The Poetics of Purpose

Victoria N. Alexander

Abstract Hackles have been raised in biosemiotic circles by T. L. Short's assertion that semiosis, as defined by Peirce, entails "acting for purposes" and therefore is not found below the level of the organism (2007a:174–177). This paper examines Short's teleology and theory of purposeful behavior and offers a remedy to the disagreement. Remediation becomes possible when the issue is reframed in the terms of the complexity sciences, which allows intentionality to be understood as the interplay between local and global aspects of a system within a system. What is called "acting for purposes" is not itself a type of behavior so much as a relationship between a dynamic system that "exists for a purpose" and its microprocesses that "serve purposes." The "intentional object" of philosophy is recast here as the holistic self-organized dynamics of a system, which exists for the purpose of self-maintenance, and that constrains the parts' behaviors, which serve the purpose of forming the system. (A "system" can be any emergent, *e.g.* an abiotic form, an adapted species, a self, a conditioned response, thought, or a set of ideas.) The self-organized whole, which is represented to the parts in their own constrained behaviors, assumes the guiding function so long attributed to the mysterious "intentional object." If emergent self-causation is not disallowed, creative *originality,* as well as *directionality,* becomes part of the definition of purposeful behavior. Thus, key tools used here, required for understanding emergence, come from poetics rather than semiotics. In the microprocesses of self-organization, I find what I call "accidental" indices and icons — which are poetic in the sense that they involve mere metonymic contiguity and metaphoric similarity — and which are preferentially selected under constrained conditions allowing radically new connections to habituate into an "intentional" self-organized system that, not coincidentally, has some of the emergent characteristics of a conventional symbolic system.

V. N. Alexander (✉)
Dactyl Foundation for the Arts & Humanities, 64 Grand Street, New York, NY 10013, U.S.A.
e-mail: alexander@dactyl.org

"…a purpose is merely that form of final cause which is most familiar to our experience."

C. S. Peirce (1940:63)

Anthropomorphism

A primary criticism of teleology is its supposed anthropomorphism. Nature isn't driven by goals, after all, nor by mental or supermental representations of them. Nevertheless, it may be that there is a simple and profound truth to teleology that has been blighted by its association with a flawed notion of purposeful behavior. Whether teleology is anthropomorphic or not, the way we understand human characteristics has changed since Aristotle named the fourth and most strange cause. Today, a new understanding of purposeful action may be used to revise our understanding of telic phenomena and vice-versa. This reciprocal self-correcting tendency has ripened the fruits of teleology, which should not be left hanging on the vine.

Darwin replaced divine selection, a kind of supernatural efficient cause, with natural selection, selection *for* a type of function.[1] Subsequently, the Cartesian view of self was succeeded by a new view in terms of evolution, begun early on by William James and lately amended by those studying self-organization (Juarrero 1999, Edelman and Tononi 2000).[2] This purposeful self is an emergent phenomenon, never predetermined. Like a species, it is not an easily definable static object, but a dynamic entity that *consequently* has coherence, stability, and individuality. *E pluribus unum* (Cf. Fletcher 2004 on the poetic self). Teleology, in turn, must reflect this non-Cartesian, post-postmodern self,[3] whose purposes emerge from its actions.

In their discussion of basic conceptual metaphors, Lakoff and Turner write, "Take for example, PURPOSES ARE DESTINATIONS… It is virtually unthinkable for any speaker of English (as well as many other languages) to dispense with [this

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[1] Here I stress Short's distinction (2007a:130 after Sober 1984:97-102) between selection *for* the abstract and selection *of* the concrete, for example, "selection *for* visual acuity and *of* concrete structures (or the genes that determine them) that improved visual acuity in specific ways." This distinction is essential to Peirce's understanding of general types as final causes.

[2] Selfhood has been considered an emergent form for a long time, but I am referring to those working specifically with the complexity sciences. For a more general biosemiotic garnering of theorists working on the problem, see Donald Favareau (2002).

[3] I take the typical postmodern self to be incoherent, unstable, and without purpose. According to Short (2007a:45-59), Peirce's early semeiotic had three faults, later corrected, which postmodern philosophers embraced: "it makes the object signified to disappear; it makes significance to be arbitrary; and it fails to tell us what signification is" (44). Peirce's mature semeiotic allows for metaphysical realism, non-arbitrary signification, purpose, and dynamically stable selfhood.

metaphor] for conceptualizing purpose…. To do so would be to change utterly the way we think about goals…" (1989:56). While Lakoff and Turner may be correct in this assessment, unquestioned devotion to a miscast metaphor does no one good. Changing the way we think about purposeful behavior is precisely what I seek to do. Purpose cannot be located at a spatial or temporal distance from the self. Drawing upon the complexity sciences, I argue that *telos*[4] involves the dynamic holistic constraints that increase the likelihood of certain patterns whose effects then further constrain. Very generally speaking, the result of the process is continuation through change, which, when radical, is often called progress.

I do not ask the old question about human purposefulness, Who does what for the sake of what? I ask more generally applicable questions, Is a system emergent or self-organized and, as such, not caused by efficient causes alone?[5] And does this radically new entity have, as a consequence, a limited way of responding that constitutes a primitive subjectivity?[6] And do these responses happen to be "good" for it (*i.e.* serve its purposes)? If yes to all, then the system has a self that allows it to maintain, grow, or change fortuitously. My teleology does not assume that emergent order and adaptive function are inevitable or necessarily progressive, but *the fact that they appear so retrospectively is what defines the telic aspect as such*.

T. L. Short's Theory of Final Cause

I understand *telos* as the "ordering tendencies of chance" (Alexander 2002). Short (1981, 2007a) has offered a similar conceptualization of final cause in terms of "chance" processes based on Peirce's writings: succinctly put, a final cause is any type for which there is selection. Final cause so conceived (selection *for*, not *of*) is always general, never particular, and thus can be attained in a variety of ways, never defined until satisfied. For example, swiftness may be selected *for* with the selection *of* longer limbs or stronger muscles. Swiftness is a general type. A purpose as a form of final cause is not a particular thing, nor electro-chemicals that fire the body into action, nor a flame of desire (117–150).[7] And because an end is not a particular, final causality is not "mechanistic," which, Short argues persuasively, always involves particulars acting on particulars (94–98).

Final cause explains irreversible tendencies; the explanation of the particular events leading to those tendencies is still left to efficient causes. For example, the proto eye never was sensitive to light in order to see. A rod or cone's reactions are

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[4] Contrary to convention, I use "*telos*" as a non-countable noun, which suits my understanding of what it is and how it works.

[5] Whether or not emergents are merely epiphenomenal is still a matter of debate. I take the position, assumed by complexity scientists, that they are radically new and effectual. For a history and analysis of the problem, see Jeffrey Goldstein (2001). For my argument, see Alexander (2005).

[6] Cf. Hoffmeyer and Emmeche (1991) on what constitutes intentional agency. They claim it follows from Bateson's notion of *information* (that which is selected by any device that responds to difference), "that information is not an exclusively human phenomenon. Rather, our world is replete with systems sufficiently sophisticated so as to respond to selected differences: Not only animals and plants, but also organs, tissues and single cells are vehicles for information processing. They are communicating systems."

