

Aesthetic Implications of the New Paradigm in Ecology

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Ecological science has wrought a change in the mental eye. —Aldo Leopold

I. Introduction

Thomas Kuhn describes a scientific paradigm as a conceptual framework or set of background beliefs and values held by members of a scientific community.¹ Part of a scientific education, he argues, is learning how the background beliefs and values that underlie scientific practices articulate a paradigm.² Part of an aesthetic education, I argue, is learning how to appreciate natural beauty differently and appropriately when new discoveries trigger what Kuhn calls a paradigm shift—a shift in the beliefs and values that determine scientific theory and practice. In 1992 scientists S. T. A. Pickett, V. T. Parker, and P. L. Fielder announced that ecology had undergone such a shift.³ The new paradigm in ecology emphasizes dynamic change, disturbance, and non-equilibrium in natural systems, and it presents some challenges for contemporary environmental aesthetics, one of which has to do with the thesis known as “scientific cognitivism.” Scientific cognitivism holds that appropriate aesthetic appreciation of nature must be informed by scientific knowledge.⁴ If this thesis is correct, and if the new paradigm in ecological science tells us that nature is in a state of dynamic non-equilibrium, then aesthetic appreciation must adapt to constant change in natural systems. More generally, if aesthetic appreciation of nature must be informed by scientific knowledge, and if ecological science undergoes a paradigm shift, then a cognitivist model of aesthetic appreciation must adapt to the new paradigm. Another challenge the new paradigm presents has some

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bearing on the positive aesthetics thesis—that pristine nature has only positive aesthetic qualities such as balance, order, and harmony. The new paradigm's emphasis on random and fluctuating disturbances may require us to abandon the notion of purely "pristine" nature and replace the positive aesthetic qualities with which it is associated because under the new paradigm nature is described as imbalanced, disorderly, and disharmonious.

Here I explore the aesthetic implications of this new paradigm, the central implication being that scientific cognitivism, when combined with the new paradigm in ecology, may require updating the qualities associated with positive aesthetics. After reviewing Allen Carlson's defense of both scientific cognitivism and the positive aesthetics thesis, I show how the significantly different conceptual framework that the new paradigm in ecology provides will require equally significant adjustments to how we aesthetically appreciate nature. I make two suggestions. First, the new paradigm in ecology suggests that aesthetic appreciation should focus on natural processes, which will require a more theoretical approach to aesthetic appreciation. Second, because the new paradigm appeals to aesthetic qualities such as imbalance, disorder, and disharmony to make the natural world intelligible, these qualities are consistent with an updated positive aesthetics thesis and should therefore replace the qualities associated with the old paradigm. Collectively, these two suggestions imply that the beauty of nature is dynamic and chaotic rather than stable and orderly.

II. Scientific Cognitivism and the New Paradigm

Carlson maintains that correct or appropriate aesthetic appreciation of natural environments must be informed by scientific knowledge.⁵ He argues that without the requisite scientific knowledge provided by sciences like geology, biology, and ecology, we simply do not know how to appreciate nature and the aesthetic qualities it possesses.⁶ Drawing on Kendall Walton's "Categories of Art," Carlson claims that nature should be appreciated according to its correct categories—the categories disclosed by the natural sciences.⁷ Moreover, Carlson argues, appreciating nature within its correct categories yields aesthetic judgments that are objectively *true*.⁸ Thus, scientific knowledge is *necessary* in determining what to focus on and how to aesthetically appreciate natural environments.⁹ To make sense of nature's complexity—what William James has called a "blooming, buzzing, confusion"—we need science to inform our aesthetic judgments and further our appreciation for the natural world.¹⁰ Carlson defines scientific cognitivism as

that appreciation of an object that reveals what aesthetic qualities and value it has . . . scientific knowledge is essential for appropriate aesthetic appreciation of nature; without it we do not know how to appreciate it appropriately and are likely to miss its aesthetic qualities and value. Thus, if this account is correct, it explains the ability

of science to both promote and enhance aesthetic appreciation of the natural world.¹¹

As a basic premise, I take the cognitive thesis to be generally correct. Carlson rightly insists that appropriate aesthetic appreciation must be informed by scientific knowledge. Otherwise, we simply do not know how to appreciate nature on its own terms.¹² The question, then, is what kind of adjustments to aesthetic appreciation need to be made in light of the new paradigm.

Ecology as a self-conscious science has a rich conceptual history, despite its being labeled “immature” compared to the so-called hard sciences of physics and chemistry. Tracing the conceptual history of ecology in any detail is far beyond the scope of this article, so instead I look to some seminal figures in the field to provide some historical background leading up to the new paradigm. But before outlining the historical roots of the new paradigm in a scientific context, I first want to examine some of the more philosophical and ancient foundations of the new paradigm’s central ideas. In scientific terms, the new paradigm separates itself from the old by emphasizing change, dynamism, and non-equilibrium in ecosystems.¹³ In laymen’s terms, the idea associated with the new paradigm is the “flux of nature,” as opposed to the “balance of nature.”¹⁴ While the former idea describes the natural world as a scene of constant change, the latter sees the whole of nature as stable.

