Chapter 12

# Art, science, and evolution

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The relationship between art history and natural history, a topic that attracted widespread attention in the decades following the 1859 publication of Charles Darwin's *On the Origin of Species*, deserves careful re-examination in the twenty-first century.[1] Such a reassessment, in fact, could potentially play an important role in promoting the health of art-historical institutions, which face significant challenges in the new millennium. In a broad sense, the increasingly business-driven and anti-intellectual character of public life can force universities, museums and publishers to privilege profitability over intellectual content. Even within the faculties of arts and sciences that form the heart of the academy, moreover, art historians and other humanistic scholars risk marginalization as research funding increasingly shifts towards scientific projects that promise to have fruitful and profitable application. In this context, it is worth emphasizing both the significant connections between art-historical scholarship and the major currents of modern intellectual life, on the one hand, and the irreducibly unique characteristics of art history, on the other. Fresh consideration of the relationship between art-historical and evolutionary thinking can advance both of these projects, thereby fostering the successful adaptation of art-historical institutions to the challenging climate of the new century.

Art history belongs to a broad class of humanistic and scientific disciplines that attempt to explain the past through analysis of its observable products. Art historians and archaeologists have much in common with paleontologists, geologists, and even cosmologists, all of whom are considered scientists, even though they cannot conduct reproducible experiments in the same canonical way that chemists and physicists can. In methodological and epistemological terms, therefore, the distinction between art history and the sciences turns out to be blurrier than one might at first expect. Art historians, like scholars in the historical sciences, generally aspire to move from mere description to the explanation of past events. In all of these fields, the development of explanatory theory in principle involves the same four basic steps: 1) description; 2) the recognition of pattern in the historical record;

3) the creation of mental models or trial narratives to explain those patterns; and, 4) the testing of each model to see how well it really works, and, if it does, to see how broadly it applies. In art history, ancient authors such as Pliny the Elder, Cicero, and Quintillian understood changes in art largely in terms of individual contributions made by famous artists, which would bring art from a "rude" state to one of greater sophistication and naturalism, after which over-refinement and decline might set in.[2] These accounts of artistic development involve description and pattern recognition, but they are straightforward and literal, in the sense that they do not appeal by analogy to any system outside the artistic sphere.

In the sixteenth century, Vasari's pioneering *Lives of the Artists* introduced an important new theme into the literature of art history by comparing artistic to biological development. For Vasari, the biological metaphor in question involved not the origin of species, which would not be carefully studied until the Enlightenment, but rather the life history of an individual organism. He therefore saw early, middle and late stylistic phases as analogous to youth, maturity and senescence. The historical trajectory from antiquity through the Middle Ages into the Renaissance, which had been charted by Petrarch and applied to art history by Ghiberti in his *Commentaries*, thus became for Vasari a story of death and rebirth.

Vasari's seductively simple biological metaphor has strongly influenced subsequent art-historical practice. The metaphor is powerful because it seems to explain, rather than just chronicle, stylistic change. The flaws in Vasari's biological metaphor, however, are many and important. To begin with, it provides no real mechanism for change. On this level, it cannot really be called an explanation at all. In addition, it implies that stylistic development follows a single linear trajectory. Vasari, of course, was aware that different artists working at a given time might work in different styles, but such diversity has no place in his simple biological model. Vasari's metaphor, finally, clearly privileges the mature or classic stylistic phase over the periods of growth and decline. This value judgment has crept insidiously into the writings of many subsequent art theorists, making it difficult to appreciate any art categorized as "late." Late Gothic art of the fifteenth century, for example, is often criticized as over-ripe and decadent, belonging as it does to the supposedly "autumnal" cultural moment made famous more than eighty years ago by Johan Huizinga.[3] The construction of the term "Northern Renaissance" may be understood largely as an attempt to rescue Jan van Eyck's brilliant paintings from this historiographical fate. Many other issues of art-historical interpretation and valuation have been similarly influenced by Vasari's widely influential biological metaphor.

In the sixteenth and seventeenth centuries, parallels between art history and natural history would have been apparent not only in the popularization of Vasari's biological metaphor, but also in the institutional structure of princely collections containing both artworks and natural wonders. In such cabinets of curiosities,

products of craft and nature would have appeared as specimens largely isolated from their original contexts. To make sense of such a collection, a viewer would have to actively categorize the objects in question. As the intellectual culture of the Renaissance began to give way to that of the Enlightenment, therefore, issues of taxonomy and categorization became increasingly important.

