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Analogize This! The Politics of Scale and the Problem of Substance in Complexity-Based Composition

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Noah R. Roderick

Abstract: In light of recent enthusiasm in composition studies (and in the social sciences more broadly) for complexity theory and ecology, this article revisits the debate over how much composition studies can or should align itself with the natural sciences. For many in the discipline, the science debate—which was ignited in the 1970s, both by the development of process theory and also by the popularity of Thomas Kuhn’s *The Structure of Scientific Revolutions*—was put to rest with the anti-positivist sentiment of the 1980s. The author concludes, however, that complexity-based descriptions of the writing act do align the discipline with the sciences. But the author contends that while composition scholars need not reject an alignment with complexity science, they must also be able to critique the neoliberal politics which are often wrapped up in the discourse of complexity. To that end, the author proposes that scholars and teachers of composition take up a project of critical analysis of analogical invention, which addresses the social conditions that underlie the creation and argument of knowledge in a world of complex systems.

Any scan of the major rhetoric, composition, or literacy journals over the past ten years or so will show that complexity and ecology are rapidly becoming dominant metaphors in those fields. Given its position as a nexus between technology, communication studies, and the humanities, it is no surprise that many in composition studies, in particular, have eagerly taken up the banners of complexity science and ecomposition. The epistemic and pedagogical possibilities of opening up scholarship and teaching in composition to complexity science and ecology studies are the subjects of countless dissertations, articles and books. Early overtures include Marilyn Cooper’s article, “The Ecology of Writing” and Margaret A. Syverson’s book, *The Wealth of Reality: an Ecology of Composition*, which took the crucial step of aligning the epistemology of complexity with the ethics of ecology. More recent works, such as Byron Hawk’s *A Counter-History of Composition: Towards Methodologies of Complexity* and Sidney Dobrin’s *Postcomposition*, continue to more fully develop the radical philosophical implications of appropriating the discourse of complexity science. Combining recent insights from the physical sciences with the post-humanist philosophies of, among others, Martin Heidegger, Gilles Deleuze, Mark C. Taylor, and Gregory Ulmer, these more recent arguments for complexity are examining the deep relationship between information technology, rhetoric, and the emergent properties of subjectivity, calling even for a post-subjective rhetoric.

In this essay, I revisit the relationship between science and composition studies, claiming that the question of whether or not it belongs to the sciences or to the humanities was not settled with the decline of the internalist-cognitivist movement associated with 1970s process pedagogy, as Robert Connors argued. I claim that compositionists need to take seriously the potential of complexity science to describe the writing act, not because the past decade has yielded any positive knowledge about, for instance, the writer’s mind, but because the interface between the natural and social sciences has been radically altered. In other words, the interesting questions for when natural scientists and scholars in the humanities and social sciences talk are no longer so much about what the

mind is or how to understand humanity through the mind, but on how, for example, information flows, social networks, and animal metabolic rates can occupy the same ontological field. Science, I argue, has traded in the metaphysics of the mind (as coherent unit) for the metaphysics of the eco-subject—a singular field where seemingly unrelated phenomena become indistinct in their processes of emergence and transformation. Under this new metaphysical goalpost, then, the writing act can be described as being a function of network behavior rather than an effect of generalizable mental processes.

Briefly, the science of complex systems concerns itself with the way seemingly simple things or actions emerge from a multitude of actors, actions, and interactions. Complex systems emerge out of positive feedback loops, rather than linear, cause-and-effect relationships. In its origins, the study of complex systems is a composite of a diverse group of theories that date back over the past 130 years or so, including James Clerk Maxwell's *kinetic theory*, Kurt Gödel's *incompleteness theorem*, Friedrich von Hayek's *microeconomics*, and Claude Shannon's *information theory*, to name only a few. Objects of complexity science commonly include what we would normally think of as networks or systems, such as animal metabolic systems, aviation hubs, fractal topography, internet search algorithms, morphological computation environments, and information economies. It also offers descriptions of metaphysical phenomena (in that they are beyond spatial and temporal apprehension), such as consciousness, cognition, intelligence, experience, as well as questions of origins and existence (natural theology, natural history, evolution, cosmology). Indeed, as I will argue, its existence as a *science* of complex systems, beyond the sum of its composite theoretical parts, can hardly be conceived of without the exigency of such metaphysical questions to call it into being. [\[1\]](#) [\[#note1\]](#)

