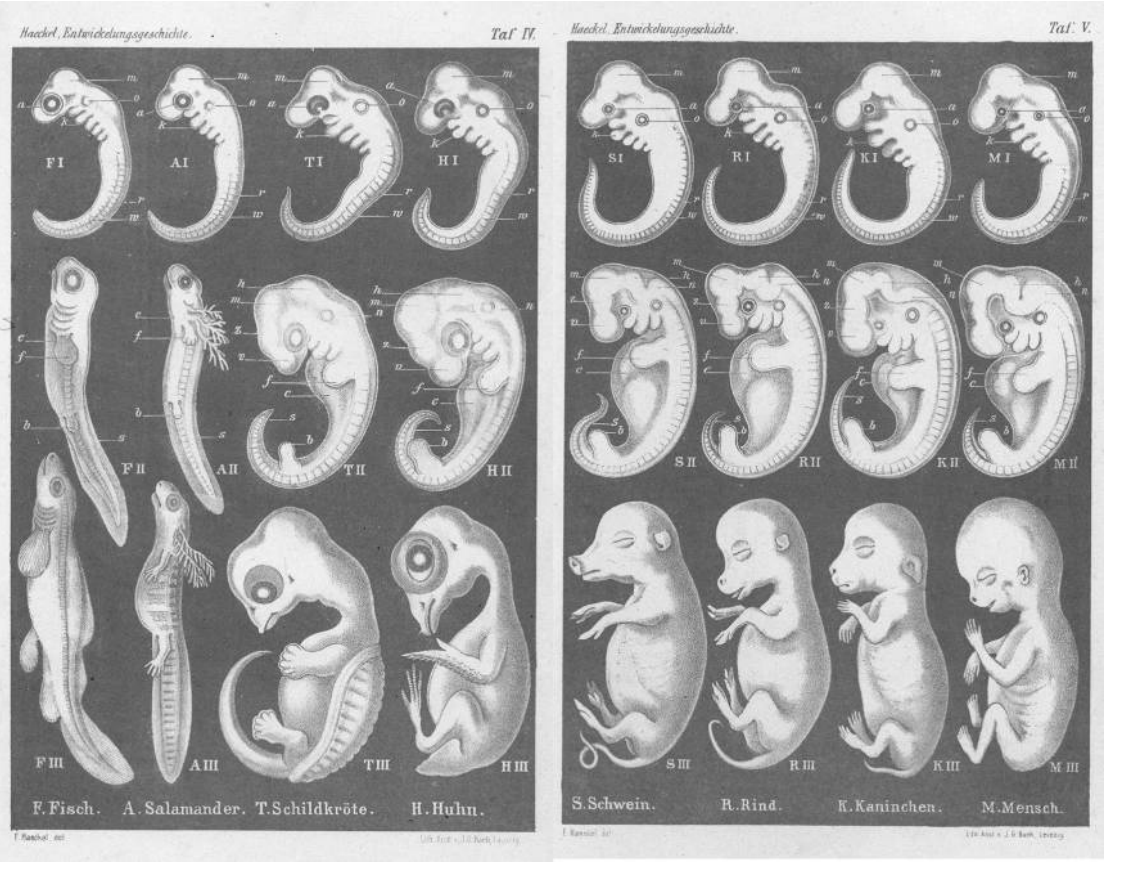

Figure 1.

Ernst Haeckel's graphic illustration that "ontogeny recapitulates phylogeny." The rows show different species: from left to right, fish, salamander, turtle, chicken, dog, pig, cow, rabbit, human being; the columns depict serial developmental stages of each species, indicating how the embryos of "higher" forms pass through stages resembling those of the "lower" forms from which they evolved. Source: Ernst Haeckel, *Anthropogenie oder Entwicklungsgeschichte des Menschen* (Leipzig: Wilhelm Engelmann, 1874), plates IV and V. (Courtesy of Harvard University Library.) Color version available as an online enhancement.

thing that the new observational technology called photography would show. They were said to be actively constructed—"nothing short of invented," one critic wrote[8]—rather than passively recorded. That is, they were said to be, in crucial respects, not science but art, where their stipulated identity as art was meant to be a devastating criticism.

Having straightforwardly admitted the sin of using the same woodcut to represent three species, Haeckel's response to the accusation that he had produced art rather than science, that he had invented rather than discovered, was nuanced and subtle. For many years, he defended the scientific accuracy of his pictures, while supporting the general legitimacy of schematic representations, that is, those that drew attention to particular structures or aspects in order to "make a point," rather than seeking to show reality in all its messy particularities. After all, schematic representations were routinely used in teaching and in engaging with wider audiences, and even his scientific critics used them. Schematic representations were scientifically legitimate, and, Haeckel said, "all schematic figures are invented."[9] Haeckel denied that anything scientifically illegitimate was going on, but in 1908 he made the tactical blunder of conceding that his pictures were "forgeries"—that in some cases he had added a little here and taken away a little there—provided that it was appreciated that practically *all* scientific representations were, in that specific sense, forgeries. The little philosophy-of-science lesson, about what came to be called "theory-laden observation," was a mistake: an audience taught to presume that science was *wholly* a matter of discovery and art *wholly* a matter of construction took this the wrong way. Haeckel, it was said, had now publicly confessed to making things up, but without the artist's scheme of value in which the *point* was to make things up.