The eighteenth century saw dramatic advances in biological scholarship, many of which would later go on to have resonances in art-historical writing. An important figure in this development was Carolus Linnaeus, whose work in the 1730s established the basic outlines of modern biological taxonomy.[4] Linnaeus's system was based on careful formal analysis, or, as an art historian might say, connoisseurship. Key features of Linnaeus's system included its hierarchical organization and its flexibility. Linnaeus grouped closely related species together into genera, related genera into families, families into orders, and so on all the way up to the largest categories of all, the plant and animal kingdoms. This hierarchical structure effectively represents species as individual twigs on a branching tree of life. Because of its branching complexity, this taxonomic structure could easily be expanded to incorporate newly discovered species. This flexibility has allowed Linnaeus's system to grow and change as the state of biological knowledge has advanced. Linnaeus's eighteenth-century contemporaries tended to rank species from least to most advanced in accord with the concept of a linear "chain of being," but hierarchy in this sense was not an inherent feature of Linnaeus's taxonomic scheme.

A fundamental advance in biological and taxonomic thinking was the recognition that species are not static. In his early work, Linnaeus had seen species as fixed and unchanging, but near the end of his life he admitted that species were "daughters of time." This idea had already been proposed by the Roman philosopher Lucretius, whose poem *De Rerum Natura* contains some eerily proto-Darwinian passages. Lucretius' writings were known in the Renaissance and the Enlightenment, but the strongest argument for the fluidity of species boundaries came from the French biologist Buffon, who explicitly demonstrated the principle by interbreeding a horse and a donkey to produce a mule. By the first years of the nineteenth century, Jean-Baptiste de Lamarck had developed his own detailed theory of organic evolution. Unlike Darwin's later evolutionary theory, which provided a plausible mechanism for change through natural selection, Lamarck's theory depended upon the incorrect postulate that acquired characteristics could be inherited by later generations. Unlike Darwin, moreover, Lamarck framed evolution in teleological terms, believing that organisms sought to work their way up the chain of being through progress towards optimality. Despite these important differences, however, Lamarck's theory certainly helped to establish an intellectual context in which Darwin's breakthroughs would become possible. Lamarck was, for example, one of the first biologists to champion the notion that the earth was far older than the 6000 years implied by a literal reading of the Bible, old enough for organic evolution

to have taken place. Another significant contributor to biological discourse in this period was Georges Cuvier, whose emphasis on the functional relationship between an animal's form and its behavior suggested the importance of adaptation to the environment.

In the decades around 1800, these newly sophisticated but still pre-Darwinian theories of natural history began to intersect with developments in art theory. By 1785, for example, Quatremère de Quincy had already noted that the territorial distribution of primordial architectural types, like that of plant species, reflected the influence of environmental conditions. Hegel's writings, which describe the progressive development of the Spirit, have a vaguely Lamarckian flavor, and his *Philosophy of Art* discusses art using terms current in recent biological discourse, such as "evolution," "genera," and "species." As Lauren Golden has recently demonstrated, moreover, eighteenth-century advances in the study of natural history exercised decisive influences on theorists of aesthetics from Kant to the Romantics.[5]

Charles Darwin, working in the middle decades of the nineteenth century, developed a comprehensive theory of organic evolution that forms the foundation of modern biology, but his epoch-making intellectual achievements have to date contributed far less than they might to the discourses of art history and related humanistic disciplines. The main obstacle to a more profound appreciation of his work, ironically, may be the very pervasiveness of older and simpler evolutionary models, whose limitations are all too often erroneously attributed to Darwin's theory. To a certain extent, this confusion may reflect the fact that Darwin's ideas themselves evolved fairly smoothly from the work of earlier evolutionist thinkers including Lamarck and his own grandfather, Erasmus Darwin. Over the course of his famous round-the-world voyage with the research vessel *Beagle* between 1831 and 1836, though, Darwin assembled a greater wealth of evidence for evolution than any of his predecessors had. Over the next two decades, he worked out his evolutionary theories in increasing detail, observing the effects of selective breeding on domestic animal populations, and communicating his ideas about natural selection only with a fairly small circle of scientific confidants, including the geologist Charles Lyell and the botanist Joseph Hooker. It was only in 1858, when he received a paper from Alfred Russell Wallace making many of the same arguments that he had developed, that Darwin decided to publish his work, which appeared in the following year as *On the Origin of Species by Means of Natural Selection, or the Preservation of Favored Races in the Struggle for Life*.