The study of complex systems should not be conflated with quantum physics or chaos theory, because although the fields often share common theoretical origins and interact seamlessly, they differ in the range of things they attempt to explain. Chaos theory tends to refer to the way small actions or actors can have large or cascading effects inside of dynamic systems. For example, Edward Lorenz's famous butterfly flaps its wings in Brazil and effects a tornado in Texas. That kind of dynamic is indeed part of emergence in complex systems. But what those who study complexity are more interested in are how the many random actions of multiple actors regularly produce simple actions on a different scale (e.g., when a school of fish suddenly changes direction without a central command). This interest in the emergence of wholes also distinguishes (but does not separate) complexity science from the study of quantum mechanics. The latter is more fascinated by the way the physical world operates in qualitatively different ways at the subatomic level. Complexity science, too, is interested in such qualitative differences between the behaviors of a system and those of its component parts; however, complexity science extends its focus to comparisons of qualitative differences between emergent systems and their component parts. Complexity science therefore emphasizes a univocal view of reality, so that, for instance, as long as neural networks and social networks can be conceptualized as complex-adaptive systems, they are essentially the same substance—they just operate on different scales. Insofar as composition studies goes, rhetorical ecologies such as genre and activity systems may also emerge and behave as complex-adaptive systems. That point becomes particularly salient as the composing of texts, both inside and outside of the classroom, happens in a multimedia environment. Such digital and virtual forums act as accelerants in the proliferation of genres (by means of feedback loops), wherein relationships between writing subjects, media, audiences, institutions, and kairotic moments are constantly co-evolving.

A return to science is nothing for compositionists to shy away from, but as our knowledge-making practices become part of the constellation of complexity sciences, we should also develop a means to identify and critique the ideological baggage that the discourse of complexity carries with it. This essay represents the groundwork for such a critique. I shall argue that complexity science need not be

a post-political project that naturalizes status-quo neoliberal capitalism, as many of the important voices of complexity science have presented it as doing. To the contrary, I will argue that composition studies has an opportunity to play an important role in describing how knowledge is produced and argued in a world of complex systems while offering new ways of critically examining the social conditions which make complexity-based knowledge claims valid and exigent.

Composition Studies and Science

The first temptation in a critique of a complexity science of literacy and writing might be to argue that appropriating descriptions and methodologies of complexity in the natural sciences for the social sciences or for the humanities constitutes a misunderstanding or misuse of legitimate scientific knowledge, just as Robert Connors argued vis-à-vis cognitive science and process theory. His 1983 attack on the scientific claims of process theory ("Composition Studies and Science") provides what I would argue is an instructive example of the failure of such an argument. In her 1982 *CCC* article, "The Winds of Change: Thomas Kuhn and the Revolution in the Teaching of Writing," Maxine Cousins Hairston claimed that process theory, with its empirical methodology and scientific discourse, signaled the emergence of composition as a normal science. Composition, she claimed, had experienced a genuine paradigm shift from the disparate practices of current-traditional rhetoric to a relatively coherent, consensus-validated set of epistemological assumptions in process theory. Connors's response to Hairston not only disputes the idea that composition had entered any such paradigm, but further denies that science could ever offer the discipline anything except useful metaphors. Connors saw the enthusiasm in composition studies for the Kuhnian paradigm as being no more than part of a larger fad:

Many have taken heart at Kuhn's description of the arrival of the first natural-science paradigms, which transformed chaotic, inchoate fields into orderly, normal-science endeavors over night The field of composition studies is by no means the only disciplinary area to be attracted to the image of the sciences and inflamed by Kuhn's explanation of them. (4)

At a most basic level, says Connors, compositionists are enamored with the elegant image Kuhn presents of the ossification of scientific knowledge being an inherently social process. But most powerfully, Connors argues that a Kuhnian description of the field offered compositionists "terms that were suitably vague," for "the implicit promise of universal scientific maturity" (17). In other words, a properly scientific description not only offered the still young discipline the assurance of a coherent definition of what constitutes legitimate knowledge in scholarship, but it also offered scientific credentials at a time when the humanities had all but lost its ability to offer privileged insight into the human condition.

Connors is happy to entertain empirical research for theoretical context, or to provide descriptive metaphors, but he warns that empirical context and scientific metaphors can never make the leap to applied scientific knowledge. Connors believes that making institutional practice work for descriptive, scientific analogies is not only deeply unscientific but it also leads to—and here I have a lot of sympathy for his argument—an erosion of the spirit of free inquiry, which, for Connors, the humanities embody:

The push toward science in our field at the present time can lead all too easily to scientism, placing methodology at the heart of rhetorical education and tilting composition studies toward the sort of mechanistic concerns with neutral "techniques" that we wish in our best moments to transcend. . . . We should not in our search for

provable knowledge forget that the essential use of all knowledge is in aiding humanity in the search for consensually arrived at truth. (19)

It is important to first of all parse out the different ways in which Connors argues composition studies cannot be scientific. He is quite correct in that *teaching* writing cannot be scientific any more than teaching physics or chemistry can be scientific. But his assertion that *descriptive knowledge* about the writing act cannot be scientific is problematic. First, his argument against positivistic descriptions of writing is actually tautological, since the argument itself rests upon a logical-positivist definition of scientific knowledge. Connors borrows directly from Kuhn's famous positivist rival, Karl Popper, to define exactly what scientific knowledge is, and therefore, why the theory choices of a discipline like composition studies could never be understood as being scientific. Connors's third "gate" criterion for the existence of a genuine science states, "Hypotheses in scientific fields should be falsifiable and should result in successful predictions, the success of which should be explicable" (6). One of Kuhn's main objections to Popper, however, was precisely that the grounds on which a theory is falsifiable are historically determined, and furthermore, that the establishment of a normal science can be described by the potentially falsifying anomalies to its theories that it chooses to overlook (until, of course, a paradigmatic crisis finally occurs).