Still, there was a way in which science *as* art could be defended, and defended *as* science: not science having "an aesthetic dimension" or evoking an inessential "aesthetic response," or some bits

or aspects of science as providing a "bridge" between science and art, but a conception in which aesthetics *belonged to* science. Here a key document is Haeckel's *Kunstformen der Natur* (*Art Forms of Nature*), 1899–1904, a collection of one hundred strikingly gorgeous lithographic and halftone prints of all sorts of animate nature, but especially of protozoa, jellyfish, sea anemones, and other marine invertebrates (see figs. 2–4).[10] What you are meant to see in these pictures is nature as it really is—objective nature—where what really existed to be pictured are its symmetrically organized forms, produced by self-organizing nature, and where their *arrangement* on the space of a printed page is produced by a human intelligence that draws scientific attention to symmetry and balance. Haeckel fell in with Keats's equation between truth and beauty—nature is a set of aesthetic objects and their representation counts as art—but there was, for him, no designing artist behind nature's ordered and beautiful forms. An aesthetic conception of nature in the nineteenth century cut across religious-secular divides. More pertinently in the German cultural context, Haeckel drew inspiration from Goethe's notion of nature's underlying archetypes (*Ur-phänomen*)—"the essential form," Goethe wrote, "with which, as it were, Nature always plays, and from which she produces her great variety."[11] These archetypal patterns were, as historian Robert J. Richards has written, "actually resident in nature," and their representation as such was part of what scientific objectivity meant. It was something the scientist did not invent but *revealed*. Yet it also belonged to the domain of aesthetics and of art: Goethe's follower Friedrich Schelling wrote that "the objective world is only the original, though unconscious, poetry of the mind."[12]

So it shouldn't be a surprise that these pictures were huge inspirations to art nouveau and Jugendstil artists, architects, and designers. The artists were drawn to them because they were beautiful; many scientists were repelled by them—because they were beautiful. Haeckel's *Kunstformen* depicted design in nature, but the pictures were

Figure 2.
Jellyfish (*Discomedusae*) from Ernst Haeckel, *Kunstformen der Natur* (Leipzig: Verlag des Bibliographischen Instituts, 1904), plate 28. (Courtesy of the Frances Loeb Library, Graduate School of Design, Harvard University.)

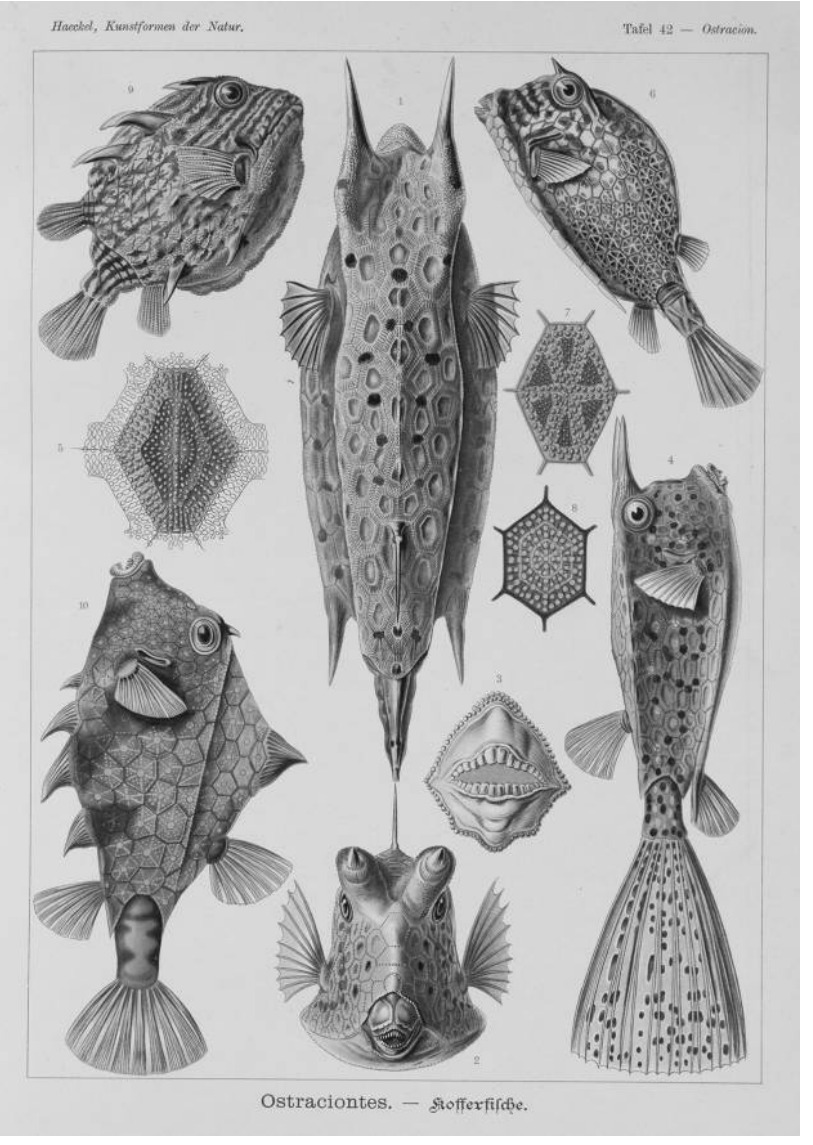

Figure 3.
Boxfish (*Ostraciontes*) from Ernst Haeckel, *Kunstformen der Natur* (Leipzig: Verlag des Bibliographischen Instituts, 1904), plate 42. Note the attention to variations on a basic hexagonal form. (Courtesy of the Frances Loeb Library, Graduate School of Design, Harvard University.) Color version available as an online enhancement.

