Introduction

Neocybernetic Emergence

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In his introduction to *Observing Systems*, “The Ages of Heinz von Foerster,” first published in 1981, Francisco Varela concluded with a characterization of “the last age of Heinz.”¹ In the chronology of second-order cybernetics, this would be considered its *first* age, the period during the early 1970s when von Foerster laid out his ground-breaking sketches of, in Varela’s words, “recursive mechanisms in cognitive systems,” thereby producing the initial formulations for a cybernetics of cybernetics.² What struck Varela in the early 1980s was the extent to which the force of von Foerster’s cognitive innovations had not yet gained secure footholds in the mainstream academy, had “*not* permeated our intellectual preferences and current thinking”:

There is little doubt that our current models about cognition, the nervous system, and artificial intelligence are severely dominated by the notion that information is represented from an out-there into an in-here, processed, and an output produced. There is still virtually no challenge to the view of objectivity understood as the condition of independence of descriptions, rather than a circle of mutual elucidation. Further, there is little acceptance yet that the key idea to make these points of view scientific programmes is the operational closure of cognizing systems, living or otherwise. These are precisely the leitmotives of Heinz’s last stage.³

Since Varela made this observation, there has certainly been some significant, if modest, penetration of these fundamental cognitive motifs into the “intellectual preferences” of thinkers across the spectrum of natural, mathematical, and discursive disciplines. As we see it, however, Varela’s words still ring true of our present time, and to the extent that they do, this volume of essays has important work to do. For it is only by theorizing the operational closure of cognizing systems that cultural theory can rescue agency—albeit agency of
a far more complex variety than that of traditional humanism—from being overrun by the technoscientific processes that are everywhere transforming the material world in which we live today. Indeed, given the acceleration in technoscientific development since the 1980s—acceleration that has witnessed the advent of artificial life, complexity theory, and other technosciences of emergence—the imperative to theorize the operational closure of cognizing systems has, arguably, never been more urgent. Better late than never, second-order cybernetics can perhaps now finally come through on its promise to provide the ecology of mind best fitted to the demands of our intellectual, institutional, and global crises.

From Cybernetics to Neocybernetics

The cultural history of cybernetics is still being written. There is no authoritative version but rather a swarm of competing accounts. Given the welter of disciplines engaged in the movement, as well as the self-reflexive turn in cybernetic thought itself, a definitive history would be an impossible project. As has often been told, however, the first cybernetics emerged in the 1940s as a technoscience of communication and control, drawing from mathematical physics, neurophysiology, information technology, and symbolic logic. Historically concurrent with the postwar spread of linguistic structuralism in Europe, cybernetics was set forward in the United States and then vigorously transplanted to Soviet and European subcultures. From a base connecting biological and computational systems by way of information theory and communications technology, cybernetics was academically mainstreamed under the names Artificial Intelligence (AI) and, more broadly, computer science in the service of command-and-control systems. But due to the long interdisciplinary roster of Warren McCulloch’s invitees to the Macy Conferences—including Lawrence Frank, Heinrich Klüver, Gregory Bateson, Margaret Mead, and Lawrence Kubie—cybernetic discourse entered psychology, anthropology, and other social sciences and from there, in the 1950s and ’60s, the humanities and the creative arts.

Coined by original Macy participant Norbert Wiener, “cybernetics” in its initial formulation was the “study of messages, and in particular of the effective messages of control.” But for Wiener cybernetics also raised new issues about the “definition of man”: If “human behaviors” can be duplicated by machines, how is one to “differentiate man” from other entities? Keeping the focus on information and communication but extending it beyond machines, Wiener
argued that among living beings only “man” is obsessively driven to communicate. While this was not in fact a satisfactory criterion of distinction between human beings and other living and nonliving things, it did show that from the start, cybernetics put the ontology of “humanity” into question.

Less than a decade later, W. Ross Ashby deflected Wiener’s emphasis on human communication and control toward the ontological neutrality of Claude Shannon’s information theory. In a similar vein, Gregory Bateson wrote of the first cybernetics that its “subject matter” extended across traditional disciplinary registers in focusing on “the propositional or informational aspect of the events and objects in the natural world.” Now we would say that cybernetic methodologies draw out the virtuality correlated with actuality, but clearly the shift in emphasis from the actual to the virtual was already under way in first-order cybernetics. According to Ashby, with regard to the substance of the media conveying informatic forms, “the materiality is irrelevant.” Cybernetics marks a shift away from the building blocks of phenomena—so long the focus of chemistry and physics and, given the success of these disciplines, too often a model for biology and psychology—to the form of behaviors, what things do and how they are observed.

The first-order cybernetic demotion of material substance relative to informatic pattern is memorably recorded in The Human Use of Human Beings, when Wiener rehearsed a teleporter scenario that characteristically operated on a biased form/substance binary: “The individuality of the body is that of a flame rather than that of a stone, is that of a form rather than that of a bit of substance.” Nevertheless, the teleportation of that form for the purpose of rematerialization at a distance would almost surely involve at least the momentary destruction of the organic being undergoing the process. One service of the science fictions retailed as The Fly has been to restore the visceral horror of a process that Wiener described with a remarkably bloodless and surgical élan:

Any scanning of the human organism must be a probe going through all parts, and must have a greater or less tendency to destroy the tissue on its way. To hold an organism stable while part of it is being slowly destroyed, with the intention of recreating it out of other material elsewhere, involves a lowering of its degree of activity, which in most cases we should consider to prevent life in the tissue. In other words, the fact that we cannot telegraph the pattern of a man from one place to another is probably due to technical difficulties, and in particular, to the difficulty of keeping an organism in
One could generalize from Wiener and Ashby—as well as from much of its popular offspring in cyberpunk and other technoid fantasies—that first-order cybernetics remains inscribed within classical scientific thought: it holds onto humanist and idealist dualisms that describe the world in terms of an equivocal dialectics of matter and form, of substance and pattern, in which the immaterial wrests agency away from the embodied.

One way to mark the emergence of neocybernetics (our preferred paraphrase of “second-order cybernetics” or “the cybernetics of cybernetics”) is to emphasize its new questioning and eventual overcoming of classical substance/form distinctions. Neocybernetic systems theory radicalizes the constructivist epistemology inscribed within the first cybernetics by shifting to an autological rather than ontological theory of form. In neocybernetic theory, the form/substance dichotomy is superseded by the distinction between form and medium.