Darwin's book was an immediate sensation, selling out its first edition of 1,250 volumes on the day of publication, but some of the points of its argument entered the popular imagination more readily than others. Perhaps the most obvious point about Darwin's evolutionary model was that it conflicted radically with a literal interpretation of Christian scripture. Darwin himself was no raging atheist—indeed, he had trained for the ministry at Cambridge—but his view of evolution was

thoroughly rationalist and materialist.[6] Darwin, moreover, progressively undercut the long-cherished distinction between humans and other animals, first with the general evolutionary theory expounded in *On the Origin of Species*, and then with his more narrowly focused books *The Descent of Man* and *On the Expression of Emotions in Man and Animals*, published in 1871 and 1872, respectively. These challenges to religious and humanistic tradition had already been anticipated to some extent in the work of Darwin's Enlightenment-era predecessors, but it was the publication of Darwin's comprehensive and meticulously researched work that brought evolutionary theory to widespread prominence in the public sphere. The success of his ideas in explaining the diversity of life on earth did a great deal to increase the prestige of rigorous scientific research in the late nineteenth and early twentieth centuries.

Perhaps because the main claims of Darwin's evolutionary theory were so spectacular and controversial, many of its nuances were to some extent lost in the shuffle, at least in terms of the broad public discourse that would go on to influence art historians. Darwin's name has therefore become associated with notions of progress, teleology and value judgment, even though Darwin's own writings clearly explain that evolution reflects the action of environmental selection pressures rather than any inherent tendency towards the development of more "advanced" forms. One of the classic demonstrations of ongoing Darwinian evolution, in fact, involves the phenomenon of "industrial melanism," in which moth populations evolve to have darker colorations in polluted forests, because the more brightly colored moths become easily visible prey when seen against dark, soot-covered tree trunks. Dark moths are not inherently "better" or "worse" than pale ones; they are simply better suited to the particular conditions of a polluted environment.

The old-fashioned idea of a "chain of being" plays no role in Darwinian theory, but evolution continues to be widely associated in the popular imagination with the idea of linear progress. This misconception likely reflects the impact of widely publicized illustrations showing the successive steps in the evolution of familiar species such as horses and humans. The dramatic sequence of hominid forms leading from small apelike creatures to boldly striding modern humans, in particular, has achieved iconic status. The fundamental patterns of evolutionary development, however, tend to involve the branching structures of increasing diversity rather than simple linear sequences. Most speciation events involve the divergence of distinct populations, such as the various finch groups that Darwin famously observed on the Galapagos Islands, rather than the progressive development of single type. Even in the context of human evolution, branching diversity has been the rule, with other hominid species coexisting with our direct ancestors until surprisingly recently.[7] The spread of modern humans at their expense has trimmed their branches off the "tree of life" through extinction, but the basic processes of evolution remain irreducibly non-linear. This should be obvious in a broad sense, because

ancient types such as dragonflies and ferns continue to flourish alongside types of more recent evolutionary origin such as humans and flowering plants. More subtly, Darwin understood that evolution depended upon the existence of variation within individual populations, because the principle of natural selection involves the relatively greater reproductive success of those individuals in the group that succeed best in their environment—like the dark moths in the polluted forests. If all the moths had been initially the same color, they would all have died out together when they suddenly became visible against trees blackened in the Industrial Revolution. As this example suggests, evolution necessarily involves the action of environmental selection pressures—which may be highly non-random—on populations characterized by a certain amount of random variation. Darwin correctly recognized that this byplay of random and non-random factors could explain the evolution of exquisitely complex organisms such as human beings without any appeal to teleology.

Among the most important and least appreciated aspects of Darwin's theory has been its potential to liberate taxonomy from essentialism. By demonstrating that biological diversity results from ongoing process, rather than reflecting the structure of a single God-given master plan, Darwin showed that category boundaries are not absolutes. Evolutionary theory thus marked a dramatic step beyond Aristotle's stubbornly durable idea that categorical essences could be discerned by stripping away the "accidents" peculiar to each member of a given class. It is precisely this liberation of science from essentialism that the noted evolutionary biologist Ernst Mayr recently cited as Darwin's most fundamental contribution to the history of ideas, the one that earned Darwin recognition by *Scientific American* magazine as the most influential scientist of the past 150 years.[8]

Darwin's impact on the intellectual life of the late nineteenth and twentieth centuries was undoubtedly enormous, but the subtleties of his evolutionary model seem to have been largely lost on art historians and other members of the public not actively involved in biological research. Darwin's greatest influence on the discourse of art history was actually quite broad and diffuse, in the sense that his success contributed to elevating the already high status of scientific research in the very decades when art history was becoming established as a modern academic discipline. Positivism and the collection of objective data became established as fashionable ideals in the humanistic academy, and many art historians of the day aspired to create an objective and methodologically rigorous *Kunstwissenschaft* based on the sciences. Despite the growing prominence of biological and evolutionary terminology in art-historical discourse, however, really close engagement with the Darwinian intellectual legacy remained the exception rather than the rule.