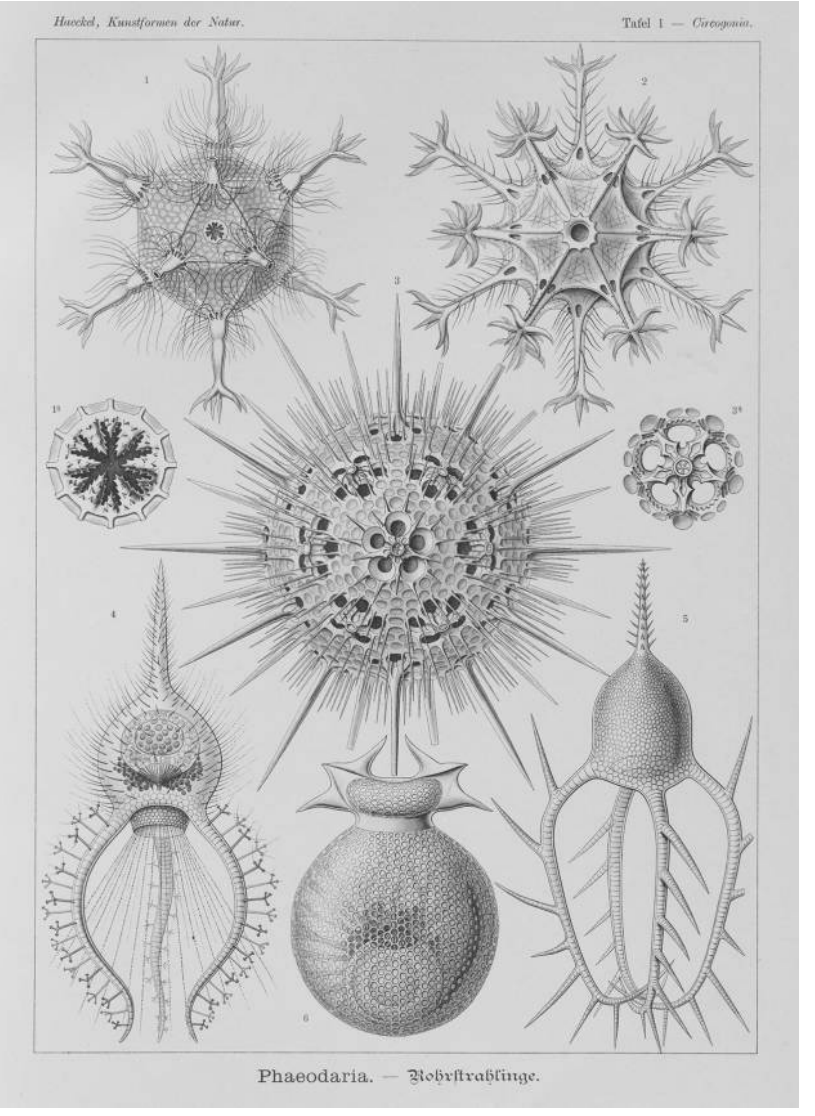

Figure 4.
Radiolaria (Cercozoan amoebae) (*Phaeodaria*) from Ernst Haeckel, *Kunstformen der Natur* (Leipzig: Verlag des Bibliographischen Instituts, 1904), plate 1. Color version available as an online enhancement.

themselves instances of design, the naturally designed organisms artfully arranged in graphic space. The move from the prints in *Kunstformen* to the design of wallpaper, floor coverings, lighting fixtures, graphics, and architectural ornamentation was seamless. There are many examples of the impression that *Kunstformen* made on art nouveau design. There was ornamental work by the Dutch architect Hendrik Petrus Berlage, especially in the Amsterdam Commodities Exchange (the Beurs), constructed from 1896 to 1903.[13] In France, the architect René Binet modeled the Porte Monumentale at the 1900 Paris Universal Exposition on Haeckel's pictures of protozoan radiolaria (see figs. 4–5)—"everything" about the Porte, Binet wrote to Haeckel, "from the general composition up to the smallest details has been inspired by your studies," and Binet's *Ésquisses Décorative* (1902–4) was a compilation of Haeckel-inspired design.[14] There were other Haeckel-infatuated artists, in glass, paint, sculpture, and photography, throughout Europe, and the interest in Haeckel and art continues, with several major exhibits in recent years.[15]

You could say, as some contemporary artists did, that Haeckel's work was a bridge between science and art, that Haeckel's science influenced artists, designers, and architects—and that, indeed, is how many of them put it and how it still seems natural for us to talk. The institutional sorting of science and art is always consequential, but from another point of view, you could say that Haeckel the scientist and the art nouveau / Jugendstil artists were *doing the same thing*—that Haeckel conceived his representations as following from ontological commitments in which the art-science relationship was not one of "influence" but one of substance. For many late moderns, the "truth-beauty" identity is just poetry; for Haeckel it was a metaphysical presumption involved in doing science. The Haeckel material shows how identifying something as art—that is, as invented—could count as an *accusation*, but it also shows a way in which we can appreciate the boundaries of science and art—between discovering and inventing—