Putting form and medium theory together, neocybernetics goes beyond classical ontology’s impasse—is it form, or is it matter, nothing, or everything?—before the oscillations of being and nonbeing. Such imponderables have always presupposed some ultimate fundament upon which to evaluate this all-or-nothing conundrum. Neocybernetic epistemology replies by “de-ontologizing” the question. Neither form nor medium reaches bottom: there is no bottom. Forms are temporary fixations of elements within a medium, and when enough like forms coalesce, they become another medium for a new, emergent set of forms. As Edgar Landgraf discusses below in the context of improvisational performances, this autological dynamic is especially decisive in the social communication of art forms. In “The Medium of Art,” Niklas Luhmann writes: “In the case of art . . . form first constitutes the medium in which it expresses itself. Form is then a ‘higher medium,’ a second-degree medium which is able to use the difference between medium and form itself in a medial fashion as a medium of communication.” Building upon this understanding, Michael Schiltz in this volume draws out the implications for Luhmann’s theory of positing meaning as the medium within which psychic and social forms interpenetrate: “If the medium of meaning is indeed the ultimate medium of psychic and social systems—i.e., if meaning is ‘the medium of itself’—then what is its ‘form,’ the distinction through which it can be expressed? I perceive only one answer: the medium of meaning must be identical to the difference between form and medium, and the reentry of that distinction into itself. Its consequent indecidability is the symbol of our dealing with the world.”
First-order cybernetics underscored the provisional nature or the construct-edness of cognitions within observing systems, but it did so by undercutting the significance and contribution of material/energetic environments to the cognitive systems that emerge within them. The strong constructivism of neocybernetic systems theory deals with the world by promoting a new level of attention to the media of its forms or, more concretely, to the environments and the embodiments of systems. As Bruce Clarke’s essay demonstrates, we see this ecological convergence of constructivism and cybernetic “environmentalism” in the key figure responsible for the turn from first- to second-order systems theory, Heinz von Foerster. At the beginning of his 1974 essay “On Constructing a Reality,” von Foerster, then director of the Biological Computer Laboratory at the University of Illinois, recounted how, “perhaps ten or fifteen years ago, some of my American friends came running to me with the delight and amazement of having just made a great discovery: ‘I am living in an Environment! I have always lived in an Environment! I have lived in an Environment throughout my whole life!’” Yet despite the ecological revelation of their newfound Environment, according to von Foerster, his friends had yet to make another and even more crucial discovery: “When we perceive our environment, it is we who invent it.”

This collection contributes to the cultural work of cybernetic discourse by tracing the lines of neocybernetic development that extend directly from the work of Heinz von Foerster. Putting von Foerster at the head of neocybernetics throws attention on what is still a minority account of cybernetics’ intellectual accomplishment and cultural significance. Neocybernetics’ greatest interest for textual disciplines, media studies, and the social sciences, we argue, derives from particular advances upon first-order cybernetics in the biological, cognitive, and social systems theories developed in the work of von Foerster and Gregory Bateson and extended from there by Henri Atlan, Humberto Maturana, Francisco Varela, Lynn Margulis, Susan Oyama, and Niklas Luhmann.

Some of the most important theoretical and critical conversations going on today in the cognitive sciences, chaos and complexity studies, and social systems theory stem from neocybernetic notions of self-organization, emergence, and autopoiesis. A growing body of scholarly work is rethinking the shape and evolution of the relations among science, technology, sociology, psychology, philosophy, history, literature, and the arts through neocybernetic terms. Expanding the initial transdisciplinary framework connecting the natural and human sciences with information technologies, recent thinkers, such as Michel Serres, Gilles Deleuze, Félix Guattari, Donna Haraway, Bruno Latour, and Isabelle Stengers, have deployed neocybernetic discourse extensively.
and transformatively. Neocybernetic discourse is central to current historical, interpretive, and theoretical investigations using concepts such as narrative, medium, assemblage, information, noise, network, and communication to remap the terrain of knowledge with reference to the operational boundaries of systems and their environments.

This body of work is both inspired and admonished by the larger unfolding of cybernetics, its institutional ups and downs, its cultural impacts and resistances, its culs-de-sac, and its continuing intellectual and social promise. Neocybernetic concepts in the line from von Foerster to Maturana, Varela, and Luhmann challenge not just the technoid rigidities of AI and first-order mechanical and social systems engineering, but also, and more profoundly, the epistemological foundations of philosophical humanism as such. Whether technical or biotic, psychic or social, systems are bounded semi-autonomous entities coupled with their environments and to other systems. One shifts attention from isolated elements and relations to the emergent behaviors of ever-larger ensembles. Neocybernetic systems theory stresses the recursive complexities of observation, mediation, and communication. Whatever comes to be (observed) owes its term of being to systems within its environment. Autonomy can never be solitary: in second-order cybernetics, autonomy is rethought as operational self-reference.

In brief, neocybernetics shifts the emphasis of observation and description from subject to system. One form of the neocybernetic turn is a shift of interest from the identities of subjects to the networks of connections among systems and environments. The humanist project that unified perception and communication in one subject, shored up against all odds by the first cybernetics, is now observed as an amalgamation or structural coupling of multiple observing systems. With this move the noumenal unity of the humanist subject gives way to a differential observation of the relations of living and nonliving systems and their environments, such as human and nonhuman bodies and societies.

Emergence and Closure

*Emergence and Embodiment* reflects on the legacy and continued, even renewed, value of neocybernetics in a world characterized by hyperacceleration in the sciences and technologies of emergence. In *We Have Never Been Modern*, Bruno Latour states that “we are going to have to slow down, reorient and regulate the proliferation of monsters by representing their existence officially.” In *Microcosmos*, Lynn Margulis and Dorion Sagan sound a similar note regarding
humanity at large in its geobiological context: “The reality and recurrence of symbiosis in evolution suggests that we are still in an invasive, ‘parasitic’ stage and we must slow down, share, and reunite ourselves with other beings if we are to achieve evolutionary longevity.” Summarizing this broad neocybernetic consensus, Dirk Baecker writes that “One of the most important aspects of systems theoretical thinking is to proceed slowly, to look at things again, and to take the time to spell them out. . . . We should not jump, as systems do, from one event to the next simply to show that we can do so. Rather, we should look back at each instance, again as systems do, to see how we effected the last jump.”

Following these complementary invocations for a “slowing down” of technoscientific hybrids, of ecological depredations, and of systems-theoretical theorizations, we acknowledge a similar need for a slowing down—in our case of everything that has recently come together under the rubric of the “post-human”—for the purpose of careful neocybernetic consideration. By now already a cultural cliché lacking definitional consensus, the posthuman has been wielded to encompass everything from contemporary theorizing and cutting-edge cultural history; to work in nontraditional sciences like nonlinear dynamics, robotics, artificial life; and indeed to the science of emergence that has been dubbed (by its most ambitious proponent, Stephen Wolfram) “a new kind of science.” By means of a performative polarization deploying classic binary logic, facile versions of posthumanism reproduce the human as the very “other”—the much despised and easily criticized figure of a unified and fully autonomous human subject—whose devalorization is to give them teeth.