The philosophical roots of these two competing ideas date back to the pre-Socratics, particularly Heraclitus and Parmenides. Where Heraclitus proclaimed “All is flux,” Parmenides held that change is illusory.¹⁵ Debate over the polarities of chaos and order, however, is not restricted to ancient philosophy; these polarities continue, quite pervasively, to influence our perceptions of nature. Under a Parmenidean influence, the “balance of nature” idea characterizes nature as orderly, stable, and predictable, which has consequences for both our ethical and aesthetic relationship to the natural world. Under the balance of nature idea, “nature knows best,” which suggests a “hands off” or preservationist approach to environmental ethics. Aesthetically, changes and fluctuations in the environment, according to this view, are anomalous, and environments will ultimately heal and aright themselves back into delicate equilibrium and benign stasis. Conversely, under the Heraclitean “flux of nature” idea, the natural world is chaotic, unstable, and randomly changing, which seems to render the natural world confusing at best and unintelligible at worst. Such a worldview leaves us with little understanding about what to do in terms of environmental ethics and policy making. Aesthetically speaking, the challenge is appropriately appreciating, or even identifying, aesthetic qualities. Under the flux of nature idea, there seems to be no standard on which we can base our judgments, which is, of course, one of the central problems in the history of aesthetics.¹⁶

III. The New Paradigm in Ecology: A Brief History

In 1916 American ecologist Frederick Clements developed a holistic and organicist model of plant succession in which he argued that species succession is unidirectional and comes to a stable point of equilibrium known as the "climax community."¹⁷ Clements's climax community concept exemplifies what I will call the "old paradigm." All ecological roads, according to Clements, lead to the climax community, and any seemingly random disturbances to it are explained as temporary anomalies. In Clements's model of the climax community, the whole was more than the sum of its constituent parts, and the system emulated one large "superorganism."¹⁸

Contrary to Clements's holistic model, Henry Gleason argued a decade later that plant associations were in fact individualistic and accidental groupings, not organized parts honoring the single direction of a unified whole.¹⁹ Thus, Gleason's individualistic notion of plant succession carried with it the idea that biological organization is much looser and more determined by chance than previously thought. The Clements/Gleason disagreement between holism versus individualism set the foundation for much ecological thought that was to follow. Indeed, the new paradigm in ecology can be considered one of the latest examples of how this disagreement historically has played out.²⁰

In partial reaction to Clements's climax community concept, Arthur Tansley coined the term *ecosystem* to explain what he saw as dynamic change in natural environments.²¹ For Tansley, the structure and function of natural environments was systemic, and ecosystems stood in a state of what he called "dynamic equilibrium."²² Therefore, moving from the climax community to dynamic equilibrium, the ecosystem concept accounted for dynamism in natural systems, albeit dynamism that maintained overall equilibrium. Raymond Lindeman, in his 1942 "The Trophic-Dynamic Aspect of Ecology," first theorized about systemic energy flow through ecological systems, focusing on processes rather than individuals.²³ Later in the 1960s Eugene Odum further developed Lindeman's views by emphasizing the systemic character of nature by modeling the flow of energy through natural environments, complete with elaborate diagrams depicting circuitous inputs and outputs.²⁴ Odum's contribution significantly expanded the focus of study in ecology beyond the species level, a central aspect of the new paradigm. But the new paradigm is only new in terms of advancements in ecological science, particularly modeling techniques used in research such as Odum's. Before these techniques became commonplace in defending their respective hypotheses, naturalist Aldo Leopold discussed the balance of nature idea when he wrote:

To the ecological mind, balance of nature has merits and also defects. Its merits are that it conceives of a collective total, that it imputes

some utility to all species, and that it implies oscillations when balance is disturbed. Its defects are that there is only one point at which balance occurs, and that balance is normally static.²⁵

Here we see that Leopold's view is consistent with Clements's view that all species serve a specific function, but it is inconsistent with Clements's view that species' functions are directed toward a single point, namely, the climax community. We also see that Leopold's view is consistent with Tansley and Odum's views about dynamism and energy flow (that is, oscillations) but is inconsistent with their ideas regarding equilibrium. The point is that the new paradigm is not all that new; the question, rather, is what makes it a new *paradigm*.

Thomas Kuhn defines a paradigm as the worldview shared by a scientific discipline and the practices the discipline employs in problem solving.²⁶ That scientific practices do not stand in isolation from the social, historical, cultural, and even psychological conditions that surround them points to how, according to Kuhn, "no natural history can be interpreted in the absence of at least some implicit body of intertwined theoretical and methodological belief that permits selection, evaluation, and criticism."²⁷ In other words, the foundation of a scientific practice lies in a paradigm's accepted research program, which is largely determined by the underlying beliefs and values held by those in a scientific community. Thus, the new paradigm in ecology can be seen as a legitimate paradigm only when it combines scientific practice with the theoretical beliefs and values underlying the flux of nature idea, and some of those values are aesthetic values.