Connors's other problematic objection to an accord between composition and the sciences is that the very status of cognitive science—to which process theorists attached their research—as a science is doubtful. Connors once again locates the essence of a science in its experimental methodology rather than in the metaphysical phenomena (the mind, evolution, etc.) it seeks to systematically describe. Experimental method, then, is where he locates the shortcomings of psychology as a science. Connors claims that some of the observational methods psychology has borrowed from the physical sciences were borrowed before psychology "had any definite content":

The natural science experimental method presupposes objectivity, an ideal whose meaning in the human sciences is exceedingly problematical... . Psychologists have found much to their chagrin, however, that the transaction between two atoms of hydrogen is not necessarily an accurate analog for the transaction between two human beings. (11)

But an analog between such micro- and macro-processes is precisely what methodologies of complexity attempt to do to studies of cognition and human interaction. Indeed, complexity science proposes nothing less than a fundamental reevaluation of our concept of analogy so that phenomena which would be essentially distinct in a mind-body epistemology occupy a single ontological plane, at least in terms of how they emerge. In his foundational text, *Gödel, Escher, Bach: The Golden Braid*, Douglas Hofstadter famously analogizes the relationship between individual neurons and cognition to individual ants and the ant colony. Each neuron, like each ant, reacts not to a central command, but to the activity of the neurons around it. What emerges from that recursive process then appears as if a response to a central command. The important insight of Hofstadter's view of complexity is that the self-organization of neurons/ants is not a single chain of responses from an external stimulus but rather a continual up-scaling of multiple chains of responses, a general process applying to all self-emergent phenomena. What's more, the same models of hierarchical clustering that describe self-organization at the cellular level are being directly analogized to systematically describe what we would more readily recognize as network phenomena, such as social organization and market behavior (Barabási 238). Given that it does call upon us to reconceive of analogy in ontological terms (in which case, *isomorphism* is more appropriate than analogy), it is not hard to see how externalist or post-process theories of literacy and rhetoric could be not just in productive conversation with complexity, but actually incorporated into the general matrix of a complexity science.

The Eternal Return of Complexity

Outspoken critic of sociological complexity science, Steve Fuller, dismisses the discourse of complexity in the social sciences as “metaphorical gas,” unfavorably comparing it to nineteenth-century positivism. Indeed, the chief difference between the two movements, for Fuller, is that positivism was originally an anti-jargonist movement that was meant to provide some measure of public accountability for claims made in the social sciences, whereas complexity science, he claims, is actually a turn inwards, *towards* jargon. Moreover, Fuller argues that the social sciences’ embrace of complexity theory has yielded no epistemic gains. Citing Émile Durkheim’s theory of population and the division of labor, among others, as an example of what could be recast as in the light the popular complexity concept, tipping point, Fuller concludes, “these metaphorical extrapolations [from complexity science] that we make in social science are ones we already have.” The question, then, is why, if complexity theory does not tell social scientists much they do not already know, has it been so enthusiastically adopted in the first place? Fuller gives two explanations, with the first being a simple question of funding. Natural sciences are prestige knowledges, both in terms of state and of corporate funding. And among the natural sciences, genomics and cybernetics—from which a large section of complexity knowledge emerges—tend to generate the most excitement, both for the general public, and for their potential for several industries to generate new wealth. It is only natural that the social sciences would want to attach themselves to those revenue sources. Furthermore, Fuller argues that there is an “elective affinity” between postmodern politics and the rhetoric of complexity.^[2] ^[#note2] Social scientists have, by and large, abandoned the grand narratives of the nation-state and class struggle to explain social phenomena, instead embracing the permanence of global capitalism. And complexity science appears in most cases to affirm the economic wisdom of Friedrich von Hayek and Milton Friedman.

Fuller is absolutely correct in both of his explanations for the enthusiasm for complexity science in the social sciences, and the remainder of this paper will focus upon that elective affinity between neoliberal ideology and the appropriation of complexity in writing and literacy studies. But he is wrong to say that complexity science is just positivism in a sleek, new package. I argue complexity science cannot be the same thing as positivism, first of all because positivism, as it were, has no *positive* content to it as complexity science does. Positivism is a stance towards methods of knowledge making rather than a particular theory of natural processes. Furthermore, as I have indicated with regards to Connors’s claims about cognitive science, positivist methods in the social sciences attempt to understand and predict individual and collective behaviors by building systematic descriptions of the mind, which, as a metaphysical object, is irreducible to the sum of its parts.^[3] ^[#note3] I argue that complexity science must be understood and critiqued through its own metaphysical foundations, and not by the metaphysics of the mind. The first challenge of critiquing complexity science in the social sciences is, therefore, not to try to prove how unoriginal it is but to identify precisely where and how it becomes new knowledge.