As we see it, the human has always been a for-itself complexly imbricated with the environment, and it is precisely a recognition of this complexity that informs the historical moment of second-order cybernetics, as well as its continuation in what we are calling neocybernetics. Central to the priority we want to claim for neocybernetics is the concept of autonomy as double closure or, as Heinz von Foerster puts it, the regulation of regulation. In stark contradiction to any naive conception of autonomy as the absolute self-sufficiency of a substantial subject, this concept demarcates the paradoxical reality that environmental entanglement correlates with organismic (or systemic) self-regulation. Thus a system is open to its environment in proportion to the complexity of its closure.

That this equation remains in force even—and indeed must remain in force especially—in the face of today’s massive incursions of technics into the domain of the living is one of the central burdens of our volume. For if the human has
always been posthuman in the sense that it has always involved an exteriorization or evolution by means other than life (as the work of André Leroi-Gourhan and, more recently, Bernard Stiegler has shown), the massive contemporary acceleration in processes of posthumanization poses the prospect of a qualitative shift in the economy between autonomy and environmental entanglement. Whether this shift entails the abandonment of autonomy as regulation of regulation is a crucial question facing cultural theorists today.

One eloquent position here—that of Katherine Hayles in My Mother Was a Computer—contends that recent technosciences of emergence and the model of the computational universe they presuppose have definitively marked the historical limits, indeed the eclipse, of the cybernetic tradition:

Even the most insightful and reflective of the cyberneticians stopped short of seeing that reflexivity could do more than turn back on itself to create autopoietic systems that continually produce and reproduce their organization. Heinz von Foerster’s classic work *Observing Systems* shows him coming to the threshold of a crucial insight and yet not quite grasping it: the realization that reflexivity could become a spiral rather than a circle, resulting in dynamic hierarchies of emergent behaviors. By the time scientists began to use this idea as the basis for new kinds of technologies, cybernetics had already lost its utopian gloss, and new fields would go by the names of artificial life, complexity theory, and cellular automata.

As we see it, however, this evaluation seriously underestimates the force of von Foerster’s account of how recursive processes generate emergent complexity. At the core of Hayles’s claim is a conviction that the role of recursion as understood by second-order cybernetics simply cannot account for the processes of emergence that are popping up everywhere in our world, whether one consults the computational model developed by Stephen Wolfram in *A New Kind of Science* or the totalizing picture of escalating onto-genesis promoted by Howard Morowitz in *The Emergence of Everything*. The “crucial question” of Hayles’s book is precisely how the “new kind of science” that informs what she calls the “Regime of Computation” can “serve to deepen our understanding of what it means to be in the world rather than apart from it, co-maker rather than dominator, participants in the complex dynamics that connect ‘what we make’ and ‘what (we think) we are.’”

While we concur with this desideratum and consider it central to what we are calling neocybernetics, we simply cannot endorse this position. For Hayles, developing an understanding of our constitutive worldliness requires a transgression or dismissal of the boundaries separating any system from its environ-
ment: “Boundaries of all kinds have become permeable to the supposed other. Code permeates language and is permeated by it; electronic text permeates print; computational processes permeate biological organisms; intelligent machines permeate flesh. Rather than attempt to police these boundaries, we should strive to understand the materially specific ways in which flows across borders create complex dynamics of intermediation.” 22 In our view, these formulations are simply too vague. It is not at all clear what exactly such “permeation” might amount to, given the very different operational fusions being asserted. In her zeal to leave closure in the dust, Hayles simply glosses over the very differentiations from which systems are generated in the first place. This move short-circuits the machinery of emergence before emergence even gets started.

Neocybernetics contends that it is precisely the injunction against such flows of information across the boundary demarcating an autopoietic or self-referential system from its environment that drives the theory’s crucial insights into the operations of self-referential and recursive forms. It is not a matter of “policing” operational boundaries: not only are they self-producing and self-maintaining, but they are the condition of the possibility of systemic functions in the first place. The environment can perturb living, psychic, and social systems but cannot operationally in-form them. More simply put, environmental stimuli can trigger systems to restructure themselves but cannot directly or causally impact their function. We can say, then, that systems’ observations of their environment are internally and autonomously constructed by their own ongoing self-productions. In other words, to maintain their autopoiesis, (self-referential) systems must remain operationally (or organizationally) closed to information from the environment. On that basis, they can construct their interactions with their environment as information. Luhmann writes with regard to the operation of communication in social systems: “A systems-theoretical approach emphasizes the emergence of communication itself. Nothing is transferred.”23

To forestall a misunderstanding that has dogged second-order systems theory since its inception, we need to insist upon the specificity of neocybernetics’ complex, nuanced, and paradoxical understanding of the concept of closure. Once the paradigm shift is made from the physical to the life sciences, the order-from-noise principle in self-organizing systems gives way to the openness-from-closure principle in autopoietic systems. To understand the stakes of this development, one must bring into play the fundamental distinction between thermodynamic and autopoietic principles. Thermodynamically, a system is either open or closed to energetic exchange with its environment; by contrast, autopoietic systems are both environmentally open to energetic exchange and operationally closed to informatic transfer. According to this understanding,
operational closure—far from being simply opposed to openness—is in fact the precondition for openness, which is to say for any cognitive capacity whatsoever. As a number of contributors demonstrate, this generalized correlation of closure with cognition informs Varela’s development of neocybernetics—specifically his development of the openness-from-closure principle—from its initial theorization in relation to autopoietic systems to the meta-autopoietic assemblages that, arguably, characterize contemporary society.

In their various characterizations of autopoiesis, Maturana and Varela correlate organizational closure with interactional openness: it is an organism’s (or system’s) self-perpetuation that allows it to be structurally coupled to the environment. In this volume, Evan Thompson restates this core neocybernetic insight from the perspective of Varela’s later work bridging life and mind, neuroscience and phenomenology, through the concept of autopoiesis: “The self-transcending movement of life is none other than metabolism, and metabolism is none other than the biochemical instantiation of the autopoietic organization. That organization must remain invariant—otherwise the organism dies—but the only way autopoiesis can stay in place is through the incessant material flux of metabolism. In other words, the operational closure of autopoiesis demands that the organism be an open system.”24 This nuanced concept of closure also informs Luhmann’s remark that with second-order systems theory, “The (subsequently classical) distinction between ‘closed’ and ‘open’ systems,” as that was previously defined in regard to allopoietic physical and mechanical systems under strictly thermodynamic regimes, “is replaced by the question of how self-referential closure can create openness.”25 Arguments that assume closure to be the simple binary opposite of openness fall short of the letter and complexity of neocybernetic conceptualization.