The call for replacing the old paradigm with the new is largely attributed to the publication of a collection of essays edited by ecologists S. T. A. Pickett and P. S. White entitled *The Ecology of Natural Disturbance and Patch Dynamics*.²⁸ In this volume the authors describe the structure of ecosystems as "patches"—spatiotemporal areas that are indefinitely bounded and influenced by "disturbances"—and fluctuations that indicate underlying natural processes that govern ecosystem functions.²⁹ Pickett and V. Thomas Parker define fluctuations and disturbances in natural systems as

biotic or abiotic interactions that influence dynamics. Any process may influence a number of ecosystem characteristics simultaneously. A clear example of this is the differential effect of a fire, killing some individuals or species while stimulating the germination of others. Fires also transform nutrient dynamics by mineralizing nutrients previously bound up in organic matter.³⁰

Generally, the new paradigm may be best described as a "dynamic non-equilibrium" theory of ecosystem structure and function. As the above quotation implies, disturbances facilitate natural processes, transforming the landscape from one condition to another. More specifically, the new

paradigm prioritizes the role of ecological processes over species interactions, mostly because species interactions are largely determined by natural disturbances.

To explicitly distinguish the new paradigm from the old, ecologists S. T. A. Pickett and Richard Ostfeld outline some of the basic assumptions of classical, “balance of nature” ecology: (1) natural systems are closed; (2) natural systems are self-regulating; (3) equilibrium comes to a point; (4) succession is fixed; (5) disturbances to natural systems are exceptional; and (6) humans are excluded.³¹ The new paradigm in ecology challenges each of these assumptions, according to Pickett and Ostfeld, replacing the no longer plausible balance of nature conceptual framework with the more accurate flux of nature idea.³²

According to the new paradigm, the ecological significance of fluctuations and disturbances can be extended beyond the narrow scope of the balance of nature idea. Disturbances such as wildfires, fluctuations in climate, and wind and soil erosion do not negatively disrupt the delicate equilibrium of nature but rather characterize or “punctuate” its continual flux. That is, any ecological process that constitutes a disturbance, according to its scale and level of intensity, characterizes nature as in flux. According to Pickett and Ostfeld,

the term *flux* highlights variation, fluidity, and change in natural systems, rather than stasis, which is implied by the word *balance*. Although this metaphor does not deny the existence of stable points in nature, it focuses our attention on the fact that natural systems, which certainly do persist, do so as a result of a variety of fluxes.³³

Note that the new paradigm does not deny the existence of stability, balance, or equilibrium in natural systems altogether. Rather, the new paradigm acknowledges equilibrium in natural systems but only relative to a particular spatiotemporal *scale*.³⁴ Since disturbances can occur on many levels and affect multiple ecosystem characteristics simultaneously and in very complex ways, scale is needed to monitor and measure the rate and extent of disturbances. Pickett and Ostfeld define *scale* as “the term used to describe the relationships between two measurements such as the extent over which a process occurs and the spatial extent of a system.”³⁵ For example, eroding changes in the Grand Canyon may be measured on spatiotemporal scales of millions of years and hundreds of miles, where seasonal changes in climate to, say, a patch of wildflowers may be measured on scales much less dramatic. The apparent regularity or randomness, balance or imbalance, order or chaos is also relative to scale—the rate, intensity, and extent to which changes in natural systems occur.

Scale, however, is not an arbitrary imposition or projection on natural systems. The extent and degree to which changes in natural systems occur is not an arbitrarily imposed “frame” but a measurement. The logical sequence

goes something like the following: When an ecological change, fluctuation, or disturbance is observed, we then measure the extent and degree of change—its scale—and interpret the data at different levels of description. For example, wildfires transform nutrient dynamics in forest ecosystems by returning nitrogen to the soil, which stimulates new growth. If we are able to observe a wildfire from a safe distance, we might try to measure its spatial and temporal dimensions—its scale—to monitor the ecological changes and natural processes it stimulates. We might then offer descriptions of what we have observed at different levels of specificity, from small-scale details about nutrient dynamics to large-scale topographical changes in the landscape. Thus, whether a particular natural system is in a state of equilibrium or non-equilibrium will depend upon the scales of changes we observe.

IV. The New Paradigm and Process-Oriented Appreciation

Now armed with the scientific knowledge the new paradigm in ecology provides, we are in a position to consider its aesthetic implications. As stated above, according to the new paradigm, combined with the cognitive thesis, I make two suggestions: (1) that we should primarily direct our attention to natural processes, which will require a more theoretical approach to aesthetic appreciation; and (2) because the new paradigm appeals to qualities such as imbalance, disorder, and disharmony in making the natural world intelligible, these qualities are consistent with the positive aesthetics thesis and should therefore replace the qualities associated with the old paradigm. I discuss the first of these claims in this section. But before discussing what I will call “process-oriented aesthetic appreciation,” I first want to see which characteristics of the new paradigm in ecology might translate into aesthetic appreciation. The following six characteristics of natural systems, identified by Pickett and Ostfeld, for example, may help guide our appreciative practice. According to the new paradigm, (1) natural systems are not closed, discrete objects—they are open systems; (2) natural systems are not self-regulating—they fluctuate in a state of non-equilibrium; (3) natural processes are directionless—they have no *telos*; (4) succession is not fixed but irregular; (5) disturbances are not exceptional but common and necessary; and (6) humans make up a fundamental component of ecological systems—we are, after all living animals.³⁶ While recognizing these six characteristics of the new paradigm may make aesthetic appreciation more difficult, they are necessary if we are committed to a scientifically informed model of aesthetic appreciation.