We could, for example, take a key concept for complexity compositionists, such as the *screen* (Bay; Hawk, “Toward”; Taylor, *Moment*; Hayles) and claim that it is merely a repackaging of Kenneth Burke’s well-known concept of *terministic screens*. Consider one of the attributes of the terministic screen Burke gives against Mark C. Taylor’s definition of the screen:

Even if any given terminology is a *reflection* of reality, by its very nature as a terminology it must be a *selection* of reality; and to this extent it must function also as a deflection of reality Here the kind of deflection I have in mind concerns simply the fact that any nomenclature necessarily directs the attention into some channels rather than others. (Burke 45)

A screen, then, is more like a permeable membrane than an impenetrable wall; it does not simply divide but also joins by simultaneously keeping out and letting through. As such, a screen is something like a mesh or net forming the site of passage through which elusive differences slip and slide by crossing and criss-crossing. (Taylor, *Moment* 199-200)

From the outset, these two identifications of the screen match up pretty well. They both claim that any selection or ingress of reality/information is simultaneously a deflection into multiple contextual channels or passages. The difference lies in the context into which each of those identifications is articulated. For Burke, the screen extends—and extends from—what he already gives as his description of the human: “Man is a symbol-using animal” (3). Against any previous definitions of the human as an inventor or communicator, he provides the example of a wren, who exhibits “genius” by using a bit of food as a way of baiting a reluctant chick out of its nest. Although other birds might be able to imitate the behavior, the wren would not be able to abstract the invention into a symbol in order to set off a chain of communication across the wren world. Communication, for Burke, both makes humans one with, and distinct from animals: “When a bit of talking takes place, just what is doing the talking? Just where are the words coming from? Some of the motivation must derive from our animalality, and some from our symbolicity” (6). The terministic screen provides Burke with a description for how his human-defining concept of “symbolicity” works in practice. Burke’s screen is, therefore, thrown into and is reproducing his humanist ideology, but it also adds new knowledge about the human, which Burke’s humanist ideology then comes around to legitimate. Similarly, Taylor’s definition of the screen is thrown into a posthumanist ideological scheme: “In network culture, *subjects are screens* and *knowing is screening*” (200). Taylor’s is an ontological notion of the screen in which humans are information interfaces among other interfaces, and in fact, are composed of self-similar, micro-interfaces. For Taylor, screens are not, as Burke would have it, modes by which we interact with reality; screens *are* reality. Drawing upon Claude Shannon’s *information theory*, Taylor argues that being always exists at the apertural screen of noise and information (110-11). Again, this concept of the screen is both reproducing and being legitimated by a posthumanist ideology, but it is also helping composition scholars to think of non-epistemic modes of rhetoric, particularly in network environments.

Even within arguments for an ontological description of rhetoric and communication, the same line of discontinuity should be drawn. For instance, in his 1978 article, “An Ontological Basis for a Modern Theory of the Composing Process,” Frank D’Angelo talks a lot about evolution and complexity. Specifically, he writes, “the composing process is analogous to universal evolutionary processes, in which an original, amorphous, undifferentiated whole gradually evolves into a more complex, differentiated whole” (143). It quickly becomes apparent, however, that D’Angelo is working with evolution as a *metaphor* for consciousness. The ontological unity D’Angelo is arguing for exists between individual consciousness and the composing process. The kind of evolution D’Angelo conceives of is “teleological” (141). Leaving behind for a moment the fact that Darwinian natural selection is resolutely anti-teleological, D’Angelo’s argument does not (actually, cannot) consider the mind itself as an assemblage, nor could it consider the monism of the mind and external stimuli. Complexity, instead, is here a product of the mind, which itself works through a kind of self-recognition process reminiscent of Hegel’s master-servant dialectic:

In the composing process, it seems that both conscious and subconscious processes take part. The subconscious mind provides the design, and the conscious mind provides its development. . . . Since the subconscious part of the mind is not always accessible for invention, the writer must aid the subconscious as much as possible by a deliberate and conscious effort, by defining the problem, by filling in the details, by carefully working

out the design—in brief, by preparing the mind so that the subconscious can take over. (142-43).

For a complexity theorist, such as Douglas Hofstadter, the very idea of self-recognition is anathema. It is anathema not only because empirical observation does not support the existence of separate realms of the conscious and subconscious, but because the metaphysical foundations from which complexity science attempts to systematically describe a metaphysical problem like consciousness are univocal, as opposed to the equivocalism of the subconscious-conscious dialectic. Again, when comparing complexity theory to prior theories that may have used similar metaphors, it is important to resist the temptation to see complexity science as either a resurrection of an old idea for fashionable purposes or as being part of a progressive continuity of knowledge.