Put another way, in order for a system to perpetuate itself, it must maintain its capacity to reduce environmental complexity, which is to say to process it not as direct input but as perturbation catalyzing (internal) structural change. As von Foerster’s “postulate of cognitive homeostasis” has it (and this would certainly hold for autopoietic systems in general), “The nervous system is organized (or organizes itself) so that it computes a stable reality.”26 The challenge we propose to take on here is precisely the one advanced by Hayles in the name of the contemporary technosciences of emergence. To Hayles’s claim that neocybernetics cannot embrace the complexity of contemporary emergences and their permeation of systems boundaries, we reply that these processes can be understood through the correlation of systemic closure and openness. What is needed is a generalization of the openness-from-closure principle that is capable of addressing the full complexity of contemporary systems operations and envi-
environmental couplings. To develop such a generalization, we propose to explore how various facets of neocybernetics—running the gamut from Varela’s work on living systems to Luhmann’s account of communicational autopoiesis—deploy recursivity to underwrite emergence. Our efforts here are loosely guided by the following postulates. They are intended as initial steps toward specifying what we mean by neocybernetic emergence and toward generalizing its extension:

1. Neocybernetics requires a recognition that there are only two orders of cybernetics or, alternatively, that the shift from a first-order to a second-order cybernetics marks the passage to a general form of recursivity that can (contra Hayles) spiral outwards and thereby create the new at successively higher levels. While such a requirement inheres in all the neocybernetic accounts explored in our volume, it finds exemplary expression in von Foerster’s claim that second-order cybernetics is a “cybernetics of cybernetics” and that a “third- [or higher-] order cybernetics . . . would not create anything new, because by ascending into ‘second-order,’ as Aristotle would say, one has stepped into the circle that closes upon itself.”

2. Neocybernetics facilitates a concept of emergence that differs in at least one fundamental way from the concept of emergence central to contemporary technosciences and the regime of computation. Whereas the latter understands emergence as a movement from the simple to the complex (cf. Wolfram’s maxim: from simple rules, complex behavior), neocybernetics views it as a movement from the chaotically complex to the manageably complex. In line with what Luhmann calls decomplexification, it is a given that any particular system that emerges within an environment is necessarily less complex than that environment (since the latter will always contain many other systems). Indeed, one of the capital advantages of the concept of the self-referential system (as against the notion of the subject) is its delineation of such a system’s capacity to manage environmental complexity and indeed to derive its identity and its autopoiesis from its continual need to reduce the complexity of the environment by processing it through systemic constraints. Our endeavor here will be to produce viable accounts of emergence that meet the terms of Hayles’s objection—and the body of research upon which it draws—by showing how neocybernetics can in fact account for the interplay of complexification and decomplexification in systems that do more than simply maintain their thermal homeostasis or basal autopoiesis. It is our conviction, moreover, that such an account is precisely what lies at the heart of neocybernetics and that what differentiates it from recent technosciences of emergence and computational
accounts of complexity is precisely its more fine-scaled and dynamic account of operational closure.

Here neocybernetics can endorse the objection raised by Ray Kurzweil against Wolfram’s new science—to wit, that it explores the emergence of complex patterns at a first level of complexity, leaving aside the crucial issue of how these patterns self-organize to create higher levels of complexity.29 And, indeed, neocybernetics lends philosophical substance to this objection, since the shift from first- to second-order cybernetics—from cybernetics to neocybernetics—is precisely what renders recursivity capable of self-organization and formal evolution. Once again, it is von Foerster who makes explicit the link between neocybernetics and the commitment to the motif of closure: “The essential contribution of cybernetics to epistemology is the ability to change an open system into a closed system, especially as regards the closing of a linear, open, infinite causal nexus into closed, finite, circular causality.”30

This shift from an equivocal concept of openness to an operational concept of openness-from-closure underwrites a related shift from a representationalist to a constructivist epistemology and ontology. In this way, neocybernetics can address the wavering between two senses of emergence—epistemological and ontological emergence—that has dogged the computational model of emergence.31 Wolfram can claim only to furnish a model of epistemological emergence, even if (or when) he wants to claim more than that; that is why the principle of “computational equivalence” (which states that a computer simulation of a complex process must be as complex as the process itself) furnishes the most powerful argument for his model of emergence. By contrast, neocybernetics, precisely because it invests in circular recursivity, seeks to develop a mechanism for explaining what Hayles (glossing Morowitz) calls “dynamical hierarchical emergences,” which is to say “how one dynamical level enchains and emerges from the next lower one through their intersecting dynamics.”32 Here the extensive similarities between neocybernetics (cybernetics of cybernetics) and Morowitz’s fourth (and to date final) stage of emergence (mind contemplating mind) are telling, since recursivity in both cases forms a powerful vehicle for the reduction of complexity that fuels emergence at the higher level. As specified through recursivity, the pruning algorithms that allow selection of probable conditions from a “transcomputable” possibility-space function in a very similar manner to reentry, the neocybernetic mechanism specified by George Spencer-Brown’s Laws of Form, the recursive introduction of a system-environment distinction into the system itself (for more on Spencer-Brown’s concept of reentry, see the essays by Clarke and Schiltz in this
volume). Following in the wake of these similarities and also of the technosciences of emergence that are undeniably at work in our world today, the task facing neocybernetics—and our various explorations in this volume—can be specified to be that of showing how the ineluctable self-differentiation of a system that must maintain its autonomy over time can yield the emergence of the new, which is to say how it can yield emergence understood in its current usage as the appearance at the system’s global level of properties that do not exist at the local level of a system’s components.

Another way to understand this specification returns us to our claim concerning the specificity of the neocybernetic concept of emergence—namely, that in contrast to the technosciences of emergence, it proceeds not (like some latter-day Herbert Spencer) from the simple to the complex, but rather by way of system-specific and system-internal reductions of hypercomplexity to ordered complexity. This is the meaning of von Foerster’s statement that it is we who invent the environment that we perceive and of similar claims appearing in Varela’s conception of the “surplus of significance” and in Luhmann’s account of contingent selectivity. Indeed, these claims all instance the operation of an epistemological constructivism that is common to all of the contributions in this volume, including those, like Mark Hansen’s and Ira Livingston’s, that manifest some doubts about Luhmann’s strong constructivism. For these critics—and here is what differentiates their accounts of emergence from the more positivist technoscientific account of Hayles—the insistence on the value, indeed the necessity, of constructivism becomes all the more imperative in the wake of the unprecedented technological complexification of the environment that coincides with the massive dissemination of computational systems throughout society.

