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Second-Order Cybernetics, Radical Constructivism, and the Biology of Cognition: Paradigms Struggling to Bring About Change[1]

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This column is a journey that considers both the failure of second-order cybernetics (SOC), radical constructivism (RC), and the biology of cognition (BoC) to achieve wide acceptance, particularly in science, and the opportunities for SOC, RC, and BoC in the social sciences and other disciplines.

I. Introduction:

For most human beings, the concept of objectivity frames one's view of the world without being aware that it has been so framed. There is a tradition going back to Xenophanes, born in the sixth century BCE, who pointed out that we can't know that we see the world as it is, "for if he succeeds to the full in saying what is completely truth, he himself is nevertheless unaware of it" (Glasersfeld, 1984, p. 25). This has never been popular or a widespread idea.

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Heinz von Foerster consistently pointed out the idea that we invent the world rather than discover it—a concept that is one of the underpinnings of second-order cybernetics and radical constructivism, and a concept that is supported by Maturana's explanation of cognition in his famous paper, Biology of Cognition (1970). Many of us had hoped that the work of Glasersfeld, Foerster, and Maturana would substantiate these ideas in science by providing close reasoning and evidence for them, but this did not happen. My journey began with Heinz von Foerster, BCL, and Herbert Brun, in 1967, and lead to a multi-disciplinary thesis supervised by Brun and Foerster and followed by a career in educational psychology, counseling psychology, and as a composer of thorny art music. The three braided strands identified in the title have continually shaped my teaching, practice as a psychotherapist, and practice as a composer, as well as my understanding of the world and of who we are as human beings. My disappointment is that, over the last 50 years, the overlapping and interlocking ideas of radical constructivism, second-order cybernetics, and the biology of cognition have not resulted in a paradigm shift in the sciences concerned with human knowing, especially biology. The existing and developing insights which characterize second-order cybernetics, radical constructivism, and the biology of cognition are not being incorporated into new research in the sciences, especially in the natural sciences, nor are the insights from these three strands of thinking finding their way to wider audiences who could use them. In this column I consider some of the aspects that have contributed to both negative and positive developments that have been taking place. In considering this topic, we will proceed through seven sections, as follows:

Section II provides a brief description of the overlapping thrust of SOC, RC, and BoC as understanding science and all human understanding as resulting from observations of closed, circular systems (us) who do not have access to a world independent of ourselves.

Section III considers how the way in which science has come to be done in disciplines that function as silos inhibits change in the overall paradigm of science as an exercise in "uncovering a 'real' world" (Glasersfeld, 2012, p. 139).

Section IV takes up the positive side of recent developments by considering the question: What happens when a discipline becomes the focus of its own practice?

Section V considers how, when multiple disciplines come together to work on a topic (as in the Macy Conferences), they forge common language across disciplines, and, in the process, each discipline looks at its own practice.

Section VI takes up the ethical implications of the practice of SOC, RC, and BoC—implications seldom talked about, but which are always just beneath the surface of our practice.

Section VII is a set of concluding statements.

II. Characterizing Commonalities among Second-Order Cybernetics, the Biology of Cognition, and Radical Constructivism

The thrust of radical constructivism (as developed by Glasersfeld) is that our knowing is a key that allows us to reach a goal; we cannot perceive or describe or represent the world as it is. Knowing is circular: "The mind organizes the world by organizing itself" (Glasersfeld, 2012, p. 139); that is, we organize the world by organizing our own knowing.

The thrust of second-order cybernetics is that the observer is always a part of the observation. This means that our descriptions do not describe an independent world; they describe a world where our descriptions say as much about ourselves as about what we are describing. Additionally, all systems—physical, biological, social, and mechanical—are circular systems. While this is, in one way, merely axiomatic since circularity is part of the definition of what it means to be a system, it is an extraordinarily useful truism in that it affords looking at complex entities and situations in ways that allow us to investigate their circularity.

The thrust of the biology of cognition, as developed by Maturana in the Biology of Cognition (1970) and related papers, is that the nervous system is a closed circular system and cannot apprehend the world directly—whether we are talking about perception in a bee, a frog, a human, or a machine.

For the purpose of the following discussion, we can summarize the assumptions as follows: Every nervous system, in whatever species, is a closed circular system with no direct access to an outside world. Knowing is always circular. Our descriptions do not describe an independent world; they describe a world where our descriptions say as much about ourselves as about what we are describing.

In contrast to these assumptions,

1. Science uncovers a "real" world.
2. Science is objective and independent of personal interests.
3. Truth is discovered through observation and/or experimentation. Discovered truth is embraced, though not always immediately, and becomes part of human understanding. For example, Galileo is regarded as an exemplar of the triumph of rational belief based on scientific discovery over irrational belief based on authority.
4. The practice of science takes the stance that observations are made as if from an objective viewpoint. Among other things, this means that objects and qualities (as identified and measured by instruments or trained observers) are assumed to be part of an objective world, as if the observer has no part in what is identified or measured.