One of the most evolutionarily minded art theorists of the nineteenth century was Gottfried Semper, who already in an 1853 lecture cited the influence of Cuvier's biological research on his own thinking about architectural history. Semper

certainly read *On the Origin of Species* when it came out six years later, and he saw his own theories as very similar to Darwin's. Even he, however, hedged his bets somewhat, observing that the "free creations of man" followed different developmental laws than species in nature.[9] Unfortunately, his writings do not explain in detail how he would have extended and modified the Darwinian model so that it could apply more adequately to cultural history.

As Lauren Golden has recently noted, Darwinian evolutionary language also occurs in the slightly later writings of Conrad Fiedler on architecture, while Darwin's work on the expression of emotion in man and animals went on to influence the aesthetic theories of Herbert Spencer and Robert Vischer.[10] Darwin's evolutionary ideas also informed Henri Bergson's philosophy of duration and change, which would go on to impact art historians such as Henri Focillon in the twentieth century, but Bergson's writings celebrated mysticism and intuiton as the rigorously rational materialist Darwin never had. On the other methodological extreme, Giovanni Morelli's positivistic attention to formal details in art had more in common with Linneaus's classification schemes than it did with Darwin's evolutionary legacy. Neither Bergson nor Morelli, therefore, really internalized the nuances of Darwin's theories.

Several of the most thoughtful and influential art theorists of the decades around 1900 were downright skeptical of Darwinian thinking, at least as they understood it. Alois Riegl, for instance, explicitly criticized Semper's followers for the naïve "Darwinismus" of their materialist approach to art history.[11] Riegl's own theories of art-historical development emerged from a more Hegelian tradition. Like Hegel, Riegl saw cultural history as a continuum, in which each work deserved to be interpreted in relation to the spirit of its own age, rather than measured against some absolute external standard such as classical realism. Riegl's careful attention to the details of formal development helped give his theory of *Kunstwollen* a degree of precision and plausibility that Hegel's more abstract scheme had lacked, but the Hegelian flavor of Riegl's work remains pronounced, especially in his earlier writings such as the *Stilfragen* of 1893. Interestingly, however, Riegl's later writings, such as the fragments of *Historische Grammatik* that were still unpublished when he died in 1905, suggested a more complex picture of cultural and artistic change. Instead of treating art history as a simple linear progression governed by the immanent logic of form, Riegl began to suggest that different formal solutions might compete with one another in an environment defined by external factors such as patronage and ideology. The demise of Classical art in Late Antiquity and the contemporaneous turn towards abstraction, for example, could be understood as a consequence of the adoption of Christianity as the official religion in the Roman empire. This more complex view of artistic evolution through cultural selection presents obvious analogies to Darwin's theory of organic evolution through selection in the natural environment.[12] Having earlier criticized Semper's followers for their supposed

"Darwinismus," however, Riegl does not appear to have recognized the resonances between his own mature views and Darwin's.

Henri Focillon, writing a generation later, similarly appears to have misunderstood the true character of Darwin's evolutionary theory. He found much to appreciate in Bergson's evolutionary philosophy, but in *The Life of Forms*, he faulted evolutionary thinking for its "deceptive orderliness" and its "single-minded directness."[13] Darwinian evolution, though, is neither orderly nor goal-directed. Focillon, in this instance, appears to have wrongly associated evolution with the Hegelian idea of progressive development that he so emphatically opposed.

Heinrich Wölfflin, working mostly in the years between Riegl and Focillon's greatest achievements, proved more willing to engage with the nuances of Darwin's legacy. In his early career, Wölfflin associated evolution with increasing perfection, but by 1915, when he wrote *The Principles of Art History*, he had come to recognize that divergence rather than linear progress was the key to both artistic and biological development. Wölfflin correctly concluded, therefore, that Darwin's model of organic evolution had much more to offer to art history than Hegelian teleology or the Vasarian biological metaphor of birth, maturation, and death. Wölfflin's mature analysis of artistic development thus depends directly on Darwin's work, with some passages echoing *On the Origin of Species* almost verbatim. Wölfflin's ideas about the psychology and perception of art, moreover, rely to a significant extent on Darwin's *The Expression of the Emotions in Man and Animals*.[14]

The kind of direct art-historical engagement with evolutionary theory seen in the work of Semper and Wölfflin has had few sequels, despite the rapid flowering of evolutionary biology in the past century. Over the nearly 150 years since the publication of *On the Origin of Species*, ongoing research has strengthened the already impressive intellectual edifice built by Darwin. The discovery of the genes, and later of DNA, helped to explain the mechanisms of inheritance and the origins, through mutation, of genetic variation. Thanks to these breakthroughs, genetic criteria could be used to help sort out evolutionary relationships, which had previously been inferred primarily from phenetics, the study of external form. These developments fostered the growth of evolutionarily based taxonomy, in addition to providing the initial impetus towards the great scientific undertaking of the early twenty-first century, the deciphering of the human genetic code. Studies of population biology and speciation have advanced the modern biological understanding of living ecosystems, while debates about "punctuated equilibria" and the pace of evolutionary change have characterized discussions of the paleontological past. All of these developments have complicated and enriched the picture sketched by Darwin while confirming the accuracy of its basic outlines.[15] Virtually none of this research, however, has had a meaningful impact on art-historical discourse.