Indeed, both Livingston and Hansen turn to constructivism as a helpful, if not ultimately sufficient, resource for reconceptualizing human agency as technically distributed agency. Even if their contributions evince a belief that contemporary environmental complexity has largely outstripped the capacity of systems to reduce it, their conceptualization of hybrid forms of agency—encompassing humans and technico-environmental processes—continues to invest in the minimal Luhmannian commitment that shores up all the configurations of neocybernetics collected here: the idea that selection is key to instituting difference into what would otherwise remain undifferentiated chaos. For these critics, it is the case that environmental processes have independent agency in technically distributed cognitive processes, but this reality does not in any way obviate the value of partial and provisional closures—closures that cut across system-environment boundaries—for facilitating observation of technically distributed cognitive operations of “system-environment hybrids.”
Distinction and Assemblage

At a more general level, the epistemological constructivism of neocybernetics provides new frames of observation disposing one to mark system/environment distinctions more rigorously. This is an analytical option like any other, but arguably it is one with real purchase on the ineluctable self-reference entailed by and embedded within all descriptions. The self-evident proposition at the self-referential origin of systems theory as a scientific discourse is that “there are systems,” followed immediately by its corollary: “There are self-referential systems.” When Luhmann goes on to indicate that all the heterogeneous assemblages of biotic and metabiotic systems and their environments are just as self-referential as the “self-reflective subject” of Western metaphysics that privileged itself on its supposedly unique possession of reflexivity, the neocybernetic description of systems cuts across the grain of classical logic. Whereas the term “reflexivity” retailed by Hayles, Morowitz, and others retains the subjectivist connotation of “reflection” in “the mirror of the mind,” we have preferred the posthumanist terms recursion and recursivity to underscore that what is being named, from cells to servomechanisms to societies, are the recursive functions of operationally closed observing systems. However, even within the same neocybernetic model, there is an important difference in its theorization of biotic as opposed to metabiotic systems. As Luhmann points out, not all autopoietic systems use meaning as a way to “virtualize” the system/environment relationship. Living systems do not, “but for those that do”—psychic and social systems—“it is the only possibility.”

Key tenets of neocybernetic logic thus run as follows: (1) there are systems; (2) observation is possible only on the part of an observing system; (3) systems are self-referential, and so, in their treatment of matters beyond themselves, paradoxical; and (4) that which is observed as paradoxical in our experience is not necessarily a cognitive aberration but is just as likely to be a necessary component of the possibility of any experience at all. If one presses this logic toward philosophical polemic, it might go like this: Many of the problems of modern social systems are exacerbated by faulty understandings of the real systematicities of things and thus, for all our vaunted rationality, by the subsequent unreal or invalid constructions (read: ideological mystifications) of causes and effects in the world. To better grasp the world that is their ostensible object, the organs of scientific knowledge must accommodate themselves to the recursive paradoxicalities of their own operation. In sum: our understanding of the world comes by way of an assessment of the world’s impact on systems, which is to say on the very systems that give us cognitive purchase in the first place.
In part, then, the goal of this volume is to set aside a lot of the anachronistic semantics that have accreted to “systems” theory and replace them with more viable presuppositions. For instance, one can “rage against the system,” but that rage will proceed on the basis of the momentary well-being of various affective, cognitive, and communicative systems. Neocybernetics underscores that there are operational horizons that put ultimate limits on the disorder of both physical and cognitive systems. At the same time, the evolution of systems feeds on anarchy—sometimes rage is an effective form of communicative irritation. This is just to say that neocybernetic systems theory at its best puts new eyes on and into the world, X-ray eyes that separate ostensibly unitary constructions—nominal identities still freighted with cultural capital but lacking in “substantial” ontology—into multiple systems references. Critics looking at neocybernetics who focus on this “negative” moment in its discourse tend to see it as a particularly soulless idiom of nihilistic deconstruction. What this critique clearly lacks is the conversion experience that “reverses the sign” of systems-theoretical distinction-making from subtractive to additive and that, like deconstruction, factors the play of supplementarity into one’s habits of discursive comprehension. For what drives the work of thinkers like Luhmann and Varela, no less than the contributions that make up this volume, is an interest in bringing an ever-complexifying world into the framework of cognition. What distinguishes the neocybernetics approach from other contemporary cultural theoretical positions is an appreciation of the difficulties and complexities involved in doing precisely that. It is our hope that the essays in this volume will help readers to get that neocybernetic message—to appreciate the importance of systems-theoretical distinction-making—and will allow them to engage productively with second-order systems theory’s rich potentials for further development.

Contents of Emergence and Embodiment

The interview with Heinz von Foerster that begins the volume took place less than a year before he died at the age of ninety-one. He had been interviewed many times by then, but unique to this interview are the answers he gives to questions about the further growth of his own neocybernetic brainchild. His remarks on the line of second-order cybernetic development, from Maturana and Varela’s conception of autopoiesis to Luhmann’s appropriation of it for social systems theory, put to rest any doubt one might have had regarding his opinion on the validity of social autopoiesis. Beyond that, the conversation documents the fabled vivacity of this great thinker, the cultural resources he
drew on as an émigré from Wittgenstein’s Vienna, and the “magical” nature of psychic systems in social communication, working out the resonances that create mutual understanding.

In “Heinz von Foerster’s Demons: The Emergence of Second-Order Systems Theory,” Bruce Clarke examines some of the prehistory of neocybernetics by reading von Foerster’s key 1959 paper on self-organization through the hindsight of his early 1970s work that launched second-order cybernetics proper. Instructively for the culture of his particular scientific practice, von Foerster’s discursive milieu is populated by old and new allegorical figures. Not one but two Maxwell’s Demons bind thermodynamic to informatic self-organization in the 1959 paper, and his own creation, the Man with the Bowler Hat, links that earlier paper with “On Constructing a Reality” of 1973, by way of contrasting the singularity of metaphysical solipsism with the multiplicities of epistemological constructivism. Not only does it take multiple demons to conceptualize negentropy in informational systems, but it also takes the co-construction of at least two operationally closed observers to produce a reality: “Reality appears as a consistent reference frame for at least two observers.” The concluding section of the essay unfolds this powerful statement from the 1959 paper as a prefiguration of the neocybernetic concept of reentry, by which the system/environment dyad recurs upon and ramifies within the system itself. In Luhmann’s theory, the dyad of mutually closed psychic and social systems is capable of interpenetration and meaningful resonance just because both systems share this same paradigmatic operation, becoming “two observers” that construct out of their coupled autonomies the world as a reference frame for psychic and social realities.