The danger here is that while a critic like Fuller might dismiss the appropriation of complexity science as recycled or repackaged knowledge, complexity science advocates can use that same claim for indistinction in order to advance a messianic notion of complexity, which reifies the very logic of the neoliberal economics Fuller denounces. Taylor, whose *The Moment of Complexity* inspired a special 2004 issue of the *Journal of Advanced Composition*, argues that the emergence of network culture absolutely closes the door on any form of cultural analysis that does not begin with self-organization as a precept. Like Francis Fukuyama (*The End of History*), Taylor places an all-encompassing historical break in 1989, when both the Berlin Wall fell and when the Santa Fe Institute hosted its conference on "Complexity, Entropy, and the Physics of Information," which would become a major entry point for complexity science in the social sciences (*Moment* 99). At this point, "[t]he social and economic problems Marx and Engels [sic] detected and the cures they prescribed reflect an industrial society and its corresponding form of capitalism, which are passing away in the moment of complexity" (100). Finally, Taylor proclaims that "[o]ther than in certain corners of the university where the news of 1989 does not seem to have arrived, Marx has become irrelevant" (100). As a matter of fact, Taylor is more of a Fukuyaman than Fukuyama in his pronouncement. For Fukuyama, liberal democracy merely signaled the end to the ideological struggles that began with the French and American revolutions (4-5). But Taylor sees the emergence of network culture as constituting a unification of historically contingent cultural and economic practices with the timelessness of natural processes:

One of the arguments in *The Moment of Complexity* is that physical, biological, social and cultural systems are bound in intricate loops of codependence and coevolution. This means that the cultural influences the natural as much as the natural influences the cultural. . . . We are coming to understand that physical, biological, economic, and political processes are to a large extent information processes. ("An Interview" 809)

Taylor is here referring to Shannon's information theory, as well as to subsequent work on information in complex adaptive systems, which cast biological processes (at both the levels of micro-mutation and of macro-speciation) in terms of the random, recursive transformation of information and noise (*Moment* 136-37). The random, recursive transformation of information and noise is, in turn, governed by the thermodynamic process of entropy. Thus, mutations in an individual organism are random noise until they are realized as information when they connect with their ecological networks, the possibilities of which are conditioned by macro-species contacts. (This process constitutes a positive feedback loop, which, originally an information trope, has become one of the most important terms in complexity science.) Evolution is here not a matter of a successful individual organism filling a niche and so distinguishing itself from its species. Evolution in a feedback loop model is a convergent rather than a divergent process; it depends upon both network formation and competition, or a "marriage of self-organization and selection" (*Moment* 190). This noise/information loop model not only eschews the Darwinian arboreal model of evolution, but in terms of its

implications for economic and cultural phenomena, it also supersedes the simple analogy between natural selection and Adam Smith's invisible hand of the market. Taylor argues that the natural selection/invisible hand analogy was based upon a "doctrine of divine providence rewritten as economic theory" (180). However, it is clear that for Taylor the noise/information model demonstrates that thermodynamic processes, biological evolution, and market behavior are ontologically indistinct. This discovery that information threads through everything in nature not only makes the global information economy inevitable, but such an advanced state of capitalism simultaneously brings us to "the moment of complexity," giving us a special insight into the nature of reality that we could not have had before. In other words, "Like it or not, global capital is the reality with which we have to deal and simply bemoaning that fact or devising futile strategies of resistance will accomplish nothing" ("An Interview" 811).

The Mind and the Eco-Subject

The messianic arrival of network culture and complexity knowledge, for Taylor, calls upon us to conceive of expanded notions not only of information, but also of subjectivity and writing ("An Interview" 809). The sense that literacy and mediated communication can no longer be accounted for in terms of grammatical structures and universal processes has been growing for decades, as both a complement to process theory and as an argument against it. Post-process theory is probably the most notable example of the rejection of a coherent, internal account of literacy and writing. Thomas Kent, with whom post-process is most closely associated, applies to the writing act Donald Davidson's notion of "externalism," which functions "in opposition to internalist Cartesian conceptions of the world" (103). Clearly, this represents a departure from the metaphysics of the mind, of which earlier cognitive scientists tried to construct a systematic description. In addition to Davidson and Richard Rorty's neo-pragmatism, Kent draws heavily from Jean-Francois Lyotard's theory of postmodern knowledge (from whom he gets the *paralogy* in "paralogic rhetoric") and Lyotard's claim that the master narratives which provided legitimacy for universalist/objectivist scientific knowledge, such as nationalism and Marxism, are in irreversible decline. The consequence of this decline for Kent is a "grand aporia that lies at the heart of the master narrative of objectivity: the impossibility of representing an objective world through the subjectivity of language"—in other words, Lyotard is announcing the decline of the autonomous subject (71). For postmodernists in the humanities, the decline of grand legitimating narratives and the autonomous subject was generally something to be celebrated. Lyotard's proclamation represented a kind of liberation from the homogenizing constraints of scientism, which was particularly attractive to compositionists who, like Connors, were suspicious of scientific prescription in the humanities. Although he would later make it clear that the decline of grand narratives was something worth affirming, Lyotard's actual position in *The Postmodern Condition*—and this is something much less talked about—was not that science realized it could no longer account for the big metaphysical questions, but that it simply lost interest in them because of the divergent capitalistic interests that began providing most of the support for science's growing price tag in the late-twentieth century.^[4] [\[#note4\]](#) The inability to pose metaphysical questions for systematic description was not, therefore, the defeat of scientism, but the failure of the humanities to develop such questions for science.