The breakdown of the dialog between evolutionary biologists and art historians attests in part to a more general breakdown of communication between humanists

and scientists, which has been particularly palpable since the middle of the twentieth century. Erwin Panofsky, in his 1938 essay on "The History of Art as a Humanistic Discipline," could still wax eloquent about the symbiotic relationship between the sciences and the humanities, but by 1959 the physicist C.P. Snow had already begun to lament the divergence of the "Two Cultures."[16] In the five decades since Snow's famous essay appeared, the relationship between art history and the sciences has become even more vexed, despite the increasingly widespread use of scientific and technical tools such as pollen grain sampling in archaeology, infrared reflectography in the study of painting and structural analysis in the study of architecture. The usefulness of such tools at a practical level has done nothing to allay more abstract theoretical concerns among many humanists about quasi-scientific explanatory structures, master narratives and over arching organizational schemes of all kinds. The rise of critical theory, in particular, has led many to question the possibility of quasi-scientific objectivity in historical scholarship. Indeed, many cultural critics from 1970 onwards have argued that scientific objectivity was impossible even in the sciences themselves. Such attitudes mark a decisive repudiation of the widespread aspiration to scientific rigor evident in the scholarly world of the late nineteenth and early twentieth centuries. Members of the scientific community have responded to these developments with varying degrees of chagrin, as expressed most infamously in physicist's Alan Sokal's deliberately nonsensical hoax submission to the journal *Social Text*.[17] Biologist E.O. Wilson, meanwhile, has proposed an explicitly neo-Enlightenment project of "consilience" between the sciences and the humanities, in which the mechanism of "gene-culture co-evolution" would play a central role.[18] Despite the more constructive tone of Wilson's project, many humanists might worry that Wilson's unified vision undervalues their expertise in the study of human culture. The stakes in these debates are high, since they have the potential to shape the relationship between scientific and humanistic discourse. The tone of these debates can also affect public and governmental perceptions of the academy, with direct and important consequences for research funding and scholarly life generally.

In this context especially, the methodological and conceptual parallels between art history and evolutionary biology deserve more attention than they have recently received. The current state of relative disengagement between these fields emerges clearly in the comments of two well-respected art historians who have discussed the topic. Linda Nochlin, in her introduction to a special 2003 issue of *Nineteenth-Century Art Worldwide* on "The Darwin Effect," writes unashamedly of her two-month "crash course" on the literature of evolutionary theory, starting with her reading *Darwin for Beginners*.[19] Nochlin deserves credit for tackling the topic intelligently, and the contributing authors effectively document the impact of Darwinism on several later nineteenth-century artists, but it is sobering that a leading humanist scholar such as Nochlin must effectively start from scratch when attempting to

engage with an intellectual tradition so central to the modern scientific worldview. In a 2001 article, meanwhile, Eric Fernie advances a curious argument for expunging evolutionary language from art-historical discourse. He begins by quite rightly distinguishing between the ways in which biologists and art historians have used evolutionary language, observing that humanists still tend to associate the term "evolution" with progressive linear development, even though Darwin's own model of biological evolution is neither progressive nor linear. Then, arguing that the usefulness of evolutionary language in art history should be judged by how it *has been* applied rather than how it *could be* applied, he concludes that evolutionary metaphors should be dismissed as unhelpful.[20] This, however, is rather like arguing that knives should be dismissed as useless because they don't cut well when held upside-down. Surely it makes sense to experiment with using a tool properly before rejecting it out of hand. From this perspective, it makes sense to suggest that art historians should carefully consider the possible relevance of evolutionary theory, instead of following Fernie's call to reject this powerful framework for the discussion of formal change over time. Fernie may be too quick to discard evolutionary metaphors, but he makes a useful distinction between such metaphors and evolutionary analyses, for which he has a bit more sympathy. An evolutionary metaphor compares general patterns of artistic and biological development, while an evolutionary analysis allows scholars to bring the techniques of biology to bear on the study of art.