To see how these characteristics of the new paradigm might translate into a model of aesthetic appreciation, we should return to Carlson’s defense of scientific cognitivism. Remember, Carlson holds that scientific knowledge “yields the appropriate boundaries of appreciation, the foci of aesthetic

significance, and the relevant acts or acts of aspection for that type of environment."³⁷ Here Carlson means that scientific knowledge will provide answers to the questions of (1) what the appropriate context for appreciation is, (2) what the focus of our aesthetic attention should be, and (3) how to aesthetically appreciate a particular kind of environment appropriately. The six characteristics of natural systems listed above provide convenient answers to the criteria Carlson outlines. First, the appropriate boundaries of appreciation, as informed by the new paradigm, are set according to scale—the spatial extent and temporal rate at which natural processes unfold. Second, natural processes, as indicated by observed changes and disturbances, should be the focus of our aesthetic attention. Third, to aesthetically appreciate constant, dynamic, and fluctuating changes in natural systems appropriately, our gaze must be adaptive, fluid, and flexible according to appropriate spatiotemporal scale. Answers to these questions provided by the new paradigm are also problematic, however.

If the appropriate boundaries for appreciation are set by the spatiotemporal scales of dynamic changes, and scales overlap in multiple, complex ways, one might ask, "Which scale is appropriate from an *aesthetic* point of view?" One response might be that we should select a scale and then search for and derive aesthetic qualities within that scale. This option, I think, is either logically or temporally backward in terms of aesthetic appreciation, according to scientific cognitivism. Aesthetic appreciation begins with the senses and is then informed by scientific knowledge, thereby broadening and deepening our experience. Selecting a scale in order to derive aesthetic qualities within it seems arbitrary and goes against the idea that we should aesthetically appreciate nature as it is and for the qualities it has—not according to how we frame it.³⁸ This approach also is contrary to the notion of scale in the new paradigm; scales are not arbitrary impositions upon natural environments but rather are discovered within environments.

A second, more plausible response might be that we attend to a change in a natural environment that offers the most aesthetically appreciable qualities. We then simply select the scale according to which those qualities present themselves to our senses most effectively. Selecting the correct scale or scales, then, is a function of what is directly presented to the senses; scientific knowledge informs our experience accordingly. Of course, some spatiotemporal scales are beyond our immediate capacities for aesthetic appreciation, whereas others are not. For example, gazing into the Grand Canyon, it is easy to "read" its evolutionary history in terms of the millions of years of rock strata revealed by erosion. On the other hand, observing nutrient dynamics between soil and species may be impossible with the naked eye. We might know something about nutrient dynamics, but little if anything is directly presented to the senses for aesthetic appreciation, which leaves us with little if anything to focus on aesthetically.

If Carlson's cognitive thesis is correct in suggesting that scientific knowledge will yield the appropriate "foci of aesthetic significance,"³⁹ the new paradigm will yield natural processes as the prime candidate. Because ecology in general focuses on relationships *between* natural objects, rather than on the objects alone, natural processes take priority over the individual natural objects they produce.⁴⁰ Note, however, that I am not arguing that we should aesthetically appreciate natural processes only and neglect natural objects altogether. That would certainly limit what is aesthetically appreciable and result in a very impoverished notion of appreciation of natural environments. What I am arguing is that natural processes affect all natural objects in one way or another; thus, attending to how the objects in question are affected by changes in the particular environment seems appropriate.

But if observation is theory-laden (and I assume here that it is), it seems plausible that we can aesthetically appreciate natural processes, as in the following example. During the summer months in the high desert regions of the American Southwest, afternoon showers occur with some regularity, especially in the mountains; but the spatiotemporal scale to which they do occur is very unpredictable and sporadic. It is common to see dark clouds quickly form and signal an imminent storm, then disperse just as quickly and reveal sunlight once again. It is just as common in these areas to see no clouds form and then suddenly be awash in a heavy downpour without warning, or to witness approaching rainfall only to see it change course, subside, or intensify. Under the old paradigm, one might aesthetically interpret these weather events as random and unruly disturbances of the delicate balance and harmony of nature; under the new paradigm, however, one would interpret these random and unruly disturbances as typical of a nature in flux. As this example illustrates, while in possession of the theoretical knowledge the new paradigm provides, any change or fluctuation in an environment—as it presents itself to our sensory apparatus—indicates *some* natural process, on whatever scale it unfolds. A sense of wonder or imagination⁴¹ may stimulate further inquiry into the observed change, where we "fill in the gaps" with scientific or theoretical knowledge regarding the rate and extent to which the change occurs, thereby establishing the appropriate context for appreciation.

The idea I am presenting here—that observable characteristics of natural objects indicate their relationships to natural processes—is not without precedent. For example, Yuriko Saito argues that

While there may be different degrees of nature's skill in storytelling, none of its parts are mute. Simply by virtue of exhibiting various perceptual features, they all bear witness to their own origin, structure, and function, which we articulate verbally in our scientific accounts. Indeed, scientific discourse exists because of nature's observable characteristics.⁴²

Appealing to Charles Sanders Peirce's semiotic notion of an *index*,⁴³ Cheryl Foster argues that

Just as a cumulus cloud serves as an index of convective activity from earth to atmosphere, so too does a bright yellow color become an index of a maple tree's withholding of nutrients from its leaves. The object we see—a cloud or a leaf—stands in causal relation both to processes we cannot see and to our recognition of these relations as having occurred before, as being present in our memories.⁴⁴