The externalism of post-process theory, with its deep roots in neo-pragmatism, would certainly not forward a metaphysical phenomenon around which to build a systematic description that the writing act could be included in. As Byron Hawk argues, Kent is still mired in an epistemic conception of rhetoric and "a reified notion of language use" (*Counter-History* 222). Hawk asserts that paralogic rhetoric cannot work beyond the linear, if not recursive, relationship between the "reader, writer, language, and text," in the communication triangle (221). Kent, therefore, reproduces the "subjectivity of language" that his anti-Cartesian stance is supposed to move beyond. There is indeed a growing consensus in composition studies (particularly among New Media specialists) that the increasing, post

-genomic interconnection between technology and nature, as well as the rapid proliferation of rhetorical genres is exceeding our ability to account for the communicative act by language alone, even by such open-ended interpretive strategies such as Kent's. As Jennifer Bay puts it: "Taking complexity theory into consideration means we can no longer envision rhetoric as merely verbal, visual, and oral. Rather, rhetoric is networked among all three components through the ultimate screening device that is the body" (30). Thus, it is clear that it just will not do to drop the metaphysics of the mind without asking new kinds of metaphysical questions. This is why I don't think it is enough to characterize this new stance towards making knowledge as being "post-humanist," the term with which Katherine Hayles, Mark C. Taylor and others identify. Indeed, the "post-humanist," in this case appears to signify a negation of humanism, which is itself a very modernistic, dialectical stance. Rather than a negation of metaphysical boundaries (in this case, the parameters of the human), I prefer to think that we are in the midst of an epistemic break, in which new metaphysical boundaries are being drawn. In other words, we can think of ourselves as post-human, as long as we don't go thinking we're post-metaphysical.

I would argue that the metaphysical object that is emerging in the sciences in general, and to which complexity- and ecology-based theories of writing are attaching themselves is not a negation of the human subject ("Man") that gave rise to modern sciences, but an expansion of the reflexive subject. Instead of the human subject, we can perhaps call it the *eco-subject*, but it shares many of the key attributes that helped European science develop as a relatively coherent project (what Lyotard might include as a grand narrative of human progress) from the seventeenth century onwards. It must be noted first of all that the modern sciences of language, economics, and government, as well as the physical sciences, could not have developed as they did without a general understanding of the mind (as transcendent to the brain) as the core of the human subject. Michel Foucault argues that seventeenth- and eighteenth-century knowledges (collectively, the "Classical" episteme) were governed by the Cartesian idea that the human, with its ability to represent through language an already tabularized world, was exceptional in its relationship to nature. Furthermore, in "Classical thought, man does not occupy a place in nature through the intermediary of the regional, limited, specific 'nature' that is granted to him, as to all other beings, as a birthright" (310). At the end of the eighteenth century, however, Foucault claims that the relationship in the *cogito* between "I think" and "I am" became opaque, as the human became not just an outside observer of nature, but an object in nature to be observed as well (311-12). The idea of the mind as being opaque to the self, but nonetheless constitutive of Man within nature, provided the moderns with what Foucault termed an "empirico-transcendental doublet," which was a subject capable of making truth about the objective world only by rendering itself knowable as a historical object (318). This "finitude" of the mind served to productively limit what was and was not possible to know about the objective world, as well as how knowing was itself possible (i.e. epistemology).

Like Man, the eco-subject is the locus of knowledge, and as it is opaque to itself, it is also an object of knowledge. In other words, like Man, the eco-subject is a fully self-reflexive being. However, in the case of the latter, knowledge production is no longer the exclusive property of the mind. Additionally, the mind itself is no longer an organic brain which embodies a self-conscious and autonomous being. [\[5\] \[#note5\]](#) The brain instead is immanent to the environment around it, a self-organizing collection of neural networks wherein thoughts happen as a result of individual neurons perceiving "signals from other individuals, and a sufficient summed strength of these signals causes the individuals to act in certain ways that produce additional signals" (Mitchell 6). The conscious mind is no more a centralized unit than a colony of ants or a traffic system. But that is not to say that consciousness is no more than the sum of the brain's neurons. Instead, consciousness is actually extended to stimuli the body experiences as it connects to its environment and other bodies. If consciousness is a series of complex networks that transcend the individual body, then thought is affect, rather than a dialectic between an immaterial unit and a material body. But although the eco-subject makes no distinction

between the mind and objective reality, it is still a metaphysical unity because there remains an assumption that even phenomena which we have not apprehended operate on the same plane on which thought operates. It is, therefore, not so different from the Newtonian universe, which operated under the singular logic of God's mind, which itself was only different from the human mind as a matter of degree rather than substance.