Art historians stand to gain from closer intellectual engagement with evolutionary biology on both the analytical and the metaphorical levels, as Ernst Gombrich appears to have recognized decades ago. At the analytical level, Gombrich noted that theories of art, beauty and visual perception must necessarily take account of human mental structure, which is itself a product of evolutionary history. In the early years of Gombrich's long career, this point would have mattered only on a fairly abstract level. With the increasing sophistication of evolutionary neurobiology in recent decades, though, the emergence of a genuine neurologically based theory of aesthetics has become a concrete possibility, if not yet an accomplished fact. Among the most eloquent advocates for closer engagement between art historians and neurologists, not surprisingly, have been Gombrich's former student John Onians, and his own student Lauren Golden, whose work involves the biological origins of visual imagination.[21]

At the metaphorical level, meanwhile, Gombrich recognized that Darwinian evolution offered a paradigm for change far more flexible and nuanced than the linear models of history proposed by Vasari and Hegel.[22] Gombrich objected particularly to the collectivism and essentialism implicit in Hegel's idea that works of art and culture merely reflect the guiding spirit of their age. Gombrich even explicitly lamented the way that Aristotelian essentialism continued to constrain art-historical discourse long after it had been rejected in the biological sciences.

Gombrich's admiration of scientific discourse doubtless reflects the impact of his long and fruitful dialog with the noted physicist and philosopher Karl Popper.

Interestingly, though, the methodological parallels between evolutionary biology and art history may be even closer than Gombrich and Popper appreciated. Popper's extensive and influential work on the epistemology of the sciences emphasizes the importance of "falsifiability," the notion that a viable scientific theory must make testable predictions. Theories whose predictions fail to match the results of experiment would then be thrown out or modified, leading to a kind of intellectual evolution towards ever more precise theories. Because physics is a discipline devoted to the study of timeless universal principles, Popper could afford to place a premium on prediction and experimentation. Disciplines such as evolutionary biology, geology and cosmology, however, deal necessarily with the past, and they therefore cannot be based on prediction in the same strict sense as physics. In both epistemological and methodological terms, therefore, these scientific disciplines have much in common with humanistic disciplines such as art history. Ernst Mayr makes this very point when discussing Darwin's intellectual legacy, suggesting optimistically that such parallels between certain scientific and humanistic disciplines should help open up the lines of communication between the "two cultures" that had been identified by C.P. Snow.[23]

At a fundamental level, of course, the mechanisms of cultural development are different from those seen in organic evolution. Self-conscious human agency provides a mechanism for cultural and artistic change that finds no direct parallel in natural history. This does not mean that Darwinian models have to be rejected in the study of the arts, but it does mean that they have to be modified if they are to prove helpful. One of the most important differences between artistic production and biological reproduction is that, while a given organism will necessarily have just two parents, both of whom belong to the immediately preceding generation of the same species, an artist can incorporate an arbitrarily large number of influences in his or her work, some of which may be ancient or largely foreign to the artist's cultural tradition. A thirteenth-century sculptor such as Nicola Pisano, for example, could be directly influenced by late antique reliefs made many hundreds of years before, and a modern artist such as Picasso could draw inspiration from African masks. Thus, while natural history can be understood as a continuously branching "tree of life," the topology of cultural history can be far more complex, incorporating tangles, loops, and multiple rather than singular root structures. Tangled webs of this sort may soon become necessary to trace the origins of hybrid organisms produced through gene splicing and other radical forms of genetic engineering, but they have not been necessary to describe the autonomous flow of natural history.

The convoluted topology of cultural process has important implications for art-historical taxonomy. Unlike biologists, who can work towards a single authoritative

taxonomy based on the branching structure of evolutionary history, art historians must be willing to simultaneously entertain multiple taxonomies. The technical details of an artwork, for example, may continue to reflect the artist's early training, even in cases where the overall conception of the work has been influenced by new ideas. The molding profiles that have been so assiduously studied by many students of medieval architecture carry mostly the first type of information, which might be termed genetic because it directly reflects the carver's immediate artisanal parentage. The gross morphology of the building, by contrast, might reflect the aspirations of the designers and the patrons to rival a famous monument that stemmed from a very different artisanal tradition. A given building might be seen as belonging to two very different "schools" depending on which set of evaluative criteria are considered.[24]

The pitfalls of a purely evolutionary approach to art-historical taxonomy become apparent when cases of convergent evolution in biology are contrasted with those in art history. Biologists recognize that whales came to have fishlike shapes without ever imitating fish or being directly influenced by them. Biologists have therefore been able to largely abandon the use of categories such as "fish-shaped animals." Comparably vague terms based on external characteristics, however, are likely to remain important in art-historical discourse, because artists often do imitate the external features of art from outside their own traditions. The term "classicizing sculpture," for example, proves useful in the case of Nicola Pisano because his work cannot readily be explained without consideration of antique prototypes as well as his own thirteenth-century Italian milieu. Art-historical taxonomy, therefore, can never be reduced to a single definitive evolutionarily based system in the same sense that biological taxonomy, at least in principle, can be.