Francisco Varela’s “The Early Days of Autopoiesis” gives his account of the personal and cultural circumstances, the intellectual and academic milieus, within which the concept of autopoiesis was cultivated. Humberto Maturana and Heinz von Foerster play major roles in this narrative, as do other figures, including Jean Piaget, Ivan Illich, and Erich Fromm. Varela cites Wiener, McCulloch, and von Foerster as “the pioneers of the conjunction of epistemological reflection, experimental research and mathematical modeling.” Along with this background in cybernetic epistemology, Varela also stresses the importance of his philosophical readings from Husserl and Merleau-Ponty for the development of his scientific work. Throughout this engaging reminiscence of a turbulent and seminal period culminating in his self-exile from Chile in the aftermath of the assassination of Salvador Allende, Varela illuminates the paths that eventually led him “from autopoiesis to neurophenomenology.”
As Varela has reminisced about the formative period of his own science, in “Life and Mind: From Autopoiesis to Neurophenomenology,” philosopher Evan Thompson opens his essay, drawn from a talk given at the 2004 Varela Symposium in Paris, with a memoir of the circumstances of his earliest encounter with Cisco. Fifteen years after that meeting in 1977, Varela, Thompson, and Eleanor Rosch would publish *The Embodied Mind: Cognitive Science and Human Experience*, which introduced a general readership to the scientific work Varela et al. had developed by then at the conjunction of epistemological reflection and experimental research. The neocybernetic theme of operational recursion emerges here as “the ‘fundamental circularity’ of science and experience.” Thompson follows out the lines that link neurophenomenological research to the “embodied mind” implicit in Maturana and Varela’s initial formulations of autopoiesis and ultimately in Maturana’s pre-autopoietic insights in “The Biology of Cognition,” then traces forward Varela’s own refinements of autopoietic cognition in his careful unfolding of embodied “sense-making” through a concatenation of recursive emergings, from life to self to world, and thence to “cognition, in the minimal sense of viable sensorimotor conduct.” Emergence and embodiment dovetail when Thompson proposes terms for understanding Varela’s late rapprochement with the notion of teleology, not as the source or goal of autopoietic organization, but as an emergent domain arising from the coupling of an autopoietic system to its enabling environment, its embodied world.

In “Beyond Autopoiesis: Inflections of Emergence and Politics in Francisco Varela,” John Protevi also traces key turning points in Varela’s work. Protevi focuses especially on the concept of emergence, which was always central for Varela, and on questions of politics, which operate at the margins of Varela’s thought. He divides Varela’s work into three periods—autopoiesis, enaction, and radical embodiment—each of which is marked by a guiding concept, a specific methodology, a research focus, an inflection in the notion of emergence, and a characteristic political question. Protevi investigates the implicit “political physiology” of Varela’s work—that is, the formation of political states and politically constituted individuals and their intersection in political encounters. Protevi maintains that in each register of political physiology the emergence of systems should be thought in terms of the resolution of the differential relations of a dynamic field. Varela had to move “beyond autopoiesis,” in Protevi’s view, precisely to be able to thematize such dynamism, as the recursive structure of the autopoietic system inhibits the ability to conceive of dynamic change. In other words, for Varela autopoiesis is bound to synchronic emergence (part-whole relations), whereas enaction can account for
synchronic and diachronic emergence (creation of novel organization), and radical embodiment can account for synchronic, diachronic, and transversal emergence (body-brain-environment loops). Protevi sees this latter, wider conceptual scheme as necessary to an understanding of political encounters in all their dimensions.

In line with Thompson and Protevi, in “System-Environment Hybrids” Mark Hansen also focuses on Varela’s conceptualization of emergence with the coupling of autopoietic systems and embodied environmental worlds. His specific aim here is less to explicate the trajectory of Varela’s thinking for itself than to position Varela—and specifically Varela’s decoupling of autonomy (closure) from autopoiesis in his key 1979 text, *Principles of Biological Autonomy*—at the origin of a mode of conceiving contemporary cognitive agency as massively technically distributed. Varela’s decoupling of autonomy from autopoiesis facilitates the deployment of closure at a higher level of inclusiveness and with a complex internal differentiation. Such a modification is necessary, Hansen argues, if we are to theorize the multiple and differentiated levels of autonomy that characterize what he calls “system-environment hybrids” (sehs), complex, hybrid forms of embodied, cognitive enaction that involve human cognizers coupled with technically advanced environmental processes wielding their own agency. Drawing inspiration from Bruno Latour’s description of contemporary human/nonhuman hybrids as “rather horrible melting pots,” Hansen positions sehs at cross-purposes to Luhmann’s description of operationally closed systems functioning through effective decomplexification of the environment. According to Hansen, it is precisely such decomplexification that has become both highly problematic and atypical in today’s technosphere, where we are continually acting together with cognitively sophisticated machines; in our technosphere, the agency and complexity of the environment simply cannot be reduced to a function of a system.

While Hansen follows Luhmann in maintaining that selection is key to instituting difference into what would otherwise remain undifferentiated chaos, he departs from Luhmann when he asks whether the institution of difference might rather cross over system-environment boundaries and thus underwrite hybrid forms of agency comprised of human beings and complex technological processes. In this endeavor, Hansen draws on the work of Katherine Hayles, Andy Clark, and Félix Guattari, all of whom argue for the need to complicate the concept of closure in light of the technically rich environments in which we live and act in our world today. To develop a strong account of environmental agency, Hansen turns to two French thinkers—political philosopher Cornelius Castoriadis and biophenomenologist Gilbert Simondon—whose
work helps to expand the impact of Varela’s decoupling of autonomy from autopoiesis. Combined with Varela’s insistence on the integrity of the human and on continuity across divergent levels of being, Castoriadis’s differentiation of levels of autonomy and his conception of radical creativity and Simondon’s privileging of the agency of the environment (what he calls the “preindividual”) in the operation of all processes of individuation furnish the tools necessary to theorize, in a broadly neocybernetic mode, the functioning of sehs that emerge in the wake of the contemporary complexification of our technosphere. Rather than possessing institutional (autopoietic) closure that cuts across the human, today’s sehs are created and dynamically evolve through what Hansen calls “technical closures,” provisional forms of closure facilitated by contingent conjunctions of humans and technologies.