[7] Unless otherwise noted, all references to Short are to his *Pierce's Theory of Signs* (2007a).

always compulsory, and, as Short might point out, unintentional as photosensitive cells cannot try to react to light in another way if they fail the purpose that explains their existence in that organism. But, following Brentano in Peirce's shoes, Short does naturalize the concept of intentionality so that it may apply to certain physical responses not just thoughts or other mental acts or states. He argues the explanation for intentionality "is that there is selection for a type of outcome, where that selection is itself due to mechanisms that were selected for their selecting for that type of outcome. (For only in such case is a mistake possible.)" (176). This is a way of restating the concept of goal-directed behavior, the exercise of a capacity that exists for that purpose. These nested levels of selection allow us to say, for example, that an organism is *searching for* food (or light) and "may do so mistakenly, guided by fallible signs" (176). Only acting for purposes "entails a capacity to modify behavior that is unsuccessful" (154). In this paper, I will be interrogating the process by which such change in behavior occurs, in an attempt to show that it bears similarity to telic change below or beyond the level of the organism, such as, for example, a cell, an organ, a species, a society, each as a nested self-organized system. The effect of my analysis will not be to anthropomorphize these other kinds of systems but to further naturalize the concept of purposeful action and sign use. Unsympathetic to any such views, Short critiques biosemioticians "who suppose that Peirce's semeiotic extends to all of life…" (177).

In this paper I use "selection" generally to explain irreversible processes (Cf. Pierce 1940; Short 2007a). Offering a specification hierarchy after Salthe (1993), I note that there are several kinds of selection; the more general is always implied in the more specific. But the reverse is not true. We have selection *for* {prevalence {formal properties {differential reproduction {expected effects}}}}.

The most general kind of selection is for the most prevalent types, which tends toward entropy. Disorderly type arrangements are more often selected because more common.

The next more specific kind is formal or "neutral" selection, which occurs in self-organizing and self-maintaining processes. Here there is selection for certain formal properties that has the effect of forming a system, an *orderly* arrangement. As it emerges, the system's constraints become significant and the probabilities of state changes are further constrained by, for example, the relative locations of parts in the system and/or the relative structures of the parts.

A third kind of selection is for differential reproduction. Here the self-organizing formal selection continues under the name "developmental emergence," as described by Salthe (1993), but the self-organized system becomes nested within a larger system when preserved and passed on.

The most specified kind of selection is the kind we associate with purposeful actions, the exercise of a capacity that exists for that purpose. Purposeful actions are selected/taken/chosen for the type of effect they are expected to have.

I shall argue, basing my assertions on work in *computation mechanics* by J. P. Crutchfield (1994a), that a self-organized holistic state is *represented* to its parts in each other's reactions, and therefore significance, which is a form of intentionality (Short 174), begins to emerge with formal selection when the whole-part relationship emerges. But this kind of representation does not occur against a background of previous selection — which circumstance, Short (176) observes, as noted above, is a

required part of the explanation for intentionality. Thus, I refer to it as "fresh representation," and it may be that we may need to term this *poesis* rather than *semiosis*. If the emergent entity becomes part of a larger system, *i.e.* the part-whole relationship is nested, say through genetic coding or other kind of memory transmission system, the representation is no longer fresh, and semiosis has emerged. The point apropos to Short is the explanation of intentionality requires nesting of *formal* selection that results in self-organized part-whole relationships. The selection involving differential reproduction and selection for an expected effect involve purposeful action only insofar as they involve formal selection. Nested levels of self-organization occur in the cell, the organ, the species, and the society as much as they do in the organism.

Self-organization: Signs of the Dynamic Whole

Here I look at the telic aspects found in self-organizing chemical reactions, simulated swarms, tornadoes, and *etc.* as studied by complexity scientists. What I will argue will also apply to arguments that homeostatic processes are semiotic. Although some biosemioticians may frown upon the semiotic analysis of non-biotic systems,[8] Emmeche (2000) asserts that emergence, as life-like, is presumed by biosemiotics. Equating self-organization with sign action, he maintains it exists if there is reciprocal function, function of parts to maintain a whole and whole to create the parts, "as Kant pointed out."[9] Self-organization occurs in biological systems and may be considered relevant to biosemiotics for this reason alone. But more to the point, the fresh representation that obtains in part-whole relationships is harnessed by biological systems, and this, I claim, makes them semiotic.

My interest in semiotics began when I noted that theoretical physicists interrogating complex systems were posing unusual questions. As Crutchfield puts the problem of defining emergence, "What is meaning? What is function? … And how do these arise when they are not originally present?" (2003). The answers, in physics as in language, lie in the idea of constraints, the creation of context.

Crutchfield (1994a) uses "computational mechanics" instead of "statistical mechanics" as a means of considering not just the degree of randomness in a system but the relationship between randomness and structure. Crutchfield makes the revolutionary claim that computational mechanics takes the model-making scientist out of the picture, demonstrating the altered behavior of a component is itself an interpretant, to inject Peirce's term, of its neighbor's behavior as a sign of (Crutchfield says "model of") the emergent holistic behavior. The whole, here, is an "object" that none has access to as such. If, however, we understand an internal

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[8] One caution, self-organized systems are capable of analog but not digital semiosis, since they do not produce material signs for later interpretation.

[9] Kant claimed that in an organism "every part is thought as *owing* its presence to the agency of all the remaining parts, and also as existing *for the sake of others* and of the whole, that is, as an instrument, or organ ... The part must be an organ *producing* the other parts–each, consequently, reciprocally producing the others ... Only under these conditions and upon these terms can such a product be an *organized* and *self-organized being*, and, as such, be called a *physical end*. Quoted in Keller (2000):107.

component as a sign of the whole, then all components have mediated access to the whole through each other. The whole as such affects the behavior of the parts, and therefore Crutchfield demonstrates (*pace* Goldstein 2001:139) that the whole is not something that merely appears to exist to an outside observer, *i.e.* emergent phenomena are real dynamically stable *effectual* "objects."

When dynamic components have adopted the most effective regime of possible behaviors (at which point self-organized dynamics emerge), "learning" has taken place, according to Crutchfield. In tornadoes, swarms or in chemical pattern formation, the parts may not act for the purpose of creating a structured whole, but their actions do serve this purpose, and the whole, in turn, maintains the selected directionality of the parts, insofar as the local sign of it affects local behavior.

If one believes that emergent systems are effectual objects, then one is required to use semiosis to explain how the whole constrains the parts: an emergent dynamically stable whole cannot have direct effects as such.