To be sure, Kuhn (2012) poked a few holes in this picture by pointing to the resistance of science to paradigm changes. However, the change we speak of here calls into question the idea that science is an escape from our own biases as observers. It's not that human beings are unaware that all human beings are biased; it's that there is a belief that human beings can escape this bias through science.

We may be reaching a point in our history where belief in objectivity interferes with the ability of science to study itself and exacerbates science's tendency to move all problems into an external realm where they cannot be solved because their connection to usefulness and desirability has been lost. For example, we have no way of approaching regional and world-wide problems in an age of cultural diversity except to fall back on science as the one objective and true thing that everyone must accept—which does not work.

One argument for accepting a biologically founded, constructivist view is that by becoming aware of the limits of our knowing, we can expand science to better study those limits—and our own biases. The point is not to diminish science but to enlarge it to better study itself so that humanity can better study itself and its own knowing.

The remaining sections of this paper develop insights about the difficulties in bringing about paradigm change. The next section considers disciplines as silos.

III. Disciplines as Silos That Inhibit Change

First-order cybernetics fit very well with the goals of power over both man and nature and with the idea of science as objective. First-order cybernetics was relatively easy to accept because, while nibbling along the edges of objectivity and the idea of an objective observer, first-order cybernetics does not require users to deal with the assumption of objectivity in science. The demise of cybernetics at von Foerster's BCL (Biological Computer Laboratory) came when public funding came to an end (Müller, 2012; Umpleby, 2003). Applying for private funding brought, in one case, the response that "the people at BCL did not understand the philosophy of science. They held the conventional view that science involved removing the observer from scientific observations, not paying attention to the observer" (Umpleby, 2003, p. 162).

I cannot image a bigger change in the paradigm of science than a move from the view of science as uncovering a "real world" (Glasersfeld, 2012, p. 139) to the view of human beings as closed circular systems who cannot uncover a world independent of its observers. Keeping this mind, we will not focus on the difficulties of making this specific change, but on the more general forces that inhibit science from taking this alternate view seriously.

A change in the paradigm of what science can know seems to have become almost impossible; or, if it did happen, it would be largely irrelevant because almost everything that happens in science takes place at the discipline level. At the discipline level itself, it is difficult to imagine a paradigm change unless an overwhelming number of practitioners of the discipline experienced a need for change. Even then, it is uncertain as to whether funding agencies would respond positively.

In other words, an individual or small group of researchers might change their paradigm about a specific set of ideas or practices within their discipline; but why would they propose a project or write a paper that might eliminate them from the cycle of proposal, funding, research, and publication—a cycle that in its modus operandi is both normative and conservative? Researchers just don't do anything in their proposals that does not follow established guidelines. In as much as research funding comes from adhering to exactly what the request for proposal calls for, and publication comes from adhering to exactly what is expected by research journals and those who peer review their papers, there is a very strong dis-incentive to depart from the norm. Not surprisingly, BoC has been better received in the social sciences (which are often not funded by outside agencies) where BoC has become a metaphor for social processes, a result that may not have been intended by Maturana but which was, perhaps, inevitable.

The nature of a discipline (or sub-discipline) as exclusionary is nowhere more evident than in its language. One cannot easily read the literature of another discipline or sub-discipline because one doesn't have the background or the vocabulary.

Each discipline develops its own language as a consequence of the need to understand and to be understood in an efficient way. It's easy to criticize this state of affairs, but it is entirely understandable and probably even necessary for the development of a discipline. The development of highly-specialized language allows a specialized group to function efficiently and unambiguously. This is not a matter of how esoteric the subject matter is. In the past, every trade had its own specialized vocabulary. For example, woodworking was highly specialized; and there were terms for all the specialized tools, processes, and products, allowing everyone involved in the trade to communicate efficiently and unambiguously about every part of windows, doors, casings, and moldings. These words have fallen into disuse by the thousands, but similar traditions continue at your local auto parts store and numerous other specialized technologies. The point is that this situation is probably unavoidable; and getting rid of jargon is not reasonable or possible and, therefore, not a solution to the problem of disciplines as silos.

Proposals for change in the paradigm of science as a whole are going to be in a more generalized language that is understandable across disciplines. Because of that, researchers are likely to consider issues such as the objectivity of science largely, if not completely, irrelevant to one's own research and to the functioning of one's discipline—even though they might lead to changes in one's research. In addition, like any closed group, there's likely to be suspicion in regard to communications about the functioning of the discipline that do not come from within the discipline. It may even be easy for members of a discipline to reject outright arguments about problems in that discipline from anyone outside the discipline (for example, someone from second-order cybernetics concerned about the nature of the observer).