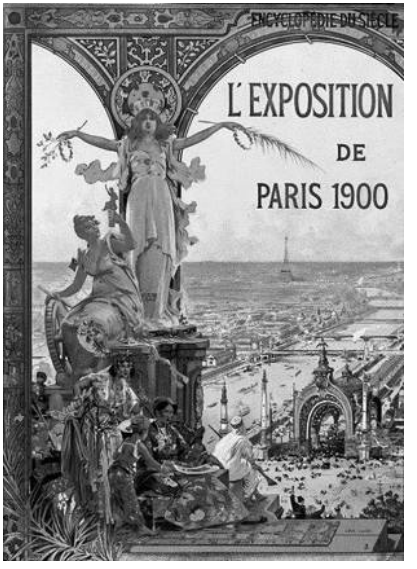

Figure 5.
Poster for 1900 Paris Exposition Universelle. René Binet's *Porte monumentale* is shown in the lower right. Color version available as an online enhancement.

as historically and culturally variable, where the categories are not timeless and stable but where circumstances, intentions, and scenes make the difference.

Now reflect on a present-day instance where the science-art distinction is a focused topic, but where it is purposefully played with in the course of making objects whose problematic identity *as* science or *as* art may be precisely the point. Take the case of Damien Hirst (b. 1965), the now not-so-young Young British Artist. Hirst is one of the richest artists in the world today—his wealth estimated at about £270 million[16]—and probably one of the best known and more controversial, someone whose works and statements do much to define, and to make problematic, the modern identity of art and, indeed, of other cultural forms relating to art.

First, quite a lot of Hirst's work—by no means all of it—is explicitly *about* scientific and technological objects, artefacts, concepts, and practices. The *Natural History* series displays animals—sharks, sheep—in vitrine cases, suspended in formaldehyde (see fig. 6); the giant bronze sculpture *Hymn* is an anatomy lesson (in more ways than is immediately obvious); *The Structure of DNA* is a polychrome representation of just that; the *Biopsy* set is based on JPEGs of things like the histology of malignant testicles; the *Periodic Table* series is an ironized and paradoxical version of the classroom chart, an attempt (it's been said) "to absorb science back into art."[17] There are paintings of the 2005 cesarean birth of his son Cyrus; the *Butterfly* paintings are in fact butterflies suspended in paint, just like the later *Entomology*, *Mineral*, and *Shell* sets—all of them gestures toward the Renaissance and early modern cabinets of curiosities (or *Wunderkämmer*); and other artworks depict a technician at a microscope, a pharmacy, medicinal

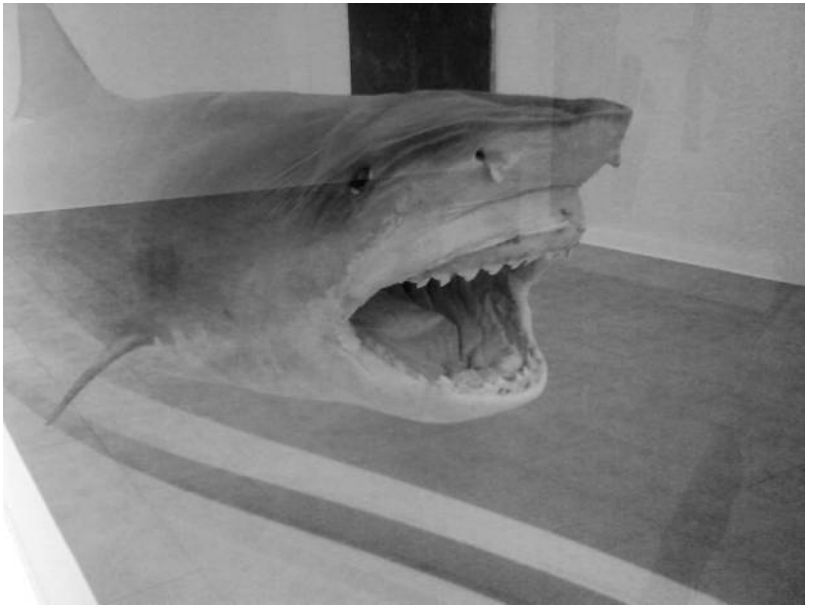

Figure 6.
Damien Hirst's *The Physical Impossibility of Death in the Mind of Someone Living* (ca. 1991), a tiger shark preserved in formaldehyde and displayed in a glass and steel case. The original work was funded by the advertising executive Charles Saatchi, but Hirst subsequently made other versions, and the original had to be repaired due to deterioration of the specimen. Color version available as an online enhancement.

pills in cases, and packets that look like pillboxes but which are labeled as foodstuffs.