Goal-Directed Behaviour

Telic behavior or "goal-directed behavior" has sometimes been conceived of as self-maintenance/self-organization and other times as the pursuit of goals/external objects that suit purposes. Attempting to incorporate (and revise) both conceptions of telic action, I argue that a self-organized entity must make use of (interact with) others in ways that serve larger purposes or that make it become part of new self-organizing trend. In being thus restrictive, I am not in agreement with those who suppose the Earth's ecosystem *acts* purposefully, for instance.[10] Nor would I say (*pace* Salthe) a tornado acts purposefully.[11]

However, I do argue that there is a poetic kind of sign use even within an un-nested self-organizing system that can and should be analyzed as such. The system's holistic dynamically stable behavior is never fully present to any observer-participant as such. *It can only have an effect through mediation.* Thus, it is like the goal-object, intentionally represented, and "sought by" purposeful agents. Such arguments, which necessarily depend on semiosis insofar as they suggest that mediated experience of the whole is available to and via the parts, are relevant to Crutchfield's notion of computation mechanics. In trying to conceptualize how the change in the activity of a neuronal group can *make a difference to itself*, Edelman and Tononi (2000:126–8) similarly suggest considering part of the system as its own observer.[12] In a self-organized system that is not part of a larger system, the representation of the whole in the parts is "fresh" representation, and it becomes intentional representation

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[10] Although "Gaia" most certainly does exist for the purpose of self-maintenance, it does not seem possible to say that it is capable of becoming part of a larger entity or capable of speciation, but one never knows. Dorion Sagan (2007) has some interesting thoughts on this.

[11] I do not agree with the argument that the purpose of all complex systems is to reduce gradients and produce entropy. This, I believe, is to confuse means (reduction of a gradient) with ends (creation of structure). I would say that tornadoes exist, if only briefly, for the purpose of self-maintenance, and their parts serve the purpose of forming the whole, but tornadoes do not act purposefully for they do not become preserved by, serving the purposes of, a larger entity, nor do they evolve into new species.

[12] Also see Tononi, Sporns, and Edelman (1994).

only if it is subsumed by another system. Such are the conditions for life and biosemiotics.

The effects attributed to an "intentional object" I attribute to a nested self-organized pattern, found, for example, in neuronal dynamics that produce thoughts and mental states. A nested self-organized pattern is also the formal cause of an unconscious conditioned response or a homeostatic system.[13] I claim intentionality emerges from a formal selection process, for which the so-called "object" or "goal" (to which selective actions refer or are "about") is better understood as the dynamic organization of the whole which is represented *to the parts of the system* in the change in the dynamic structure of their own responses that support the system as a whole.

The goal-directed view of purpose (*e.g.* Short's) fails adequately to consider the agent as a nested *self-organized* system. Let me offer examples of the goal-directed view versus the nested self-causation view of purpose:

Goal-Directed Purpose

1. Reacting with pressure and temperature gradients, moisture and air swirl, forming a tornado, which neither exists for a purpose, serves a purpose of its own, nor acts for a purpose.
2. The heart beats mechanically for a purpose of pumping blood (*i.e.* the capacity exists for that purpose). But as the heart is not subject to control by that purpose, it does not beat purposefully.
3. In an isolated population, new types are selected for a purpose (*i.e.* increased fitness). But as their coming into existence is not subject to control by that purpose, they do not appear purposefully.
4. The mosquito flies toward carbon dioxide mechanically for a purpose of getting blood (*i.e.* this capacity exists for that purpose). The mosquito is subject to control by that purpose, thus it does fly purposefully.

Self-Caused Purpose

1. Reacting with pressure and temperature gradients, moisture and air swirl, forming a tornado. As moisture and air are subject to continued, further constraints by the dynamically stable tornado, their behaviours serve the purpose of maintaining the tornado. But as the system is not nested in a larger system that requires its survival, which might have provided a fairly predictable environment, it has not formed internal models with which to react. It cannot adjust to a variety of conditions to continue to maintain itself, nor can it produce a new type of itself, thus the tornado does not act purposefully.
2. The individual heart cell changes states mechanically, serving the purpose of forming and maintaining a holistic dynamically stable pattern (that results in a heartbeat). As state changes are subject to further control by that pattern because

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[13] Cf. Ulanowicz (1997) generally, and Juarrero (1999:125) who writes, "Playing a role analogous to Aristotle's formal cause, the coordinated relationships make the system one kind of thing and not another…. The organization and coordination are distributed relationships that act as a virtual governor."

that pattern is a useful part of another system, the body, the heart does beat purposefully.

3. DNA interacts with material in a developmental context mechanistically, serving the purpose of creating a self-organized emergent form. Further development is constrained by the context provided by the form resulting in increased adaptability. The more plastic form is part of the larger population, for which it serves the purpose of being more advantageous than other forms. These advantages constrain the gene pool, that is, selections are made for the purposes they serve. These constraints help to stabilize the population, further increasing the possible appearance of more of the self-organized types that happen to be more complex with greater adaptability. Thus, a newly adaptive species does evolve purposefully.

4. The mosquito's protein sites react with carbon dioxide in the environment, resulting in an organized adaptive response, which further constrains the reactions. The response serves the purposes of the mosquito, a self that seeks live targets as food sources. The mosquito's capacities - as parts of the mosquito — are subject to further control and modulation. Learning takes place and capacities are improved. Thus, the response is purposeful.

Acting for purposes only emerges in the fourth example under the goal-directed purpose view, but obtains in all but one of the examples under the self-caused purpose view, in which the purposeful agent or individual is characterized as a complex system within a larger system. The formula for self-caused purpose 2–4 is: Parts (A) interact mechanistically, forming an organized whole (B), which further constrains the parts. That whole (B) serves a purpose for a larger system (C). That purpose served further constrains the whole (B) as a part in the larger system (C). Thus, B acts purposefully.

Purpose and Creativity

Thus my remedy to Short's disagreement with biosemioticians involves defining purposeful action (as opposed to mechanical reaction), not in terms of an individual unit pursuing "goals" but in terms of whether or not self-causation obtains. As Juarrero (1999:17–19) stresses, Aristotle, attempting to explain purposeful (voluntary) action, found it necessary to posit an object of desire, a goal, as intentionally represented. He was trying to answer the question: How can a whole, a unit, move itself without being divided? In the context of critiquing the uses of him made by action theorists, Juarrero glosses Aristotle's solution this way:

One aspect of the lion as active (its soul) efficiently causes another aspect as passive (its body) to move. But the soul cannot efficiently cause itself, so in reaching out for the gazelle as food [*i.e.* as significant], the lion's psyche is the unmoved mover of the body. The lion's soul thus requires an external object (the gazelle), as intentionally represented, to actualize the soul's desire by serving as final cause (Freeland 1994) or object of desire (Furley 1978 [Gill & Lennox 1994]).

In my own analysis, the whole constrains its parts, not by moving as a unit or being actualized by something other than itself but by being a dynamically stable process. With repeated exposure to each other, the parts are constrained by signs of the whole in each other's actions. A lion's instinctual response is a self-organized pattern of behavior, a whole, that emerges from the efficiently caused, mechanical reactions of its environment-embedded parts (*e.g.* sensory organs, nerves, brain, and muscles).