One major goal of this volume is to work through the lingering controversies over the purchase and application of the concept of autopoiesis, without blurring the important differences staked out by the key theorists involved but also in hopes of illuminating the shared commitments that gather the wider discourse of neocybernetics together. Thus we have deliberately brought the work of Francisco Varela and Niklas Luhmann into direct contact, and we invite our readers to determine their own positions within the powerful neocybernetic force field they generate between them. In “Self-Organization and Autopoiesis,” our excerpt from Einführung in die Systemtheorie (Introduction to systems theory), Luhmann introduces his reformulation of autopoiesis by distinguishing it from another, closely related but earlier, systems concept with which it is often confused, namely, self-organization. This concept arose in the heyday of first-order cybernetics but even then marked the turning of classical cybernetic interest toward the manifestly autonomous behaviors of biotic and metabiotic systems, relative to their mechanical and computational counterparts. In contrast, autopoiesis was a second-order cybernetic concept from its inception, marking the initial fulfillment of von Foerster’s heuristic formulations of “recursive mechanisms in cognizing systems.”

The fact that self-organization remains a fundamental concept in the contemporary sciences of emergence indicates a sidelining or dismissal of the second-order, autopoietic approach. We see it as a kind of first-order hangover of the atavistic desire to endow computational systems with the facilities of a body, a desire best epitomized in the development of artificial life research, and brought to powerful and ironic narrative realization in Richard Powers’s Galatea 2.2. Luhmann formulates the distinction in concise terms: self-organization relates to autopoiesis as structures relate to systems. The important point is not that certain systems “are” self-organizing, but rather that because certain
systems are self-referentially or operationally closed, their formation of internal structures can result only from processes of self-organization. As Luhmann puts it, “there is no importation of structures from elsewhere.” To develop this point, Luhmann works through a series of notions—expectation, memory, and the determination of the observer—relating the structurality of autopoietic systems to their temporality. Systemic structures partake of the time of the system and have effect only in the present moment of its operations. This contingency is most concretely obvious in the life of a cell but is also enshrined in the truism one applies to psychic and social systems, minds, and relationships: *Use it or lose it*; an autopoietic system is always about the business, from moment to moment, of reconstructing its structures.

The continuation of the Luhmann excerpt takes up autopoiesis proper and includes some important reminiscences of his conversations with Maturana. For instance, Luhmann gives his version of the anecdote concerning the *praxis/poiesis* distinction that Varela related about Maturana in “Early Days.” He also joins von Foerster in commenting on Maturana and Varela’s hesitation to apply the concept of autopoiesis to the processes of social communication. It is our hope that the overlapping concerns of the readings assembled in this volume will help to bury this bone of contention and allow everyone concerned with the further development of neocybernetics to move on to more fruitful initiatives. What unites all of the essays assembled here is the concept of operational closure. As Luhmann explains, the recognition of operational closure “is connected to a break with the epistemology of the ontological tradition that supposed that something from the environment enters into the one who cognizes and that the environment is represented, mirrored, imitated, or simulated within a cognizing system. In this respect the radicalism of this innovation is hard to underestimate.”

In “Space Is the Place: The *Laws of Form* and Social Systems,” Michael Schiltz examines a key resource for neocybernetic innovation, George Spencer-Brown’s *Laws of Form*, a work of overarching importance in Luhmann’s later studies of the functional systems of society and their culmination in the—deliberately paradoxically formulated—“society according to society” (*Die Gesellschaft der Gesellschaft*). Unsurprisingly, Spencer-Brown’s “calculus of indications” had previously captured Heinz von Foerster’s attention. In his *Whole Earth Catalog* review first run in 1970, von Foerster enthusiastically proclaimed *Laws of Form* a book that “should be in the hands of all young people.” In 1975 Francisco Varela deemed it a “calculus for self-reference.” Yet for all its seminal qualities, *Laws of Form* remains a subject of contention, particularly on account of its dense, at times koan-like, vocabulary (for instance: “distinction is perfect conti-nence”). In Schiltz’s illuminating treatment, Spencer-Brown’s calculus presents
a protologic of distinctions, rehearsing the forms of any possible observation. From this angle, it derives its importance from its unusual realization and innovative expansion of topological awareness. It addresses something not often realized, the contingency of Euclidean space—in particular two-dimensional space—and demonstrates that by reconceiving the form of space, we may meaningfully and more easily conceive of forms that “reenter” their own space. For instance, distinctions written on a torus “can subvert (turn under) their boundaries, travel through the torus, and reenter the space they distinguish, turning up in their own forms.”

This reconceptualization of space has wide-ranging consequences for epistemology. For example, it informs Luhmann’s description of the autopoiesis of psychic and social systems, which must reenter the system/environment distinction into themselves in order to observe their environments. By stressing the operative nature of this process, Spencer-Brown thus presents the mathematical foundations underlying second-order cybernetics’ insistence on constructivism and self-reference, or autology. Its long-standing appropriation of Laws of Form shows how fundamentally second-order cybernetics’ view of the possibilities and conditions of knowledge differs from traditional epistemologies. Shifting from the world of things to the world of observations, self-reference comes full circle: “Our understanding of the world thus cannot reside in some form of discovery of its present appearance (out there, beyond observation), but comes from remembering the conventions agreed to in order to bring it about.”

Drawing on Luhmann’s systems theory and Spencer-Brown’s concept of form, Edgar Landgraf’s “Improvisation: Form and Event—A Spencer-Brownian Calculation” theorizes the operational closure of the art system and its consequences for our understanding of the artist, the creative process, and the experiencing of art. The first part of the essay looks at improvisation historically and argues that the twentieth century’s celebration of spontaneity and improvisation in art, as well as the emphasis put on performance and effect, are long-term consequences of aesthetic codes that became dominant in the late eighteenth century. These codes secured the reproduction and social autonomy of art but also challenged traditional notions of agency in art. The aesthetics of genius reacted to these challenges with paradoxical figurations of intentionality. In their place, Landgraf suggests that we understand the art-creating process as self-ordering, as a process that reduces the complexity and contingency it finds in its environment according to programs it devises for itself. Such descriptions of the creative process are able not only to theorize the autonomy and heterogeneity of artist, artwork, and art system, but also to account for the increased prominence of contingency and improvisation in modern art.
In the second part of his essay, Landgraf explores the neocybernetic shift from an ontological to an operational viewpoint, in order to account for the emphasis improvisation (and contemporary art in general) puts on performance and effect over depiction and meaning. In line with Schiltz’s discussion of *Laws of Form* as a protologic, Landgraf shows how Spencer-Brown’s form concept allows us to conceive of art in pre-representational terms: we can understand the “experience” of cognitive engagement with art without having to assume an interpretive stance toward the work, but also without having to subscribe to ontological notions of “materiality” or existentialistic definitions of the human body and our being-in-the-world. Instead, we can comprehend the artistic *event* as created by the multiple, conscious and subconscious, operations the psychic and nervous systems (learned to) perform when they observe, relate to, identify with, ignore, reflect on, and let themselves be surprised by the artistic irritations they find in their environment.