Foster labels this the "narrative" dimension of aesthetic appreciation, and I generally agree. Natural objects serve as indexes or indicate underlying natural processes, and thus they reveal the object's "story" or evolutionary history, which informs aesthetic appreciation. But I would add that natural processes are not only history-laden but also theory-laden. The index in this case—the yellow color of the leaf—not only tells a story about the maple tree's withholding of nutrients but also indicates dynamic change in general that is consistent with the theoretical underpinnings of the new paradigm. Changes or fluctuations in natural environments of this sort function as theory-laden indicators of ecological processes directly presented to the senses and are thus aesthetically appreciable. During the spring in the Texas hill country around Austin, for example, huge greenish-yellow clouds of cedar pollen swarm about the landscape in a random and chaotic flux. Provided one is not allergic, these pollen clouds not only indicate a natural process but have an ephemeral beauty in and of themselves. They not only tell a story about the natural or evolutionary history of pollination in the Texas hill country but also indicate ecological relationships in real time as we observe and aesthetically appreciate them. That is, theory-laden natural objects tell a story about the natural history of a particular environment, and disturbances exemplify natural processes and ecological relations that are aesthetically appreciable.

V. The New Paradigm and Positive Aesthetics

Carlson's positive aesthetics thesis has generated considerable debate.⁴⁶ In this section I discuss how the new paradigm combined with scientific cognitivism may require updating the positive aesthetics thesis. In particular, I explain how the scientific knowledge that the new paradigm provides can yield new aesthetic qualities such as imbalance, disorder, and disharmony, which seem to run contrary to the traditional positive aesthetic qualities Carlson lists. I then argue that in light of the new paradigm, aesthetic qualities such as imbalance, disorder, and disharmony will replace their now outdated counterparts, thereby defending an amended and updated version of the positive aesthetics thesis. But first, we should familiarize ourselves with some of the central claims of positive aesthetics. Carlson writes:

All the natural world is beautiful. According to this view, the natural environment, insofar as it is untouched by humans, has mainly positive aesthetic qualities: it is, for example, graceful, delicate, intense, unified, and orderly, rather than bland, dull, insipid, incoherent, and chaotic.⁴⁶

The general point Carlson is making here is that the degree to which nature is untouched by humans, it has positive aesthetic qualities such as unity and order, rather than incoherence and chaos. There are a couple of important points to clarify concerning Carlson's positive aesthetics and some of the debate it has generated. First, positive aesthetics is a theory of appreciation that was originally intended to apply to wilderness areas, not what we might call "mixed" environments—that is, environments that contain both natural and artifactual objects. For this reason it is important to note the logical sequence in which Carlson states his view: that pristine nature is *only* beautiful, *not* that only *pristine* nature is beautiful. As we now know, because of global warming all natural systems have been affected by human influence to some degree, yet this seems to be no reason to abandon positive aesthetics. For if it is assumed (incorrectly) that only pristine nature is beautiful, and if there is no such thing as pristine nature, then nothing in nature is beautiful, which is absurd. Accordingly, we must assume that Carlson means that positive aesthetic qualities are a function of the degree to which nature is unaffected by human influence.

Second, the notion that nature's beauty is a function of humans' noninteraction is contrary to the sixth principle of the new paradigm—namely, that humans play an important role in ecological systems. As Pickett and Ostfeld argue,

For example, forgetting the effect of Native Americans on vegetation and animal communities could result in neglecting important ecological controls on systems. Neglecting human effects is unfortunately easy, because many such effects are subtle, or originate at a distance from the site of interest.⁴⁷

Of course, now humans' effects on natural systems aren't so subtle, and the pervasive destruction of ecological systems by humans won't easily be forgotten. Nevertheless, if positive aesthetics is a function of the degree to which humans influence natural systems, then just *how* humans influence natural systems is also very important, not only in aesthetic terms but in ecological terms as well, which is why the new paradigm considers the role humans play in natural systems significant. Particularly significant is, again, the notion of scale. If positive aesthetics is a matter of the degree to which humans influence natural systems, ecologically speaking, the scale of that influence directly figures into the aesthetic qualities yielded. For example, the static and bland homogeneity of an industrial scale agricultural

field is a function of how its impact exceeds the scale of naturally occurring disturbances. On the other hand, the fluctuating and rich diversity of a small-scale organic farm exemplifies how humans can facilitate natural processes that are beneficial to them and the natural system they inhabit. Thus, if the scale of human (anthropogenic) disturbances are, say, smaller than the scale of natural (nonanthropogenic) disturbances, then in light of the new paradigm the positive aesthetics thesis seems to remain intact, at least in terms of human interaction.⁴⁸

So why are aesthetic qualities such as unity and order considered positive, where qualities such as incoherence and chaos are not? One of the reasons is that science locates these qualities in natural environments, and these specific qualities make the natural world more intelligible. In describing the relationship between correctness in science and positive aesthetic qualities, Carlson writes:

A more correct categorization in science is one that over time makes the natural world seem more intelligible, more comprehensible to those whose science it is. Our science appeals to certain kinds of qualities to accomplish this. These qualities are ones such as order, regularity, harmony, balance, tension, resolution, and so forth. If our science did not discover, uncover, and/or create such qualities in the natural world and explain the world in terms of them, it would not accomplish its task of making it seem more intelligible to us; rather, it would leave the world incomprehensible, as any of the various world views that we regard as superstition seem to us to leave it. Moreover, these qualities that make the world seem comprehensible to us are also those that we find aesthetically good. Thus, when we experience them in the natural world or experience the natural world in terms of them, we find it aesthetically good.⁴⁹