It would be a mistake to imply that the self, as a unit, varies behavior to correct mistakes. Various kinds of selection processes determine behavior, and those selection processes constitute the self. What makes an action purposeful or self-caused is not the mechanical interactions of the parts or the actions of the self *per se*, but the effects of its selected constraints that arise from the mechanical interactions. While Short explains intentionality in terms of a general type selected for as final cause, I describe the origins of general types within the dynamics of self-organization. Purposeful action is quintessentially action that is internally caused, action that can be said to originate in a newly emergent, constraining self. Thus *creativity* is at the heart of my notion of purposefulness. It is on this one crucial point that Short and I disagree, and he rightfully warns me that in common usage, "'purposeful' does not mean, as you seem to want to make it mean, creative," and he further notes that my trying to redefine it this way only "breeds confusion" (personal communication).

Confusion usually precedes new knowledge, so I take that risk. I have noted creative self-causation implied in ideas about purpose somehow involving chance throughout the history of teleology (Alexander 2002). My understanding of purpose may be a product of my background, which is not philosophy, as one might have guessed, but literature, and I am primarily concerned with defining and exploring creativity. I am also a novelist and a poet, and, as such, I am in the business of making words mean what they *can* mean, drawing out their historical and contextual implications.

I began my study of teleology when confronted with an odd prejudice in my field regarding the nature of teleological creativity. While in biology, one says an organism appears teleological if it is harmoniously fitted to its environment and seems intelligently designed, in literary studies, one says a novel is teleological if it is conventional or contrived. The latter observation seemed, if not entirely amiss then at least partial, since if one is writing "purposefully," rather than merely "mechanically," this should imply some sort of creative self-causation, as it does in Kant's description of teleological biology.[14]

Only after reading the biological literature from a complexity science perspective, did I come to understand how *telos* works from within: dynamically stability arises out of the relationships between parts which simultaneously affects the behavior of the parts, and therefore one can say a telic system, as such, is self-caused, or, in literary terms, creative.

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[14] See note 9 above.

Such assertions have been made before by complexity workers, and to these I add this Peirce-inspired thesis: At the level of individual actions/state changes within a self-organizing system, there are relationships between things that matter in ways that are language-*like*, involving index and icon, or at least nascent versions of signs. Language-like interactions make a system's evolution unpredictable. Possible outcomes are not equiprobable in the evolution of a complex system, and the most statistically prevalent do not necessarily prevail. Instead likeness — or metaphoric properties — begin to effect outcomes. Also, the causal relationships invoked by nearness — or metonymic properties — begin to effect outcomes. This is my interpretation of formal or neutral selection. These ideas will be further developed in "Originality in self-organization: Fresh Signs." The question I seek to answer there is: Why are emergent systems unpredictable? My answer, *Because their dynamics are language-like*, does not pretend to add any new information about the way complex systems work; it only characterizes their dynamics in terms of poetics. Some indices and icons are signs by mere nearness or likeness to an object; their interpretation as signs is what I would call "accidental." Poets have long known that new ideas come to us in an "inspired" way, a way that, though not supernatural, is not mechanistic (as Short defines it). Upon reiteration of selections for mere likeness and/or nearness, an organizational whole emerges, and the selected activities of the parts begin to represent the whole to each other. These language-like interactions, involving accidental icons and indices, exist prior to semiosis and give rise to dynamical structure — a proto-example of the symbolic, where a conventional/ habituated coherence obtains. As with all telic phenomena, what comes after seems to cause what comes before. But actually the cause is in the making as it makes. While it may be misleading to say these processes that give rise to semiotics are semiotic themselves, we can only understand proto-semiotic processes as such by looking at them in semiotic terms.

A Complexity Science Rereading of the History of Teleology

Recalling the concerns of Kantian morphologists and teleomechanists,[15] complexity scientists (*e.g.* Fontana and Buss 1994, Goodwin 1994, Salthe 1993, and Schuster et al. 1994) note that the existence of attractors constitute biases of pattern formation that precede natural selection and work in the background of developmental processes. Self-organization is an aspect of teleological directiveness lately re-inscribed. In complexity science's reformulation of final cause, constraints are generated by the complex system itself. Thus despite its historical associations with predeterminedness, final cause is clearly coincident with — rather than prior to — use. This is not a wholly new idea, but a clarifying of an obscured idea. Although

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[15] For example, Karl Ernst von Baer, Johannes Muller, Carl Bergmann, and Lotze Leuchart. Von Baer and Muller in particular stressed the fact that a final cause was neither an external agent nor an efficient cause; they argued that final causation was nonphysical; it was immanent in the dynamics of organic processes. They hoped to understand the teleological principles (the functional relationships of the parts to the whole) that guided morphogenesis, often making animals of entirely different species appear to have been produced by the same general ground plan.

Kant did imagine that telic limiting principles existed abstractly prior to the phenomena in which they appear to be expressed, as Juarrero (1999:113) writes, "Kant's emphasis on recursive causality, wherein the parts are both cause and effect, precludes the existence of a preexisting whole" as cause.

Directionality – Originality

Throughout the history of teleology the explanations change, but the specific kinds of phenomena requiring special explanation have remained constant. Telic systems — be they social systems, adapted species, organisms, organs or abiotic systems — exhibit self-organized emergent order, which I call *directionality*. If a product of directionality (an emergent self) interacts with another object and this confers an additional functionality on the system (causing it to adapt/speciate or to become part of a new more complex system), this is what I call *originality*. To put it in semiotic terms, a familiar sign (of a useful object) will become incorporated in the self-organized response to it (the response will constrain the sign, making it part of the same system from which it emerges), and this will reinforce the self-maintenance of that response — directionality. In a different case, a sign maybe mistakenly interpreted[16] as signifying a useful object due to some similarity. If that sign actually represents a different kind of object that turns out to be functional for the system in a different way, there may be a re-functioning of the system/response to maintain a new purpose — originality.

Underused today, my distinctions have recurred throughout the history of teleological-focused biology. Directionality and originality loosely correspond to formal and final causality, respectively, but with a certain amount of confusing overlap. In the early 19th century, Richard Owen conceived of two principles: the first, a "polarizing force," brings about stability and similarity or "a vegetative repetition of structure." The other, a "special generalizing force," which he considered "teleological," brings about change and diversity by shaping a system according to its function. Similarly, C. B. Reichert made a distinction between "class" and "functional" modifications in the structures of biological organisms. Meanwhile, the 19th century German teleomechanists (see Note 15) studied the same phenomena Owen attributed to the polarizing force, but believed, conversely, they were "teleological." While the teleomechanists were self-proclaimed *finalists*, many had strong *formalist* leanings. They were pitted against the Darwinists who claimed to be against finalism. These aspects continue to be recognized today in the opposing concerns of "neutral evolutionists" and Neo-Darwinists. Clearly, formal cause/directionality is associated with final cause for good reason since with directionality, the parts *serve the purpose* of self-creation and self-maintenance of the whole, which exists for that purpose. With originality, actions *serve purposes* of adaptive change.