Second, the mode of production of these things is also explicitly identified with science and technology (especially in its capitalist modes) and is advertised as such. The Hirst artistic output is vested in a corporate commercial structure called Science Ltd., with offices in Marylebone; there is a 97,000-square-foot production facility in Gloucestershire—it's called the "Science Production Studio"—with a separate formaldehyde room where employed assistants work under Hirst's general direction in making, among other genres, the "spot" and "spin" paintings (see fig. 7) that require so much repetitive work, raising the question, first posed in modern times by Andy Warhol (from whom Hirst says he took inspiration), whether art can be "we" as well as science, or whether the display of collective production can count as an in-

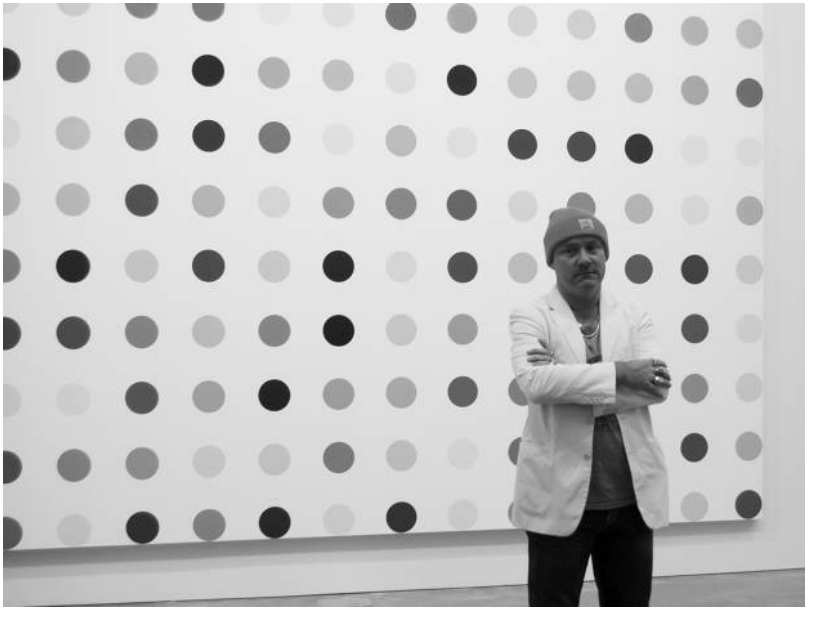

Figure 7.
Damien Hirst in front of one of his many "spot paintings." This photo was taken in 2012 at the exhibition *Damien Hirst: The Complete Spot Paintings 1986–2011* at the Gagosian Gallery in New York. (Reproduced by permission of the photographer, Andrew Russeth.) Color version available as an online enhancement.

tellectual provocation about the nature of art. (There may be as many as 160 people employed in the Hirst enterprise, and it's been reckoned that there are now over 1,400 Hirst spot paintings in existence.)[18] Hirst once recommended the work of his assistants over his own: "The best person who ever painted spots for me was Rachel [Howard]. She's brilliant. Absolutely fucking brilliant. The best spot painting you can have by me is one painted by Rachel."[19]

There's another sense in which some of Hirst's work challenges the concept of the author in the art-science distinction, or which it is accused of so doing. If art is "I," then its authorial *originality* as well as its uniqueness is assumed. It's not considered devastating to Darwin's genius, or to the value of the *Origin*, that Alfred Russel Wallace also, and at the same time, "discovered" evolution by natural selection, though it would be considered immoral if one had "stolen" it from the other. But art has not traditionally been reckoned as authentic if it is just copied—in whole or part—from some other artwork, or from some bit of reality, that is, if it's established that it was *not* invented by its stated author. Yet Hirst has been charged with copying, and even with plagiarism. Andy Warhol's soup cans were indeed representations of Campbell's Tomato Soup cans—just like that, except that they were offered as art objects—while Hirst's butterflies, biopsies, formaldehyde-preserved animals, periodic tables, and faux drug-packs generally add and rearrange elements to reframe and respecify the objects so as to invite reflection. In this way, Hirst places himself in an artistic genealogy going back to Marcel Duchamp's readymades—notably his celebrated 1917 urinal-as-art-object (*The Fountain*) and his 1919 Mona-Lisa-with-an-added-moustache (*L.H.O.O.Q.*)—made in multiple copies and dropped into art exhibitions, where they were intended to represent defiantly different art objects, but in-your-face art objects all the same.[20]

Nevertheless, Hirst had to settle a lawsuit when, in 2000, the sculpture *Hymn*, bought by Charles Saatchi for £1 million and described as a "masterpiece" and as "the first key work of British art for the 21st cen-

tury," was said to be an exact copy of a £14.99 toy in the commercial "Young Scientist Anatomy Set," a product marketed by Humbrol Ltd., which also made the famous Airfix line of model airplanes. Hirst headed off legal action for breach of copyright by making a "goodwill payment" to the designer and makers, but acknowledged that the sculpture was inspired by that exact toy in his son's Humbrol anatomy set. For his part, the commercial designer, who had been paid less than £2,000 for *his* work, said, "I'm a commercial sculptor not an artsy-fartsy sculptor. My sculptures are mainly for merchandising. If I had done a 20ft one, who would have known it?" Ironically, the year before, Hirst had sued British Airways for unauthorized use of images that seemed like his assistant-produced spot paintings.[21] (Hirst has never made any bones about the money motive for his work—cutting out gallery commissions by auctioning his work directly—or about his intention to control prices by carefully controlling supply.)[22] And, to layer irony on irony, in 2007 the anonymous star public artist Banksy produced a work called *Keep It Spotless*, a defaced version of Hirst's spot paintings, which itself has value as an art object: it was sold at auction at Sotheby's New York for $1.87 million, making it the most expensive Banksy ever.[23] There's now a raging debate over whether Hirst's productions do count as art, or as "good" art, but it's a debate that Hirst (and other Young British Artists) did much to instigate.[24]