According to Carlson, science makes the world more intelligible to us, and it does so by describing and explaining nature in terms of aesthetic qualities like balance, order, and harmony. These qualities are *theory-constitutive*; they are necessary descriptive and explanatory elements of the theory, though in this case they are elements constitutive of the old paradigm. But Carlson admits that “in light of various views about science, positive aesthetics might be, for example, absolute, culturally relative, or *paradigm relative*.”⁵⁰ If aesthetic qualities are theory-constitutive and paradigm-relative, and there is a paradigm shift, then the aesthetic qualities constitutive of the new paradigm will displace the qualities associated with the old, according to the positive aesthetics thesis. If the new paradigm in ecology locates qualities such as imbalance, disorder, and disharmony in the natural world and explains the world in terms of them, they make the world more intelligible to us and are aesthetically better than the qualities associated with the old paradigm. By measuring the spatiotemporal scale of dynamic changes, disturbances, and fluctuations that occur in natural environments, the new

paradigm establishes the aesthetic context in which these qualities are located and makes what was previously less intelligible more so. Therefore, *ex hypothesi*, imbalance, disorder, and disharmony can be considered positive aesthetic qualities in terms of how they describe and explain the natural world according to the new paradigm in ecology.

If my reasoning here is correct, must we abandon altogether the aesthetic qualities with which the old paradigm is associated, such as balance and order? There are two reasons why we should answer this question in the negative. First, as the new paradigm suggests, qualities such as balance and order are tied to their spatiotemporal scales, but they are not appropriate descriptions of nature as a whole. As Pickett and Ostfeld point out, the flux idea does not deny the existence of local stability in nature but focuses on the ecological significance of fluctuations and disturbances in natural systems.⁵¹ Second, and more importantly, while balance, order, and harmony may no longer be accurate descriptions of the natural world, they will retain their heuristic, pedagogical, or exegetical value.⁵² They are essential to theory articulation even when the theory they articulate has been displaced by a better theory. In fact, because the aesthetic qualities associated with the new paradigm in ecology are the antonyms of the qualities associated with the old (that is, *imbalance*, *disorder*, and *disharmony*), they are necessary heuristic devices employed in teaching the new paradigm. In other words, to articulate the new paradigm in ecology, and embrace the aesthetic qualities constitutive of it, teaching the old paradigm and its theory-constitutive qualities is absolutely necessary. In short, to understand the disorder of nature, we must first understand its order. Interestingly, and along these lines, Carlson defends “order appreciation”—the view that appropriate aesthetic appreciation of natural environments reveals the “natural order”—when he writes:

All of nature necessarily reveals the natural order. Although it may be easier to perceive and understand in some cases than in others, it is yet present in every case and can be appreciated once our awareness and understanding of the forces that produce it and the story that illuminates it are adequately developed.⁵³

Carlson’s espousal of order appreciation here has direct bearing on the scientific knowledge supplied by the new paradigm in ecology. That is, unless by “natural order” Carlson means *some* kind of order, however sophisticated in terms of structural and functional organization, the aesthetic qualities yielded by the new paradigm, such as *imbalance*, *disorder*, and *disharmony*, will run directly at odds with his account. Indeed, the new paradigm tells us that the order of nature is fundamentally disorderly, due to the random nature of disturbances and fluctuations across the landscape. Appreciation of natural order of whatever variety is dependent upon the scientific

knowledge that reveals it. Thus, the *disorder* of nature revealed by the new paradigm is consistent with Carlson's view, just as the order of nature was once revealed by the old paradigm.

Daniel Botkin addresses some of these issues in his book *Discordant Harmonies*, which puts the new paradigm in perspective for those unfamiliar with the details of contemporary ecology. In a section entitled "Randomness and the Aesthetics of Nature," Botkin writes, "Nature that is inherently risky may seem less beautiful than nature that is completely deterministic."⁵⁴ I don't see why this should be so. Remember that for Carlson, the information that ecology provides not only directs aesthetic appreciation but also renders nature as having positive aesthetic qualities in line with the old paradigm, qualities such as balance, order, and harmony. But the old paradigm no longer provides accurate scientific knowledge of the natural world, and it must be abandoned because it no longer makes the world more intelligible to us by appealing to these qualities. If a theory accurately describes nature as chaotic, as the new paradigm does, then it follows that we may aesthetically appreciate nature as chaotic, just as we once could appreciate it as orderly under the old paradigm. That is, if we accept both the cognitive and positive aesthetics theses, *any* aesthetic qualities that science appeals to in making the natural world more intelligible to us can be considered positive aesthetic qualities.

We might consider how these sorts of qualities have characterized much of modern and contemporary art and music. Examples can be found in automatic painting; abstract expressionism; kinetic sculpture; and atonal, improvisational, and polyrhythmic music, all of which may exhibit aesthetic qualities that are consistent with the ones I have associated with the new paradigm in ecology. I fail to see any reason why these kinds of aesthetic qualities found in art and music cannot apply to nature as well. Just as the aesthetic qualities of disorder and imbalance are tied to the art-theoretical categories of the above-mentioned genres, these kinds of qualities are tied to the scientific-theoretical categories of the new paradigm in ecology.