I chose the terms directionality and originality because they are descriptive of the phenomena that are variously, and less clearly, labelled elsewhere. Directionality emerges fortuitously in a direction (but not toward anything) and originality

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[16] *i.e.* interaction is possible due to physically defined properties. A sign is "interpreted as" such because the capacity to interact in this way is a product of selection for a type of result.

fortuitously changes direction. Teleologists focusing on the aspect of directionality have been interested in archetypes, self-maintenance, self-organization, species coherence, and homeostasis, that is, emergent dynamical *stability*. Teleologists focusing on originality have been interested in functional adaptations, species evolution, accidental functionality, or fortunate *change*.

Directionality and originality are two sides of the same process. Directionality is the trend that arises from original selections for formal properties. Part-whole relationships are nested in a scalar hierarchy:

First Emergent Level Self-Organization[17]

Originality occurs at the micro-level of self-organizing processes
Self-organized forms are directional

Second Emergent Level Evolution of Species

Originality obtains in the discovery of accidental functions for self-organized forms.
Functional adaptations that come to define and stabilize a species are directional.

Third Emergent Level Selfhood

Originality occurs at micro-level of bodily/neurological processes that create coherent responses/thoughts.
Responses and thoughts are directional and come to define selfhood.

Fourth Emergent Level Semiosis

Originality occurs when effectual, but accidental, indexical or iconic relationships are found between distinct thoughts/responses/signs.
The new symbols that grow out of these selections are directional.

Serving/Existing for a Purpose and Selfhood

Analyzing purposeful/teleological action, Short relies upon the distinctions that we find in ordinary language between "serving" purposes, "existing for" purposes, and "acting for" purposes. I maintain that there is originality when something serves a purpose, and that there is directionality in a capacity that exists for that purpose. But the individual exercise of a capacity that exists for a purpose always *serves* the purpose afresh, even if within the context it is directional. Many instances of

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[17] It is somewhat arbitrary that I begin here. Salthe (1993) and Laughlin (2005) would argue that emergence is found below this level – and all the way down.

originality result in directionality. The full face of *telos* is not apparent in any single action or selection.

Existing for Purposes

An adapted individual's inherited structures and ways of responding to the environment exist for a purpose, but since they lack originality *at the level of action*, they are robot-like, previously designed-in, or directional. Although they are somewhat creatively self-maintaining, they are not creatively adaptive. Intelligent weapons, troping machines and so forth behave with a kind "purpose," only as Wiener *et al.* (1943, 1954) define it. Directional behavior can be varied, if it does not succeed, using feedback, but this depends upon design for a specific type of error correction. Whether the capacity was naturally selected for or a human designer chose it, it is (almost) all the same to me. The purposeful behavior did not originate in the acting system. Much human behavior too is either instinctual, inherited from culture, or so habitual it has become automatic (Cf. Salthe 1993 on senescence as inflexible automation). Inherited or artifactual purposes are directional. In arts and literature, we disparagingly refer to productions of this kind as "genre" art.

A genre is something like an attractor and many initial conditions may fall into the same attractor basin, so while there is variety within a genre, each work conforms to a general type. Similarly, when speaking of purposeful behavior, we sometimes say that there are many means to the same end. When we speak this way, we are speaking of directionality, of only the limiting guiding aspects of final cause, not the radically creative aspects. Sometimes what is called a means to an end can become what is called an end in itself. But this is no radical change of direction, and it is not creative. A truly original act, like "turning over a new leaf," would achieve an entirely new end.

This is not to say that I think directionality is mechanistic (*sensu* Short: particulars acting on particulars); directionality is an emergent phenomenon; an entity emerges that has a radically new and distinct identity, but its behavior, as such a system, is automated insofar as it remains purely directional and self-maintaining. Edelman and Tononi make a useful distinction between and "feedback," which depends upon design for a specific type of error correction, and "reentry," massively parallel, simultaneous intercommunication among numerous regions, such as occurs, they theorize, in the human brain, which constantly *evolves new* definitions of rewards and errors (2000). A reentrant system would exemplify both directionality and originality and thus would enable one to behave more creatively than robots do. When we depend more upon feedback than reentry we act with more directionality than originality.

Directionality is associated with limiting constraints, but also with enabling stability. Nature is limited in the kinds of attractors it can produce, and these limitations help ensure that stochastically interacting systems, for example neural systems, will achieve coherency even in highly fluctuating environments. Assuming the brain is a complex system, one may theorize that coherent mental representations occur when neuronal activity falls into an attractor basin. The recurrence of a particular kind of attractor does not require exact initial conditions and, in the brain,

would not need to activate the same network of neurons in the same order.[18] In this way, an individual has coherency or an identity.

Serving Purposes

Originality (not purposeful without respect to directionality) occurs at the level of individual action and loosens the predictive grip of determinism. True selfhood entails a degree of freedom of action, which, in our deterministic world,[19] can only mean being able to do the unpredictable.[20] I claim unpredictability arises with misinterpretative responses ("fresh representation," as in formal selection processes) that happen to serve purposes. With "misinterpretation" I mean a novel interaction that is made possible by circumstantial spatial relations and/or coincidental resemblances, the metonymic and metaphoric. Peirce might have referred to this as abduction.[21]

We are not exactly in control of what enters our consciousness or subconscious, but what enters is, mostly, characteristic of our directional selves. To wit, we construct the world we see to some extent, but our means of construction have evolved and developed in tandem with the environment we perceive, thus our picture is more or less reliable and may continually improve (Cf. Rocha 1998). But true learning, accepting what is radically new, must proceed by the disruption of the smooth directional nature of the self perceiving in its environment. How does this occur in a deterministic world? As Crutchfield puts it, "Is anything ever new?" (1994b). *I argue originality is brought about by selection for accidental properties.* Originality is not a product of reactions between essential properties. It entails selection for formal properties of likeness and nearness.

Let me give a brief example of originality found in contemporary culture — an example, in Short's terms, of an action that *serves a purpose* — at the fourth scalar level, that of thought. A musician is trying to compose a melody. He looks out the window to see birds sitting on electrical wires in a way that he interprets as the right musical notation. This is found usefulness, but the musician's directional tendency to see chance order in terms of musical icons makes this discovery, via metaphor, possible.

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[18] Cf. Edelman and Tononi (2000:98). For a memory to be repeated, what must be called forth is "any one or more of neural *response patterns* adequate to that performance, not some singular sequence or specific detail."

[19] Following mainstream science, I assume that even complex self-organizing systems are deterministic. Non-linear dynamics theorists stress the fact that, even if universe had begun (or did begin) in a completely uniform state (without any quantum fluctuations), something (*e.g.* functions and context), unaccounted for in the measure of total energy would later be generated by the dynamics, leading to self-organization and/or deterministic chaos. We can refer to this as *generative chance*.

[20] When I use the term "unpredictable," I mean *inherently* unpredictable, not just practically so. The outcome of an emergent system cannot be pre-specified even with *complete* knowledge of the initial conditions and the physical laws that govern their evolution. Predictions of complex system behavior do not become proportionally more accurate the more information one gathers. Complex systems are deterministic *and* unpredictable.

[21] I thank Wendy Wheeler for reminding me of this.