Consequences for Composition Studies

One of the consequences of the natural and social sciences galvanizing around the eco-subject, for composition studies, is that epistemology is being jettisoned in favor of ontology in the description of writing. Under this new knowledge regime, for instance, it is anathema to conduct research on topics such as the psychology of rhetorical invention, as process theorists had once done. Furthermore, the search for generalizable foundations of knowledge or for the conditions in which knowledge is created, which was at the heart of James Berlin's socio-epistemic rhetoric, are not interesting for complexity theorists, because in self-emergent, adaptive networks, those foundations are in such flux so as to be unobservable in any synchronic way. A further consequence of jettisoning epistemology is that the critical categories of race, class and gender are subsumed under the onto-political category of ecology. Sidney Dobrin and Christian Weisser argue, for instance, that ecology is just as valuable a critical category as the others (567), whereas Hawk goes further to claim that "race, class, and gender are reductive intentional topoi ... which may or may not connect to students' local lived lives" (*Counter-History* 214). This is not a reactionary stance, but rather an expression of Deleuzian micro-politics, which is particularly well-suited to posthumanist complexity science. For Berlin, the power of race, class, and gender to produce social subjectivity is exerted through language, and so it is through critique of language that they are resisted. But from a micro-political perspective, resistance is exercised against totalization and sameness. This is achieved by the continuous invention of subjectivity by means of linking up desires between individuals, which, in turn, is experienced in terms of affect instead of as the result of a dialectic. In the classroom, this means that students "would need to, and be encouraged to, work out their own constellations that would mix our curriculum with their context, our theories and methods with their own political interests—should they have them" (Hawk, *Counter-History* 219). Thus in the place of politics and critique, the sciences of ecology and complexity gives us the ethics of linking and locality.

To the extent that a socio-epistemic understanding of writing is merely politically prescriptive without actually describing anything new about the embodied or localized conditions of knowledge production, the desire to leave it behind is understandable. But I argue it is equally undesirable to take a post-political stance, wherein we simply focus on developing pedagogical strategies which adapt and conform to the sciences of complexity and ecology. In order to cultivate a more productive interface with those sciences, composition studies should not only be engaged with the new knowledge regime concomitantly, but critically as well. Therefore, in addition to experimenting with eco- and complexity-based pedagogies, compositionists should also focus on (a) researching and teaching how knowledge is argued and produced under the regime of the eco-subject, and (b) critiquing the ideological assumptions of that knowledge regime.

Where I see work in rhetoric and composition making a critical contribution to the constellation of complexity sciences is on the question of invention. If indeed the cognitivist-process movement constituted a Kuhnian paradigm, the necessary crisis that called that paradigm into existence was the persistent lack of a coherent way to describe invention. It was the problem of invention that turned research in rhetoric and composition towards the writer's mind, and which led to a general consensus in the discipline that the relationship between mental processes and the writing act is recursive. Furthermore, as Anis Bawarshi argues, in understanding invention as internal to the mind, the cognitivist-process movement also "'invents' the writer as the primary site and agent of writing,"

therefore circumscribing agency to within the writer (51). That rhetorical invention is a non-linear process is not in question, but the fact that the mind as the agent of invention is being superseded by the eco-subject means that invention, and, therefore the writer's agency, are, once again, in need of coherent descriptions. The discourse of complexity seems to be able to provide such descriptions. A complex-ecological understanding of invention maintains that it happens through the emergence of *schemata*, in which experience is adapted to new contexts (Taylor, *Moment* 206). Hawk argues that in turn, "[e]nvironment, rhetoric, texts, and audiences are complex adaptive systems in themselves and together form other complex adaptive systems," and so "[w]hat we have are networks linked to other networks" ("Toward" 150). The convergence of singularities that create these contexts thus have as much part in the moment of invention as the writer does. Whereas a writer's agency in a cognitivist understanding was conditioned by her ability to gather objective knowledge about her audience and genre (a kind of *gestalt*), the writer's agency in a complex ecology depends on her ability to successfully adapt to new settings by making analogies to her experience of prior settings. That analogy is both the foundation of descriptive knowledge in complexity science (e.g., the analogy between traffic patterns and ant colonies) and also the means by which rhetorical invention occurs in complex networks actually affirms the disciplinary ethos of rhetoric and composition—that argument is not simply an arrangement of knowledge, but is inseparable from the very creation of knowledge.