Haeckel confronted the charge that he had not discovered but invented and, therefore, that what he produced was not science but art, or at least that it was science spoiled by the inventiveness of imaginative art. Hirst's problem, such as it is, is the charge that he does not invent but merely discovers what already exists, or at least that it is art spoiled by the correspondence to mundane reality associated with science and technological artifacts. Originality is counted an unambiguous good in art, and at most an ambiguous one in science: originality in science is thinking a thought that, it's said, was bound to come to someone else eventually. There is, for that reason, a potential puzzle

in paying homage to the discovering scientist that doesn't attach to honoring the inventing artist.[25]

Then, there is the question of how the *framing* of Hirst's objects—conceptually and physically—addresses the science-art question. "My most enduring interests," Hirst has said, are "the relationship between science and art, natural history, mortality and our attempts to comprehend death."[26] "There [are] four important things in life," he says: "religion, love, art and science." But Hirst's conception of science predates the modern separation of fact and value, description and prescription. The point of all of these "important things" is moral, to help you negotiate your way through life: "None of them really work that well, but they help. Of them all, science seems to be the one right now. Like religion, it provides the glimmer of hope that maybe it will be all right in the end."[27] And the purpose of art, Hirst says, is to reflect on death, to make objects more permanent than the artist—or to remind yourself that you die in the attempt. So Hirst's obsession with science is linked to what he sees as its redemptive power, but one thing that makes these objects artworks rather than scienceworks is his intention to use them to initiate a *reflective* exercise, reflection on death, reflection on life and its fragility.

The physical framing then works in parallel with the conceptual framing, inviting a specific understanding of the objects as art objects and as art-appropriate intellectual and moral objects. That's the point of the formaldehyde, the vitrine cases, the permanence of the bejeweled skull that is itself a residue of death and a symbol of death (see fig. 8). Hirst's skull is a resituated memento mori of the medieval, jerked out of context—it was cast from an eighteenth-century skull purchased from a London taxidermy shop—by the platinum and diamonds, and also by the fact that you know when you're looking at the object that it was supposedly sold for £50 million, making it the most expensive work of art produced by any living artist.[28] (We don't now, in general, take scientific objects as occasions for moral reflection,

Figure 8.
Damien Hirst's *For the Love of God* (2007). The diamond-encrusted skull shown superimposed on the façade of the Rijksmuseum in Amsterdam, publicizing an exhibition of Hirst's work in November–December 2008. Hirst made a personal selection from the Rijksmuseum's collection of Dutch seventeenth-century still-life art to accompany the exhibition. (Photo credit Marcel Antonisse/AFP/Getty Images.) Color version available as an online enhancement.

but that's a fact about our culture: we *used to* reflect on these sorts of things—they were, as Shakespeare said, "sermons in stones"—but that was another time, another culture.) "I love how different forms of display affect what the eye sees," Hirst has said. "It's bound up in my interest in the Victorian obsession with nature, or really the dominance of man over the natural world. Those Victorian natural history displays are so stupidly self-confident, it's nature seen through the eyes of man, beautifully ordered according to aesthetics. They're meant to be about the natural world but they're more like zoos—fake places or facades of reality. It's an idea that I've thought about and used in my

'Natural History' series, the animals in formaldehyde, and also the 'Entomology' cabinets I've made more recently."[29]

It's interesting enough to think about how Hirst's objects act as a "bridge between" science and art, but (as with Haeckel's images) it would be more interesting to think through the sense in which they *could be* art, science, some hybrid of these—possibly that "bridge between" them—or something more unstable than any of these responses. They are, of course, art objects—clearly so, in the institutional sense that they are displayed in art galleries, commented on by art critics, bought by art collectors, and valued (or devalued) according to their presumed place in artistic traditions. Even, and especially, the gestures that ironize traditional understandings of art—the modes of production, the commercialism, the resemblance to science objects—are all invitations to understand them as commentary on the historical traditions of art in the same way that, for example, Nietzsche's or Richard Rorty's anti-philosophies make sense only within philosophical traditions.

And yet Hirst's objects might belong to science and might make sense within scientific traditions—even though scholars concerned with science have not "owned them" in the way that the art world has owned (and at times disowned) them. They're not valued as contributions to natural knowledge, not written up or about in science journals, not discussed (with rare exceptions) by historians, sociologists, or philosophers of science. But it is possible to imagine circumstances in which these objects do belong (or could be seen to belong) to the culture of science.