To be a self is really to form a purpose, a trail to blaze and maintain, and therefore, even though an agent might perform an action unconsciously that merely serves a purpose, it is his evolving directional nature that makes it likely for him do the action (make a fortuitous misinterpretation, an abduction) and recognize its usefulness to his purposes. The genius/artist who makes use of luck to fulfil his goals is the quintessential purposeful, *self-caused*, self because he projects what he wants onto the world, thereby making what he "finds." Originality, let me stress again, is only purposeful with respect to directionality. The emphasis on the creative act of "making use of luck" is on "making use." Luck and randomness are everywhere and uninteresting, uninteresting until bent to a purpose.

Emergent Selfhood and Short

A self is directional. "Directionality" does not imply the act of moving toward a goal, but the creation of a type of pattern or trend. A self is an organized whole that has no particular form and is never complete; many different behavioral patterns may fall into the same attractor basin; no two may be the same. A self, as an attractor, is *dynamically* stable and cannot be described quantitatively or fully represented with any kind of formalism. A self is not equal to the particular person; it constrains actions of that particular person. It is limitation (through directionality), but also possibility (through originality).

In Short terms, it is a general type that was selected for. Short observes that "acting for purposes," selection for a type of result, "occurs within an individual's lifetime — that is why we say *it* acts purposefully — and thus it is unlike natural selection, which takes place within populations of many individuals over many generations" (146 emphasis in original). We may *say* it acts purposefully, but does it? We, as *homo symbolicus*, are but parts of a language system in which our actions are purposeful. Purpose always emerges between part-whole-part relationships.

Short and I agree that selections are not made by the self *per se*; they occur with respect to the self. Contemporary neuroscience corroborates the idea that there is no entity that chooses between possible thoughts or actions. Rather formal selections are made at the micro-level selection process that gives rise to thoughts/responses, and though we may become aware of these "chosen" thoughts and actions, the individual as a unit does not choose them (for a review see Wegner 2002). However, distancing my theory from those who claim selfhood is a mere epiphenomenon (or that people are mere parts in a social organism, which itself is a mere epiphenomenon), I do argue (as does Short) that the selection process is biased by past actions and experiences. So it possible to say that the self is a real, effectual dynamic entity. The self has the effect of constraining choices available, but it does not make choices. Various kinds of selection simply occur. *Short leaves unexplained how the self constrains or is effectual.* I argue, availing myself of Crutchfield's computational mechanics, that the self is effectual (constraint occurs) insofar as signs of this whole are "poetically" represented in the parts' interactions with each other.

Therefore, we can still *say* that an individual acts purposefully, but we would be referring to the case that directional selfhood emerges from original relations at the lower level and may become a part that serves the purpose of forming the next new whole. The new ever more complex self (which at a sufficiently complex level may

be defined as a whole that constrains the selection for thoughts, actions, feelings of a certain type) in turn may become a part of original interactions between distinct interpretants (theories), which, if continually selected in a self-organizing process, will constitute artistry, genius, scientific discovery — or just plain surprising individuality. I do not disagree that there is a uniqueness to organismal selfhood insofar as it emerges within years not eons and, in humans, within 1000–1500 or so cubic centimeters, but the underlying creative processes of abiotic self-organization, adaptive speciation, selfhood, and artistry are generally the same: originality leading to directionality, leading to further originality.

Adaptive Speciation[22] Compared to Selfhood

Let me try to show, using a well-known example from biosemiotics, that there can be "intentionality" in adaptive speciation even though there is no "acting for purposes" distinct from the interaction of existing for purposes and serving purposes. Short, we recall, argues the explanation for intentionality "is that there is selection for a type of outcome, where that selection is itself due to mechanisms that were selected for their selecting for that type of outcome. (For only in such case is a mistake possible.)" (176). A tick, which has the evolved ability to respond to the presence of a chemical in animal sweat, detects it, detaches itself from a branch, and falls upon a host (Cf. Uexküll, 10–12). The capacity to do so exists for a purpose, but an automated (*i.e.* self-organized, directional) response by itself is not fully intentional at that level. The action merely serves that purpose.[23] Now suppose there is a chemical, produced by a plant, whose molecular structure is coincidentally similar to the tick's trigger chemical found in sweat (this is a source of originality via metaphor). The tick detects the chemical, detaches and falls. The tick's response is an interpretation of the new chemical as a sign of sweat of a host, which doesn't exist in that context. As a member of particular species, it has made a mistake relative to the purpose that, in the case of ticks, detaching has. Thus we can say that the tick is "looking" (robotically though, to be sure) for sweat and may do so mistakenly, guided by fallible signs (Cf. Short 176). Can the behavior of the tick be adequately described without referring to the object sought, which does not exist? No, we cannot explain the tick's capacity to react to the sign of sweat without mentioning sweat. If we cannot then that action would seem to be intentional, since it has an inexistent object

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[22] I want to distinguish, first of all, between the allopatric model of speciation, which is manly concerned with the accumulation of unmeaningful differences between recently separated groups and the functional Darwinian model which is concerned with the meaningful differences: adaptations to an environment. Secondly, I want to note that I (Alexander 2001, 2002/2003) tend, however, to disagree with Darwin's idea of *gradual* changes. I agree with Reid's argument (2007) that evolution occurs first by means of self-organization and new species are only stabilized, not created, by natural selection. Reid seems primarily concerned with what I called *originality*, whereas I also consider *directionality* and the relevance (to my theory of purpose) of the stability and coherence of the individual, which in this instance is the species.

[23] Consider a hammer and a stone. The former happens to exist for the purpose of pounding in a nail; the latter does not, but the use of the hammer and the use of the stone alike always merely serves a purpose. The capacity of the hammer to fulfill the function is directional, while the capacity of the stone to fulfill the function is accidental.

(Cf. Short 10). Nevertheless, if the individual tick acts by physical necessity and cannot vary its behavior to correct, no purposeful action is possible here. However, there may be a number of ticks in the population that respond to this new sign. If the mistaken response (a source of originality) happens to serve a different purpose, a re-functioning (*i.e.* evolution) can occur, leading to differential reproduction and quickly to the stabilization of a new, differently adapted, species. *Thus the new species if not the individual would be purposeful.*[24] Clearly, we should not compare the individual tick in this instance to Short's purposeful self. What we can say is that individual neurons in a purposeful organism's brain, like the tick, act by physical necessity and cannot vary behavior in order to correct, but a variation among neuronal behaviors may be selected. Thus, purposeful selfhood emerges out of various selection processes that we can take to be mechanical at the lower level. If a neuron fires in response to a similar but irrelevant stimulus (this can be considered "adaptability": it makes a mistake relative to the ongoing directional mental state) and this happens to serve a different purpose, a re-functioning can occur leading to a new and original thought, like a new adaptive trait of tick.