Linda Brigham’s “Communication versus Communion in Modern Psychic Systems: Maturana, Luhmann, and Cognitive Neurology” continues the focus on perceptual systematics by assessing the relationship between modern social time and some peculiar instances of so-called temporal disruption in individual experience. Her essay explores the impact of the global, univocal time that has become increasingly necessary for the functioning of advanced technological society, a society in which performing appropriate actions at appropriate moments is critical. Global modernity demands the orchestration of a huge array of human activities and places a premium on the interpenetration of unambiguous linear temporal measures with psychic systems. In order to illuminate the implications of this interpenetration, Brigham explores three instances in which psychic systems hesitate or fail to articulate themselves linearly in time. The phenomenon of the phantom limb, the intrusive memories that often follow trauma, and the lingering sense of the dead that constitutes grief all comprise conditions in which the past is experienced as in some way present. Brigham’s accounts of these temporal disruptions portray them as posing differing degrees of threat to linear temporal autobiography.

Brigham argues that these temporal disruptions of autobiography, particularly trauma and grief, introduce affective limits to the inroads of communication—in Luhmann’s sense of the medium of social systems—on psychic systems and instead constitute the basis for affective contagion, a source of social cohesion in which the closure between psychic systems and social systems appears to be in some way breached. Indeed, it may be that in the context of affective contagion certain high-level autopoietic distinctions between system and environment are radically altered, and a range of salience emerges that is
not generally at the command of psychic systems interpenetrated by modern social systems. This scenario suggests that Fredric Jameson’s observation of the waning of affect in modernity has a systems-theoretical foundation.

Cary Wolfe’s “Meaning as Event-Machine, or Systems Theory and ‘The Reconstruction of Deconstruction’” returns to the neocybernetic disarticulation of psychic and social systems. Decisively confirming the breadth of systems theory’s philosophical credentials, Wolfe’s essay aligns the work of Niklas Luhmann and Jacques Derrida as both converge on the problem of meaning—its form, its systematicity, and its function. Wolfe argues that Derrida and Luhmann bring to bear on the question of meaning remarkably similar theoretical stances whose chief characteristics include difference, differentiation, distinction, and temporalized complexity. This convergence has been difficult for readers to grasp because Derrida and Luhmann approach the same theoretical terrain from opposite directions and with rather different purposes. Where Derrida assumes the entrenchment of an always already logocentric philosophical tradition that must be shown to deconstruct itself, in the process revealing the various forms of difference and complexity of meaning (Derrida’s “writing”) that such a text represses, Luhmann’s functional analysis is concerned with how difference and complexity are adaptive problems for systems that need to continue their auto-poiesis in the face of overwhelming environmental complexity. For Luhmann as for Derrida, systems use “codes” to reduce and process complexity, but for Luhmann as for Derrida (as in his concept of the grammé in Of Grammatology), the fundamental nature of those codes is self-referential paradox that cannot be overcome but only temporalized.

These shared theoretical commitments enable Derrida and Luhmann to disarticulate psychic and social systems, consciousness, and communication (a position long familiar to readers in Derrida’s critique of the elevation of speech over writing and the auto-affection of the voice as presence in his early work), the better to specify the ways in which they do, and do not, interpenetrate. For both, communication is possible only as a form that transcends dependence upon perception and consciousness. As Derrida puts it, meaning understood as “writing” comprehends language in the more narrow sense. Both communication and consciousness, however, use the form of meaning, and the medium that allows their interpenetration is language, a second-order evolutionary achievement that, Luhmann writes, “transfers social complexity into psychic complexity” and one that becomes more and more powerful—more and more communicative—in the evolutionary drift from graphic and alphabetic writing to printing, which further decreases the reliance of communication upon perception.
Both Derrida and Luhmann, then, undertake two crucial disarticulations that make their work thoroughly anti-representationalist and resolutely posthumanist: on one hand, of psychic systems and consciousness from social systems and communication, and on the other, of language in the strict sense as a type of “symbolically generalized communications media” (Luhmann) from the more fundamental dynamics of meaning that comprehend it. For both thinkers, in other words, language may be human, but meaning is not, and this allows us to think the relations between human and nonhuman worlds (technical, social, animal, and biological) with a renewed appreciation and understanding for the henceforth virtual space that they co-constitute in their processes of making meaning.

In “Complex Visuality: The Radical Middleground,” Ira Livingston provides our volume a coda from the side angle of cultural studies. Livingston examines a number of the claims this volume makes for neocybernetics by viewing them through the lens of contemporary visual culture. What, Livingston asks, can postmodern constructions of visuality “tell us about notions of emergence, complexity, and systematicity?” In line with Hansen’s interrogation of the potential for “system-environment hybrids” to breach the system/environment distinction and Brigham’s investigation of cognitive phenomena that appear to suspend notions of operational closure in psychic systems, Livingston seeks to delineate a “radical middleground” wherein the problematics of the contemporary visual field situate a continually emergent intermedial space between figure and ground, system and environment. Occupying his own discursive middleground both inside and outside the parameters of neocybernetic concepts, Livingston offers a performative critique of this volume’s philosophical polemics. Sympathetically skeptical, Livingston’s pointed inquiries clarify what is at stake in the volume’s strong construction of neocybernetics’ continuing relevance to current theoretical and cultural debates.

*Emergence and Embodiment* is a collective effort to update the historical legacy of second-order cybernetics. In order to understand today’s hyperacceleration of technoscientific incursions into the human and in order to arrive at more highly articulated observations of the systemic situatedness of cognition, all of the contributors correlate epistemological closure with the phenomena of ontological emergence. In this respect, and despite their diversity, they forcefully testify that the latter cannot be understood independently of the former. The contemporary understanding that the human is and has always already been posthuman could not have emerged, and cannot be rendered productive, without the perspective afforded by neocybernetic recursion.
Notes

2. Ibid., xvi.
3. Ibid., xvii.
5. Ibid., 1–2.
6. See Ashby, An Introduction to Cybernetics.
10. Ibid., 110.
13. Ibid.
15. Latour, We Have Never Been Modern, 12.
18. For an extended rehearsal of the “neocybernetic posthuman,” see Clarke, Posthuman Metamorphosis.
21. Ibid., 280.
22. Ibid.
24. For the full development of this line of thought, see Evan Thompson, Mind in Life.
25. Luhmann, Social Systems, 9; our emphasis.
28. See Wolfram, A New Kind of Science.
29. See Kurzweil, “Reflections on Stephen Wolfram’s A New Kind of Science.”
31. Silberstein and McGeever, “The Search for Ontological Emergence.”
32. Hayles, My Mother Was a Computer, 30.
34. Varela, “A Calculus for Self-Reference.”