While it is obviously valuable to teach students about the connection between analogy and invention as they negotiate their way through multimedia and multi-disciplinary environments, it is also essential that we not ignore the political dimension of analogy. Analogy is potentially political because it can provide the bridge between descriptive and prescriptive knowledge—in other words, what is and what should be. On one level, analogical invention could mean moving between texts in a genre, such as encyclopedic writing, in order to write a successful Wikipedia article. But it could also mean something more radical. For example, researchers from the University of Arizona's *Institute of the Environment*, working with agencies such as the U.S. Department of Homeland Security, are developing a science of analogy between animal immune systems and global security against the decentralized threats of global terrorism and pandemic disease. The research team behind the project, Sagarin et al., claims: "The most potent biological analogy for human security is the immune system, which shifts from early, generalized responses to more adaptive responses as pathogens become more threatening" (293). Using a metaphor like "pathogen" to describe threats to security is nothing new. But Sagarin et al. are not, as propagandists and political leaders have done in the past, forwarding the comparison in order to strip the security threats of their humanity so that they can have license to treat them in inhumane ways. The question of humanity simply does not arise, as the difference between cell-level pathogens, global pandemics, and international security threats is a matter of scale rather than one of substance. The descriptive claim that global disease pandemics and terrorist groups organize and reproduce like pathogens in the body *causes* the prescriptive statement that those threats to security should be dealt with in ways analogous to the ways in which antibodies respond to pathogens. The overall descriptive analogy is incomplete without conceiving of the existence of scaled antibodies for both global pandemics and for people considered terrorists.

The student writing the Wikipedia article and the Sagarin team's study on global terrorism are both examples of invention because they are forging new links between phenomena in order to make new knowledge. But in neither case is there necessarily a historical understanding of the conditions that make those analogies valid or exigent, such as the revival of an Enlightenment project to make the world's knowledge universally accessible in the case of Wikipedia, or the phenomenon of post-nation-state sovereignty in the case of the pandemic/terrorist analogy. In order, therefore, to understand the social conditions that make an analogy valid or exigent, it is necessary to continue to call upon those sometimes reductive critical categories of class, race, gender, sovereignty, etc.

While I strongly reject Mark C. Taylor's assertion that a big political project like Marxism is an anachronism in the age of complex systems, it must be conceded that much of our talk in the humanities and social sciences about ideology and language falls on deaf ears, as far as the physical sciences are concerned. But this is not because complexity science can now explain social structures, communication, and lived experience ways that make social critique obsolete. Rather it is because for the past thirty years or so, basic science has been regarded and funded not as a big social project, but as a means to the fractured ends of the applied sciences. (In this respect, compositionists and those in the basic sciences already have a lot in common.) But with global economic and ecological catastrophes looming, capital "S" Science may again become a coherent, social project. That can only be a good thing for the humanities and social sciences, provided that we ask interesting questions which guide the project. Critical analysis of analogical invention, I believe, is the best way to start that conversation.

Notes

1. Throughout this essay, I will talk about complexity "science" instead of "theory." Although "theory" is the currency of the realm in the humanities and the social sciences, my interest is in the moment at which composition studies appropriates the science of complexity, and in the social conditions that enable that moment. ([Return to text. \[#note1-ref\]](#))
2. Fuller uses the term, *elective affinity* knowing that it has strong resonance for sociologists. It was used in eighteenth century science to describe and predict chemical reactions. Max Weber later took the term up (from Goethe) in *The Protestant Ethic and the Spirit of Capitalism*. ([Return to text. \[#note1-ref\]](#))
3. In his *The Rules of Sociological Method* (one of the foundational texts in the social sciences), Durkheim goes to great pains to make a sharp distinction between sociology as a "science of institutions," and psychology, which is the science of the individual mind (Ivi). However, Durkheim's central and very influential idea of the collective consciousness—radically different though it may be from individual consciousness—is still subject-object orientated, and is, therefore, just as tied into the Cartesian conception of the mind as was the field of psychology against which Durkheim was defining sociology. ([Return to text. \[#note3-ref\]](#))
4. "The State and/or company must abandon the idealist and humanist narratives of legitimation in order to justify the new goal: in the discourse of today's financial backers of research, the only credible goal is power. Scientists, technicians, and instruments are purchased not to find truth, but to augment power" (Lyotard 46). ([Return to text. \[#note4-ref\]](#))
5. Descartes is famous for his dualistic formulation of the human, being both animal body and eternal soul; however, he could not imagine the two entities co-existing without meeting in a real, physical space. He guessed, therefore, that the body and soul intermingle in the pineal gland, which is located at the base of the brain. This was, perhaps, an even more materialistic take on the mind than the one developed in nineteenth and twentieth century psychology, wherein the unconscious was not located anywhere spatially, but was nonetheless immanent to the brain. ([Return to text. \[#note5-ref\]](#))

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