First, imagine that the formaldehyde shark or the bug cabinets or the anatomical sculpture were set up, with appropriate labels, not in an art gallery but at, say, a museum of natural history, like the one in South Kensington in London. Then imagine what the scene might be as streams of visitors, on their way to the animatronic *Tyrannosaurus rex*, or the glass cases of stuffed but lifelike hummingbirds, should

happen upon Hirst's shark or one of his entomology cases. We don't know, but it's plausible that the art objects would be engaged with as science objects—not constructed but the things themselves—discovered, collected, mounted, and displayed in a science museum, just like all the other more-or-less traditional or more-or-less innovative exhibits of science objects arrayed around them. After all, that's what you find in a science museum, and the physical framing and location tell you what sorts of things they are and how you might appropriately respond to them.

Second, imagine—something that is possible but not likely—that, while Hirst was making an art object, he was addressing not just the present-day culture of science but its *history*. Suppose that he was engaging with historical changes in science that run parallel to those in art, that he was encouraging reflection on changes from a science whose objects did invite reflection on life, death, and meaning to a science disengaged from such sentiments, from science objects as sources of aesthetic and emotional response to science objects as sources of wholly intellectual response, from science as a form of disinterested inquiry into how things are to science as an arm of commerce, from science whose author was understood to be a unique individual to the sort of collectively authored science that one finds in present-day biomedical and physical journals, from science as discovery to science as a coordinated labor process.

So Hirst's art objects *could be* science objects, except that they're not; the writing and talk around his objects *could* belong to science criticism and not just art criticism, except that they don't. What we've *discovered* is that the art-science relationship is historically variable and, in principle, institutionally unstable. A different relationship has existed, and it could now be *invented*. The distinctions between science and art have much to do with ideas about what's made and what's discovered, with the sort of author associated with each, with intentions about appropriate responses, and with the frame

surrounding them and the institutions in which they are placed. All of these now are as they are—so it's intelligible to say that we know art or science when we see them—but they all have been different from how they now are, and, in future, they could be different still. The art and the science of the future may be such that we will *not* know them for what they are when we see them.

Notes

1. For example, Matthew Gibson, *Yeats, Coleridge and the Romantic Sage* (New York: St. Martin's, 2000), 126.

2. See here especially Gillian Beer, *Darwin's Plots: Evolutionary Narrative in Darwin, George Eliot and Nineteenth-Century Fiction*, 2nd ed. (1983; Cambridge: Cambridge University Press, 2000).

3. Charles Darwin, *On the Origin of Species by Means of Natural Selection* (London: John Murray, 1849), 6.

4. See a treatment of these tendencies in the 2009 celebrations of the anniversaries of both Darwin's birth and the publication of the *Origin*: Steven Shapin, "The Darwin Show," *London Review of Books* 32, no. 1 (January 7, 2010): 3, 5–7.

5. Darwin, *Origin of Species*, 490.

6. The account here largely follows the fine treatment in Nick Hopwood, *Haeckel's Embryos: Images, Evolution, and Fraud* (Chicago: University of Chicago Press, 2015). My appreciation of Hopwood's book is Steven Shapin, "What Do You Mean by a Lie?" *London Review of Books* 38, no. 9 (May 5, 2016): 35–37. In these connections, see also Lorraine J. Daston and Peter Galison, *Objectivity* (New York: Zone Books, 2007), esp. chap. 3.

7. Ernst Haeckel, *Anthropogenie oder Entwicklungsgeschichte des Menschen* (Leipzig: Wilhelm Engelmann, 1874), 7.

8. Wilhelm His, quoted in Hopwood, *Haeckel's Embryos*, 123.

9. Hopwood, *Haeckel's Embryos*, 126.

10. Ernst Haeckel, *Kunstformen der Natur* (Leipzig: Verlag des Bibliographischen Instituts, 1904).

11. Letter from Goethe to Charlotte von Stein, 10 July 1786, quoted in John H. Zammito, *The Gestation of German Biology: Philosophy and Physiology from Stahl to Schelling* (Chicago: University of Chicago Press, 2018), 288.

12. Quoted in Robert J. Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002), 114; also, here and in other connections, see Richards, *The Tragic Sense of Life: Ernst Haeckel and the Struggle over Evolutionary Thought* (Chicago: University of Chicago Press, 2008), esp. chaps. 5, 7–8; Hopwood, *Haeckel's Embryos*, esp. chaps. 7–8.

13. Pieter Singelenberg, *H. P. Berlage, Idea and Style: The Quest for Modern Architecture* (Utrecht: Haentjens Dekker & Gumbert, 1972), esp. 133–36; Detlef Mertins, "Bioconstructivisms," Department of City and Regional Planning, University of Pennsylvania, Departmental Papers (2004), https://repository.upenn.edu/cgi/viewcontent.cgi?article=1036&context=cplan_papers.

14. Robert Proctor, "A World of Things in Emergence and Growth: René Binet's *Porte monumentale* at the 1900 Paris Exposition," in *Symbolist Objects: Materiality and Subjectivity at the Fin de siècle*, ed. Claire I. R. Mahony (High Wycombe: Rivendale, 2009), 221–44, at 223; Olaf Breidbach and Robert Proctor, *René Binet: From Nature to Form* (New York: Prestel, 2007), 7; Proctor, "Architecture from the Cell-Soul: René Binet and Ernst Haeckel," *Journal of Architecture* 11, no. 4 (2006): 407–24; Serena Keshavjee, "'Cristalliser leur pensée': Émile Gallé's Pasteur Vase and the Aestheticization of Scientific Imagery in Fin de Siècle France," in *The Symbolist Roots of Modern Art*, ed. Michelle Facos and Thor J. Mednick (London: Routledge, 2016), 95–106; René Binet, *Decorative Sketches: Architecture and Design Influenced by Nature in Early 20th-Century Paris* (1902; Mineola, NY: Dover, 2017). (The public domain image of the Expo poster with Porte in the background: https://upload.wikimedia.org/wikipedia/commons/3/3f/Exposition_univ_1900.jpg.)