VI. Conclusion

I have suggested that the cognitive thesis, when combined with the new paradigm in ecology, will require two important adjustments to how we aesthetically appreciate natural environments. First, because natural processes influence every aspect of the natural world to some extent, aesthetic appreciation should be directed to them. Second, because the new paradigm appeals to aesthetic qualities such as imbalance, disorder, and disharmony in order to make the natural world more intelligible to us, these theory-constitutive qualities are consistent with the positive aesthetics thesis and should therefore replace the qualities associated with the old paradigm. The

aesthetic qualities associated with the old paradigm should not be entirely abandoned, however, because they play an indispensable role in teaching the new paradigm in ecology. Thus, contrary to Tansley's notion of "dynamic equilibrium," we may experience more tension than resolution in nature, but that makes it no less beautiful. And if the beauty of nature is dynamic rather than stable, random rather than predictable, and chaotic rather than orderly, we must learn to aesthetically appreciate it in a more adaptive and theoretically informed way—if we take scientific cognitivism seriously.

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NOTES

1. Thomas Kuhn, *The Structure of Scientific Revolutions* (Chicago: University of Chicago Press, 1962). The epigraph is from Aldo Leopold, *A Sand County Almanac and Sketches Here and There* (New York: Oxford University Press, 1949), 173-74.
2. Kuhn, *The Structure of Scientific Revolutions*, 11.
3. S. T. A. Pickett, V. T. Parker, and P. L. Fielder, "The New Paradigm in Ecology: Implications for Conservation Biology above the Species Level," in *Conservation Biology: The Theory and Practice of Nature Conservation, Preservation, and Management*, ed. Peggy L. Fiedler and Subodh K. Jai (New York: Chapman and Hall, 1992), 261-78. See also S. T. A. Pickett and Richard Ostfeld, "The Shifting Paradigm in Ecology," in *A New Century for Natural Resources Management*, ed. Richard L. Knight and Sarah F. Bates (Washington, DC: Island Press, 1995), 65-88; Daniel Botkin, *Disordant Harmonies: A New Ecology for the Twenty-First Century* (New York: Oxford University Press, 1990); and Thomas Kuhn, *The Structure of Scientific Revolutions*.
4. See Allen Carlson, "Appreciation and the Natural Environment," *Journal of Aesthetics and Art Criticism* 37 (1979): 267-76; Allen Carlson, "Nature, Aesthetic Judgment, and Objectivity," *Journal of Aesthetics and Art Criticism* 40 (1981): 15-27; and Allen Carlson "Nature and Positive Aesthetics," *Environmental Ethics* 6 (1984): 5-34. All three articles are reprinted in Allen Carlson, *Aesthetics and the Environment: The Appreciation of Nature, Art, and Architecture* (New York: Routledge, 2000). All subsequent page references refer to this book unless otherwise specified.
5. Carlson, "Nature, Aesthetic Judgment, and Objectivity," 54-68.
6. Carlson, "Appreciation and the Natural Environment," 51.
7. Kendall Walton, "Categories of Art," *Philosophical Review* (1970): 334-67.
8. Carlson, "Nature, Aesthetic Judgment, and Objectivity," 54-68.
9. Carlson, "Appreciation and the Natural Environment," 51.
10. William James, *The Principles of Psychology* (1890; repr., Cambridge, MA: Harvard University Press, 1983), 462.
11. Carlson, "Nature and Positive Aesthetics," 93.