In general, analogies between art history and the sciences must be recognized as approximate and imperfect, but potentially powerful. Memory, self-consciousness, and intelligent agency, perhaps the most wonderful of human characteristics, are precisely the characteristics that will always prevent art history from attaining epistemological equivalence with the sciences. Nevertheless, art historians have much to gain from the active consideration of scientific analogies, especially those involving biological evolution. Darwinian language provides a broad and flexible framework within which the rich diversity of the world's artistic output can be readily understood without appeal to essentialism or teleology. In these respects the Darwinian model offers significant benefits that the far more influential Hegelian and Vasarian models of artistic development do not. In fact, the languages of evolution can be taken as a powerful model for art-historical discourse, one that would automatically incorporate many of the most profound insights of scholars such as Riegl, Wölfflin, and Gombrich. Art historians attempting to construct coherent theories of diachronic cultural process, therefore, have good reason to engage with the discourses of evolutionary biology and other historical sciences.

The analogies between art history and the sciences deserve to be pursued not only because of their potential to spawn valuable new theories of artistic development, but also because the ensuing conversation could help heal the discursive breach between the sciences and the humanities. Scientists and humanists both have much to be proud of, and active dialog between the two groups would likely foster increased mutual respect as well as mutual understanding. Humanists may be positively surprised by the power, lucidity and relevance of scientific intellectual models. Scientists, conversely, may be struck by the subtlety and complexity of the problems that humanists confront in their work, which make the substantial achievements of humanistic scholarship all the more impressive. The fact that the topology of artistic influence is far more intricate than that of evolutionary biology, for example, helps to demonstrate why cultural history cannot be treated in precisely the same way as natural history. Thus, while some might worry that exploration of the analogies between the arts and the sciences would lead to the colonization of one discourse by the other, it seems far more probable that such dialog would underline the autonomy and the dignity of each. Since the academy in the early twenty-first century often seems both divided against itself and marginalized by increasingly business-driven social paradigms, the potential benefits of cross-disciplinary communication are simply too great to ignore.

## Notes

1 A number of colleagues have contributed significantly to the evolution of this essay. The first strong impetus leading me to explore its themes came from Marvin Trachtenberg, who invited me to speak in his session on the parallels between art-historical and scientific models of periodization at the CAA conference in 2000. The present essay should thus be understood as a sequel to my talk, which was published as "Pros and Cons of Stratigraphic Models in Art History," *RES* 40 (2001): 177–87. I am grateful to Elizabeth Mansfield for expressing interest in some of the related material on Darwinism that I was not able to include in that short article. I owe particular debts also to John Onians and to his former student Lauren Golden, who generously shared with me her richly detailed dissertation "An Enquiry concerning the Imagination in Philosophy, Art History and Evolutionary Theory" (University of East Anglia, 2001). Last but not least, I am pleased to acknowledge the guidance and support of my paleontologist father, Ken Bork, who first introduced me to the world of evolutionary theory.

2 Because this essay must cover a vast amount of historiographical ground in a small space, detailed citations will be given only for recent art-historical works. The basic positions of ancient and Renaissance theorists are briefly sketched in e.g. Eric Fernie, *Art History and its Methods: A Critical Anthology* (London: Phaidon, 1997) pp. 10–11.

3 Johan Huizinga, *Herfsttij der Middeleeuwen* (Haarlem: H.D. Tjeenk Willink, 1919).

4 A good introduction to the history of taxonomy in paleontology is the chapter on "Systematics" in Donald R. Prothero, *Bringing Fossils to Life* (Boston: McGraw-Hill, 1998) pp. 42–61.