15. See https://www.mediamatic.net/nl/page/23076/kunstformen-der-natur, a 2014 Amsterdam exhibition, for a number of illustrations of *Kunstformen*-inspired design and ornamentation.

16. Eileen Kinsella, "Damien Hirst and Anish Kapoor Land on UK Rich List (Again)," https://news.artnet.com/art-world/artists-on-sunday-times-rich-list-952055.

17. Nicholas James, "Damien Hirst: Beyond Belief," in *Damien Hirst: A Retrospective*, ed. Nicholas Philip James (London: Cv Publications, 2012), 38–47, at 41. The reproduction rights of Hirst's artworks are tightly controlled and beyond the budget of a simple academic for these purposes, but much can be seen online, and the *Natural History* series are available in Damien Hirst, *Entomology Cabinets and Entomology Paintings . . .* (London: Other Criteria, 2013).

18. Catherine Meyer, "Damien Hirst: 'What Have I Done? I've Created a Monster,'" *The Guardian*, June 30, 2015, https://www.theguardian.com/artanddesign

/2015/jun/30/damien-hirst-what-have-i-done-ive-created-a-monster; Mark Brown, "Damien Hirst to Show New Spot Paintings at 18th-century Mansion," *The Guardian*, January 8, 2018, https://www.theguardian.com/artanddesign/2018/jan/08/damien-hirst-to-show-new-spot-paintings-at-18th-century-mansion.

19. Don Thompson, *The $12 Million Dollar Stuffed Shark: The Curious Economics of Contemporary Art* (New York: St. Martin's, 2008), 65; see also Mark Brown, "Rachel Howard: Damien Hirst's First and Best Assistant Steps Out of the Shadows," *The Guardian*, July 17, 2015, http://www.theguardian.com/artanddesign/2015/jul/17/rachel-howard-damien-hirsts-first-and-best-assistant-steps-out-of-the-shadows.

20. Caroline A. Jones, "Andy Warhol's 'Factory': The Production Site, Its Context and Its Impact on the Work of Art," *Science in Context* 4 (1991): 101–32, and *Machine in the Studio: Constructing the Postwar American Artist* (Chicago: University of Chicago Press, 1996), esp. chap. 4.

21. Clare Dyer, "Hirst Pays Up for Hymn That Wasn't His," *The Guardian*, May 19, 2000, http://www.theguardian.com/uk/2000/may/19/claredyer1; http://www.independent.co.uk/news/hirst-to-sue-ba-over-adverts-1102958.html; Thompson, *$12 Million Dollar Stuffed Shark*, 65.

22. Felix Salmon, "The False Narrative of Damien Hirst's Rise and Fall," *New Yorker*, December 6, 2017, https://www.newyorker.com/culture/culture-desk/the-false-narrative-of-damien-hirsts-rise-and-fall; Jonathan Jones, "Damien Hirst: Treasures from the Wreck of the Unbelievable," *The Guardian*, April 6, 2017, https://www.theguardian.com/artanddesign/2017/apr/06/damien-hirst-treasures-from-the-wreck-of-the-unbelievable-review-titanic-return.

23. See http://arrestedmotion.com/2011/09/banksy-top-25-most-expensive-works-ever/.

24. Jonathan Jones, "Faking a Fortune: Why Damien Hirst's Paintings are Poor Imitations of Art," *The Guardian*, May 20, 2014, http://www.theguardian.com/artanddesign/jonathanjonesblog/2014/may/20/faking-fortune-damien-hirst-paintings-art-florida-pastor-jailed, and "Damien Hirst: Two Weeks One Summer—Review," *The Guardian*, May 22, 2012, http://www.theguardian.com/artanddesign/2012/may/22/damien-hirst-two-weeks-review.

25. This issue is touched on in Steven Shapin, *The Scientific Life: A Moral History of a Late Modern Vocation* (Chicago: University of Chicago Press, 2008), chap. 1.

26. Damien Hirst, "The Artist as Collector," http://www.christies.com/features/Damien_Hirst_as_Collector-5683-1.aspx.

27. See http://www.gagosian.com/artists/damien-hirst/. Damien Hirst, *Damien Hirst: New Religion* (London: Other Criteria, 2008).

28. Charlotte Higgins, "For the Love of Damien Hirst: Tate Modern Hosts First UK Retrospective," *The Guardian*, November 21, 2011, http://www.theguardian.com/artanddesign/2011/nov/21/damien-hirst-tate-modern. Damien Hirst, *For the Love of God: The Making of the Diamond Skull* (London: Other Criteria, 2007). A brief account of the murky circumstances surrounding the sale of this artwork can be found at https://en.wikipedia.org/wiki/For_the_Love_of_God.

29. See http://www.christies.com/features/Damien_Hirst_as_Collector-5683-1.aspx.