   To summarize then, Short assumes there is a relevant distinction to be made between an emergent agent and an emergent species (146). *But I am not convinced that either kind of emergent entity cannot be defined generally as a trend of narrowing constraints that continually (re)define what counts as purposeful.* Although I do believe that each level of telic emergence has unique features that are truly radical, I do not think the underlying process of emerging human selfhood are different from those that lead to speciation. Both involve originality that leads to directionality. Even in my limited sampling, I have found biosemioticians tend to argue (for example, Hoffmeyer and Emmeche, generally, and Denizhan (2007) in her analysis of magnetotactic bacteria) semiosis obtains in the relationship between the whole (*e.g.* response, species, self and *etc.)* and its parts.[25] Thus, Short's criticism of biosemiotics may only be applicable to those who attribute purpose to individual actions of selves as units irrespective of the process from which they emerge.

Responses as Directional Behavior

Short disputes Brentano's claim that "intentionality" is a mark of consciousness, and he argues that intentionality as Brentano defines it includes Peirce's idea that an

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[24] Short reminds me (personal communication) that a species does not act, and therefore it does not act for a purpose. As Gould (2002) might argue, speciating is what a species *does* as an individual. (It also self-maintains.)

[25] Hoffmeyer and Emmeche (1991) observe "the population (rather than the single organism) passes on a message about conditions of life to the memory (the gene-pool). The population should be considered a code expressing a message." Demonstrating an understanding of Short's early analysis in this manner and incorporating it into their assertions, they further write, Peirce "admitted that habits or habit changes can be the 'ultimate' interpretants of some signs (Short 1986). The change of genetic organization in response to conditions of life may be seen as a change of habit in the lineage." Denizhan (2007) agues, "… for an individual bacterium the magnetic field is not a sign but just a property of the environment… On the other hand, it is possible to assert that the magnetic field and the rate of survival constitute a basis for a sign for a lineage of magneto-tactic bacteria living in a given region, and adaptation involves lineage learning."

interpretant can be a physical response. This raises some compatibility issues that may be explored through one of Short's own illustrations.

A bear searches for grubs when prompted by an odor, which he has come to interpret as the "sign" of grubs, so Short argues. Assuming that bears have to learn to search for appropriate foods, when the odor is first detected it is not yet a sign of grubs. Although it is a natural index of grubs, to an inexperienced bear, it is merely coincident with grubs. Only after the bear develops a response that associates the odor with grubs do we say it a sign, to the bear, of grubs. I argue that *the bear's directional capacities to respond in a specific way come to exist for a purpose, but its responses can only serve that purpose or not.* Directional responses are only highly probable; as emergent, they are to some small degree accidental. If it were the case that if the habit exists for a purpose, its exercise occurs for a purpose (*i.e.* illustrates "acting for purposes"), then the exercise of any capacity by a cell or an organ would occur for a purpose (*i.e.* illustrate "acting for purposes"). Short claims that a cell is not capable of purposeful behavior because it cannot vary its behavior to achieve a purpose if it fails. *Most likely, however, the cell's behavior, or that of any part in a homeostatic system, will be corrected (selected for or not) by virtue of its being within such a system, a directional system that defines what counts as part of itself. Likewise the bear's response if it fails its purpose will be corrected by virtue of its being part of a directional pattern. Note my use of the passive voice in both cases.* Here again is the difference between the goal-directed view of purpose and the self-caused view (see "Self-organization: Signs of the Dynamic Whole").

Once the bear's response has developed, the odor itself directly initiates a behavior — which we call "searching" — and the odor does not have to be a sign of something else *to the bear* (though all adaptive behaviours/responses may be sign *to us* of the fortuitous goal state having been reached in past generations/trials). Sometimes it is not. This is the nature of efficient responses. They must themselves become directly effective, otherwise they do not work well. This is true of all learned, directional behaviors, from dancing, to driving, to eating, to looking for love.[26] Both adaptive and learned responses arise through formal selection processes. On the path of directionality, organisms cannot help but perform learned behaviors in the right circumstances. When responses are automated, causation at that level is always direct, not mediated by signs, not by signs *in the environment* that is. As Peirce observes, when "there is an 'automatic regulation', [it is] an idea opposed, in our minds, to that of *semiosy*" (Peirce 1940: 275). I claim that when there is automatic regulation, it is not the self, the whole, that is making use of a sign of a goal, but rather it is the parts of the self that are being guiding by signs of the self-organized pattern of behavior of the conditioned response. (A self may be defined as a number of conditioned responses, that is, by its habits.) Creative

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[26] Some interesting cases of directional responses involving originality *at that level of action* are to be found when stochastic resonances strengthen a "signal," where "signal" is defined by the scientist as a sign of, for example, prey. In these cases, what makes a weak "signal" detectable is the coincidental similarity between it and noise. See Russell, Wilkens, and Moss (1999). But what is being called a "signal" here is actually defined by the self-organized directionality of a response that has been developed over time. Noise is able to activate a familiar attractor basin because it is familiar.

responses (new or better) are possible through original (mistaken but lucky) interpretations of objects as signs of the whole.

Thoughts, memories, imaginings, perceptions, like learned behaviors, are probably directional, self-organizing processes, to a degree automatic, formed over time by a process selecting original relations. Thus, it would not be possible to locate a moment in thought or action when the self is "acting for purposes." Selected actions that serve purposes and unconscious responses that serve purposes *simply occur*. What makes an action "purposeful" (though I am redefining this term) is its *originality* and its occurrence with respect to both a background of directionality and new directionality to come.

I do think we need semiosis to explain telic behavior, at *all* levels of its emergence, but the individual actions of selves as parts of larger wholes are always poetic insofar as they merely serve purposes; they are not purposeful in themselves. Only as a nested part-whole relationship is a self semiotic.

Radically New

Fully teleological change in behavior requires a disruption of automated, directional behavior. This type of change should be understood as distinct from the kind of change that results from feedback or error correction. *Fresh representation (as opposed to the automated or the previously designed-in kind found in directional processes) enters the causal process with originality.* Originality in human behavior occurs when accidental similarities and contiguities are found between directional habits of thought and the environment, such as when our musician found his avian inspiration, or when similarities between disparate habits of thoughts present a novel understanding. In neuronal dynamics, making a fortuitous mistake, a false analogy, or an abduction (these are "mistaken" or "false" only relative to previous ways of thinking), occurs when associations, having nothing essential to do with the particular habit of thought, are reinforced by other irrelevant stimuli/associations. Distinctions may not be made between actual stimuli and strong associations. Numerous contingencies associated with previous manifestations of a thought may appear, *e.g.*, one suddenly recalls what one was wearing when last one smelled that scent. A neuron or neuronal group may have strong connections with other neurons and/or groups, and these connected groups may not be relevant to the stimuli that the first group is responding to, but the other groups may become activated all the same. Most irrelevancies must be dampened away or we could never think straight, but some coincidental similarities and contiguities (sources of originality) may enhance a few irrelevancies and make them come to the fore in the process know as *stochastic resonance*.[27] When this happens a new directionality might be discovered, via arbitrary constraints. This description assumes that a habit of thought is an attractor basin and that the behaviors of complex systems are relevant here. A deeper description of a thought as an attractor basin is needed, but our need outstrips current means of investigation. Suffice it to say that some kind of self-organization most

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[27] Stochastic resonance is a well-studied feature of neuronal systems. For a review, see Gammaitoni *et al.* (1998).

likely does occur in the brain, and what happens in less complicated, well-studied self-organizing systems (see next section) probably occur with much greater complexity in the brain. The character of dreams may be our best evidence that neuronal dynamics generate patterns whose succession is determined either by directional tendencies that have evolved or by accidental contiguities and similarities between different attractor basins.