5 For Quatremère de Quincy and Hegel, see Golden, "An Enquiry," p. 139 and 126–35, respectively. For Kant and the Romantics, see Ibid., pp. 99–119 and 130–38.
6 Adrian Desmond and James Moore, *Darwin: The Life of a Tormented Evolutionist* (London: Viking, 1991).
7 On the recent discovery of the tiny Homo flouresiensis, for example, see Kate Wong, "The Littlest Human," *Scientific American* 292(2) (2005): 56–65.
8 Ernst Mayr,"Darwin's Influence on Modern Thought," *Scientific American* 283(1) (2000): 78–83.
9 Golden, "An Enquiry," pp. 139–144.
10 Ibid., pp. 150–54.
11 Margaret Iversen, *Alois Riegl: Art History and Theory* (Cambridge, MA: Harvard University Press, 1993) p. 27.
12 I am grateful to Jackie Jung for bringing these evolutionary resonances to my attention. For her translation of Riegl's late work, see Alois Riegl, *Historical Grammar of the Visual Arts,* trans. Jacqueline Jung (New York: Zone Books, 2004). See also Golden, "An Enquiry," pp. 155–59.
13 Henri Focillon, *The Life of Forms in Art* (New York: Zone Books, 1989) p. 47. The book was originally published in French in 1934. For Bergson's influence on Focillon, see Walter Cahn's entry on Focillon in Helen Damico, ed., *Medieval Scholarship—Biographical Studies on the Formation of a Discipline* (New York: Garland, 2000) pp. 263–64.
14 Golden, "An Enquiry," pp. 160–65.
15 These more recent developments in evolutionary theory are briefly sketched in Prothero, *Bringing Fossils to Life*, pp. 66–77. Particularly interesting from an art-historical perspective is the fact that modern evolutionary biologists increasingly distinguish between micro-evolution, which governs small changes in largely stable species, and macro-evolution of the kind seen when new species arise, usually in response to powerful new selection pressures. Art historians, similarly, often differentiate between the moments of bold creativity associated with innovative artists, and the more workmanlike development of their ideas by their successors. Focillon's student George Kubler, for example, used a distinction of this kind to develop the idea of artistic "sequences," which would begin with innovative "prime objects" whose influence could be traced in later versions. See Kubler, *The Shape of Time* (New Haven, CT: Yale University Press, 1962) especially pp. 70–79.
16 Erwin Panofsky, "The History of Art as a Humanistic Discipline," cited in Golden, "An Enqiry," pp. 160–65. Snow originally delivered "The Two Cultures" at Cambridge in the Rede Lecture Series. It has subsequently appeared in print in various versions, e.g. C.P. Snow, *The Two Cultures: and A Second Look* (Cambridge: Cambridge University Press, 1965).
17 Alan D. Sokal, "Transgressing the Boundaries: Toward a Transformative Hermeneutics of Quantum Gravity," *Social Text* 46–47 (1996) pp. 217–52; and Alan D. Sokal, "A Physicist Experiments with Cultural Studies," *Lingua Franca* (May-June 1996) pp. 62–64.
18 E. O. Wilson, *Consilience: The Unity of Knowledge* (New York: Knopf, 1998).
19 Linda Nochlin, "The Darwin Effect," *Nineteenth-Century Art Worldwide* 2(2) (2003).
20 Eric Fernie, "Art History and Evolution from Henri Focillon to Stephen Jay Gould," in Lauren Golden, ed., *Raising the Eyebrow: John Onians and World Art Studies*, (Oxford: Achaeopress, 2001), pp. 67–78. Fernie had earlier advanced a similar but shorter critique of evolutionary language in *Art History and its Methods*, pp. 336–37. In the course

of his 2001 article, Fernie critiques two articles examining the relationship between architectural history and biological evolution: Stephen Jay Gould and R.C. Lewontin, "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme," in *Proceedings of the Royal Society of London*, Series B, Biological Sciences 204 no. 1161 (1979) pp. 581–98; and Robert Mark, "Architecture and Evolution," in *American Scientist* 84 (1996): 383–89. Mark himself rightly faults some of Gould's reasoning, which places less stress than it might on the importance of scale in architectural design, but Gould's desire to work art-historical analogies into evolutionary theory suggests the potential power of this cross-disciplinary exchange. Taken together, these two articles suggest that art historians and biologists should engage with each others' work more closely, rather than less.

21 See John Onians, "Architecture and Painting: The Biological Connection" in Karen Koehler, ed., *Architecture and the Pictorial Arts from Antiquity to the Enlightenment*, (Aldershot: Ashgate, 2002), pp. 1–14; Golden, "An Enquiry," pp. 169–293. Golden usefully summarizes many of the main points of "An Inquiry" in the shorter and more accessible, "Science, Darwin, and Art History," in *Raising the Eyebrow*, pp. 79–90.

22 E.H. Gombrich, "Evolution in the Arts: The Altar Painting, Its Ancestry and Progeny," in Alan Grafen, ed., *Evolution and Its Influence* (Oxford: Clarendon, 1989), pp. 107–25, especially pp. 107–108. See also E. H. Gombrich, *In Search of Cultural History*, (Oxford: Clarendon, 1969); Didier Eribon and E.H. Gombrich, *Looking for Answers: Conversations on Art and Science* (New York: Harry N. Abrams, 1993) p. 168, and John Onians, "Gombrich and Biology," in Paula Lizzaraga, ed., *E.H. Gombrich in Memoriam* (Pamplona: Universidad de Navarra, 2003). For Gombrich's thoughts on classification and essentialism, see E.H. Gombich, "Norm and Form," in *Norm and Form: Studies in the Art of the Renaissance* (London: Phaidon, 1978) pp. 82–88.

23 Mayr, "Darwin's Influence," p. 80.

24 I first explored these themes in "Holy Toledo: Art-Historical Taxonomy and the Morphology of Toledo Cathedral," *AVISTA Forum Journal* 10(2) 11(1) (Fall 1997/Spring 1998): 31–37.