12. See Yuriko Saito, "Appreciating Nature on Its Own Terms," *Environmental Ethics* 20 (1998): 135-49.
13. See Pickett, Parker, and Fielder, "The New Paradigm in Ecology," and Botkin, *Discordant Harmonies*.
14. See J. Baird Callicott, "From the Balance of Nature to the Flux of Nature: The Land Ethic in a Time of Change," in *Aldo Leopold and the Ecological Conscience*, ed. Richard L. Knight and Suzanne Riedel (Oxford: Oxford University Press, 2002), 91-105.
15. See Jonathan Barnes, *The Presocratic Philosophers* (Boston: Routledge and Paul, 1979).
16. See David Hume, "The Standard of Taste," in *Essays: Moral, Political, and Literary*, vol. 1, ed. T. H. Green and T. H. Grose (London: Logmans, Green, and Company, 1882).
17. A later and more sustained treatment of the climax community concept is given in Frederick Clements, "The Nature and Structure of the Climax," *Journal of Ecology* 24 (1936): 252-84.
18. *Ibid.*
19. H. A. Gleason, "The Individualistic Concept of the Plant Association," *Bulletin of the Torrey Botanical Club* 53 (1926): 7-26.
20. See Robert McIntosh, *The Background of Ecology: Concept and Theory* (Cambridge: Cambridge University Press, 1985).
21. Arthur Tansley, "The Use and Abuse of Vegetational Concepts and Terms," *Ecology* 16 (1935): 284-307.
22. *Ibid.*, 300.
23. Raymond Lindeman, "The Trophic-Dynamic Aspect of Ecology," *Ecology* 23 (1942): 399-418.
24. Eugene Odum, *Fundamental of Ecology* (Philadelphia: Saunders, 1953).
25. Aldo Leopold, "A Biotic View of Land," *Journal of Forestry* 727 (1939): 266-73.
26. Kuhn, *The Structure of Scientific Revolutions*.
27. *Ibid.*, 16-17.
28. S. T. A. Pickett and P. S. White, *The Ecology of Natural Disturbance and Patch Dynamics* (San Diego: Academic Press, 1985).
29. *Ibid.*, 3-13.
30. V. Thomas Parker and S. T. A. Pickett, "Restoration as an Ecosystem Process: Implications of the Modern Ecological Paradigm" in *Restoration and Sustainable Development*, ed. K. M. Urbanska, N. R. Webb, and P. J. Edwards (Cambridge: Cambridge University Press, 2000), 17.
31. Pickett and Ostfeld, "The Shifting Paradigm in Ecology," 263-65.
32. *Ibid.*, 266.
33. *Ibid.*, 266-67.
34. Callicott, "From the Balance of Nature," 100.
35. Pickett and Ostfeld, "The Shifting Paradigm," 268.
36. *Ibid.*, 263-65.
37. Carlson, "Appreciation and the Natural Environment," 51.
38. For a discussion of the "framing problem," see Allen Carlson, "Formal Qualities in the Natural Environment," in *Aesthetics and the Environment* (New York: Routledge, 2000), 28-38; Noel Carroll, "On Being Moved by Nature: Between Religion and Natural History," in *Landscape, Natural Beauty and the Arts*, ed. S. Kemal and I. Gaskell (Cambridge: Cambridge University Press, 1993), 244-66; Nick Zangwill, "Formal Natural Beauty," in *The Metaphysics of Beauty* (New York: Cornell University Press, 2001), 112-26.
39. Carlson, "Appreciation and the Natural Environment," 51.
40. I take this point from Callicott, who argues that "ecological relations are prior to the things related" ("The Metaphysical Implications of Ecology," in *In Defense of the Land Ethic: Essays in Environmental Philosophy* [Albany: State University of New York Press, 1989], 110-11). By "individual natural objects" I simply mean plants, animals, and the inorganic aggregates of the natural landscape.

41. For a debate concerning the role of imagination in aesthetic appreciation of natural environments, see Emily Brady, "Imagination and the Aesthetic Appreciation of Nature," *Journal of Aesthetics and Art Criticism* 56 (1998): 139-49; Marcia Mulder Eaton, "Fact and Fiction in the Aesthetic Appreciation of Nature," *Journal of Aesthetics and Art Criticism* 56 (1998): 149-57; and Robert Fudge, "Imagination and the Science-Based Aesthetic Appreciation of Unscenic Nature," *Journal of Aesthetics and Art Criticism* 59 (2001): 275-85. My view is that imagination should be constrained by scientific knowledge, which is consistent with Eaton's account.
42. Yuriko Saito, "The Aesthetics of Unscenic Nature," *Journal of Aesthetics and Art Criticism* 56 (1998): 101-11. See also Saito, "Appreciating Nature on Its Own Terms."
43. Charles Sanders Peirce, "Logic as Semiotic: The Theory of Signs" [1923], in *Semiotics: An Introductory Anthology*, ed. Robert E. Innis (Bloomington: Indiana University Press, 1985), 13.
44. Cheryl Foster, "The Narrative and the Ambient in Environmental Aesthetics," *Journal of Aesthetics and Art Criticism* 56 (1998): 203.
45. See Stan Godlovitch, "Valuing Nature and the Autonomy of Natural Aesthetics," *British Journal of Aesthetics* 38 (1998): 180-97; Malcolm Budd, "The Aesthetics of Nature," *Proceedings of the Aristotelian Society* 100 (2000): 137-57; Saito, "The Aesthetics of Unscenic Nature," 103-9; Eugene Hargrove, "Carlson and the Aesthetic Appreciation of Nature," *Philosophy and Geography* 5 (2002): 213-23; and Glen Parsons, "Nature Appreciation, Science, and Positive Aesthetics," *British Journal of Aesthetics* 42 (2002): 279-95.
46. Carlson, "Nature and Positive Aesthetics," 72.
47. Pickett and Ostfeld, "The Shifting Paradigm," 265.
48. This is similar to a quote from J. Baird Callicott, where he paraphrases Leopold by writing, "A thing is right when it tends to disturb the biotic community only at normal spatial and temporal scales. It is wrong when it tends otherwise" ("From the Balance of Nature," 104).
49. *Ibid.*, 93.
50. *Ibid.*, 94.
51. Pickett and Ostfeld, "The Shifting Paradigm," 269, emphasis added.
52. Thomas Kuhn makes a similar point in his "Metaphors in Science," in *Metaphor and Thought*, ed. Andrew Ortony, 2nd ed. (Cambridge: Cambridge University Press, 1993), 533-42. See also Richard Boyd, "Metaphor and Theory Change: What Is 'Metaphor' a Metaphor For?" in the same volume (481-532).
53. Carlson, "Appreciating Art and Appreciating Nature," in *Aesthetics and the Environment: The Appreciation of Nature, Art, and Architecture* (New York: Routledge, 2000), 120.
54. Botkin, *Discordant Harmonies*, 188.