Originality in Self-organization: Fresh Signs

A focus upon directionality leaves unarticulated a great deal of the anthropomorphic character we sense in telic phenomena. Finally, I will elaborate on the original part of my thesis, going deeper into the process of self-organization to reveal the telic originality operating at the micro-level, where I claim poesis leads to semiosis.

Index Here I'll refer to the distinction Peirce makes with regard to different kinds of indices. Some indices are physically correlated with an object by necessity. They are "natural" signs. An axon is an index of a neuron. Smoke is an indication of combustion. Other indices are only in some sort of new resistance or reaction with their objects as a result of contiguity or juxtaposition. Their indicativeness, in my terms, is "accidental" and a source of originality. For example, the behaviors of parts of a system become more regular than is possible as they become more like their neighbors, who are behaving more like their neighbors. Thus, the behaviors of the parts *come to function as* indices of the whole, which has fewer degrees of freedom than free individuals.

To take a different kind of example, observing a chemical reaction with an even mixture of activator and inhibitor molecules, one might expect homogeneity to result, but because there is a context, more activators will be produced where activators are against the edge not an inhibitor. Activators *serve* as indicators of an all activator neighborhood. The accidental property of one part being near to something else affects the outcome of the system as a whole. The difference made by the existence of constraints makes a difference. In butterfly wing pattern development these types of differences can lead to a range of beautiful self-organized patterns (Nijhout 1991), which may turn out to be useful for the insect (Alexander 2001, 2002/2003).

The unintended pun, the simplest of poetic forms, is an accidental index of its context. The newly limited behavior of a part within a self-organizing system (*e.g.* a swarm, as described in "Self-organization: Signs of the Dynamic Whole") is likewise an indication of its newly created context. *Mere contiguity rather than permanent causal connection constitutes the grounds of significance of the parts as a sign of an influencing whole. This whole is "conventional" or produced through habituation.*

Icon Some icons are physically similar to an object by indexical grounding. A footprint looks like a foot. A photograph resembles its subject. Other icons, however, are linked to an object only by an accidental likeness. Accidental icons *serve* as signs of objects. Accidental icons are a source of originality (Alexander 2002:221–222,

2005). The ubiquitous phenomena of *stochastic resonance*, the process by which noise is transformed into signal, illustrates the causal effectiveness of accidental similarity.[28]

Deacon and Sherman (2008) provide another example of accidental icons in their work on morphodynamics. They note that as molecules collide into each other randomly, some may stick together if their shapes happen to fit together like puzzle pieces, which better enables molecular bonding. The resemblance is accidental, that is, the molecules were not joined at one point and detached. As the process continues, more like molecules are selected, and, in the example of an autocell, this serves the purpose of creating an emergent form.

Note that Peirce's distinction between "natural" and "pure" icons and indices does not correspond to my distinction between "natural" and "accidental." In my view, "natural" signs may be such by natural convention or habituation, that is, by formal selection over time. They are signs whether interpreted as such or not. "Accidental" indices and icons are not signs until interpreted as such. However, when they are repeatedly interpreted as signs of the same general object over time, artificial or conventional symbols emerge. Perhaps I can say that they become naturalized (directional) in this way.

Understanding teleological phenomena in semiotic terms, shows how *accidental* icons and indices lead, through habituation, to self-organized patterns and may provide concrete approaches for developing artificially teleological phenomena, specifically an artificial intelligence that is more human, more poetic, and capable of *generating* meaning. Peirce did not suggest that a specifically *poetic* type of index or icon leads to emergence. I am making this claim. It is because accidental indices and icons (and words) do not have permanent and natural causal connections like smoke to fire, or a footprint to a foot, (or a name for an object) that new, abstract connections can form conventional or symbolic systems.[29] *If such arbitrarity*[30] *is key to understanding how language emerges, it also may be a key to understanding how radically new forms emerge in nature.*

Mind as Selection

Similarity and contiguity constrain and enable a formal selection process to form an organized pattern. Hoffmeyer and Emmeche (1991) note that information as such (as conceived by Bateson) must be selected by some kind of "mind," which, very generally speaking, is a device that responds to difference. We can go further and say that mind is not a device that selects but mind is formal selection itself, wherever and however we find it. This is probably close to what Peirce meant when he infamously declared intelligence to be everywhere.

Hoffmeyer and Emmeche claim the ability to respond to differences make living systems biosemiotic. In my example of self-organization, neither the part nor the

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[28] Kitajo *et al.* (2006) claim they offer the "first experimental evidence that noise can optimize a higher brain function which involves distinct brain regions above the level of primary sensory systems—switching behavior between multi-stable attention states—via the mechanism of stochastic resonance."

[29] Terrence Deacon's *Symbolic Species* (1997:92-101) inspired this idea.

[30] I use this form for the parallelism between similarity, contiguity, and arbitrarity.

whole is "able" to select. Rather, selectiveness is a consequence of existence within an organized whole. There is no selector distinct from selection.

In a recent response to his critics, Short has reflected upon how wise it is to generalize human nature in ways that Perice was wont to do.

> Go too far, and you start talking nonsense, attributing thought and purpose to inanimate objects and mechanical processes. Go not far enough, and you divorce thought and purpose from nature, precluding their naturalistic explanation. Peirce's strategy … is to find something very abstract … common to mind on the one hand and to nature on the other. Then we can see how, despite their very great difference, (a) mind may have emerged from unthinking nature and (b) the physical world may be known. 2007b:668

Peirce's strategy is what I have tried to employ here.

Poesis Versus Semiosis

With these special types of indices and icons there is an accidental grounding of sign relations. *Initially poetic*, as the process continues with reiteration and stabilization, there is the emergence of a self-organized structure, capable of maintaining a dynamically stable identity, whose formation is analogous to that of the symbol.

In the above examples of self-organization, the object of the sign comes into existence coincidently with the "interpretative" processes: fresh representation. Thus, we might say this is poesis, not semiosis. The "right" interpretation has not been established yet as the purpose is only just emerging (Cf. Short 53–56). We might conclude then that poesis creates semiosis, but we usually conceive of poesis operating against a background of already existing semiosis. Here we have run into the supposed paradox of all observed teleological phenomena. They can only be seen as such retrospectively. What comes after seems to cause what came before. The paradox dissolves when we think of interweaving scalar hierarchies of originality and directionality. The product of directionality at one level becomes a part, which forms an original relationship with another part, and new directionality emerges at the next level. Short concedes (personal communication) that what I call "originality" may be the pre-condition to purpose, not part of purpose as such, which for him seems to be defined by the condition of directionality only. But if our view of purpose is limited in this way, we have only purposeful "robots," whose individual actions are automated, not original.

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