A problem with the topic bias in the conceptualization and the doing of science is that there is a built-in bias against bias, as if it is bad and can be avoided or eliminated. In science, bias means not being objective and disinterested (as in not having a personal stake in something). Bias in any system that does not examine its own functioning and circularity becomes invisible. Science has become such a system, hopefully only temporarily.

Questioning the assumptions of science within a discipline—including how the discipline operates—is likely to raise enormous amounts of cognitive dissonance within and between individuals. The greater the cognitive dissonance, the more likely it will be resolved in favor of existing ideas and beliefs. The idea that science doesn't uncover a "real" world creates a maximum amount of cognitive dissonance. It should be no surprise that a threat to existing ways of thinking about and doing science should be seen as absurd, irrelevant, or dangerous. For example, I remember Maturana saying that his colleagues urged him to abandon the work (personal communication) that became the set of ideas known as BoC, or the biology of cognition--especially Biology of Cognition (1970) and Reality: The Search for Objectivity or the Quest for a Compelling Argument (1988). Maturana explained that he himself, when he first began to develop the ideas that constitute the Biology of Cognition (1970), wondered if he might be going crazy. In other words, the greater the cognitive dissonance it creates, the more likely an idea is to be rejected and then avoided.

A human activity that does not consider its own circularity cannot easily be aware of how it operates. But why would a discipline consider how science functions, if science—including one's own discipline—is a method of objective discovery? Even if individuals or groups do become aware of the need to examine the circularity of their own practice, they are likely to have no control over the larger system of funding and publication that makes science what it is at this time. In addition, if there is no need to consider basic ideas about observation and objectivity in order to carry out research programs, then it would seem a waste of time to consider such ideas. In fact, there is likely to be a dis-incentive to spend time pursuing ideas that make one less likely to be funded or published. This doesn't mean that there isn't a larger need for science to reconsider its assumptions; it's more the case that science has, at least temporarily, lost this ability to examine itself (see discussion in Mueller, 2012, pp 77-91).

The basic conclusion of this section, then, is that there is a stalemate between the traditional idea of objectivity in science and the ideas of circularity and non-representational knowing that characterize SOC, RC (including Piaget's psychology of cognitive development), and BoC. A scientific discipline tends to be closed to paradigms that come from outside itself because they will be perceived as irrelevant—or from inside itself if they differ from the current paradigm because they are a threat—no matter how much empirical evidence and/or how impeccable the reasoning for adoption may be (an exception to this might be the general acceptance of the concept of autopoiesis).

Everything in this section has pointed toward the difficulty of examining one's own practice—a key part of changing one's thinking (including one's paradigm). Everything in the next section is pointed toward considering examples of disciplines that have become the focus of their own practice.

IV: What Happens When a Discipline Becomes the Focus of Its Own Practice?

SOC, RC, and BoC include consideration of their own practice within the scope of their practice. In other words, they undertake to include the study of their own circularity as part of their research. Science does not do this, suggesting that SOC, RC, and BoC are outliers. Viewed in terms of the practice of science and technology, this is accurate, hence the failure of these three research projects. However, in the twentieth and the twenty-first centuries, there are areas of practice that have come so far in the exploration of their own possibilities that they have turned to a focus on their own practice as the subject of their practice. To name a few: design, painting, literature, professional reflective practice, music, and mathematics. When considered in the company of these areas of human culture and accomplishment, it is science that is the outlier, lagging behind other areas of human cultural accomplishment, at least in this one respect. The following paragraphs consider three of these areas, plus second-order cybernetics, organized into four exhibits: painting, music, mathematics, and second-order cybernetics. The discussion of each of these is very brief and is designed to suggest connections, not to make a case for such connections. I leave that to others.

Exhibit 1: *What happens when the discipline of painting becomes the focus of its own practice?*

In the visual arts, painting went through a series of transformations in which the subject of painting turned from representing “what is real” to styles of painting that became more and more abstract. Painting itself became the subject of painting. Eventually, the experience of viewing a painting became the subject of painting. Robert Irwin gave up painting altogether to focus on the viewer's experience as the subject of visual art (Weschler, 2008). He created works of art that were neither performances nor objects but that consisted of subtle changes in environments that changed the viewer's experience of those environments. For example, by putting a single strip of tape at a certain point in an empty art space, he was able to change the viewer's experience of the space. Whereas art has always been the experience of an object (such as a painting) or a performance (such as play or a piece of music), with some of Irwin's work, art ceases to be something external and exists only in the experience of the experiencing person. Irwin turned the subject of painting from the thing being painted to the experience of the viewer.

Exhibit 2: *What happens in composition when composing music becomes the subject of its own practice?*

In music, composers explored the possibilities of melody, harmony, and rhythm. As music became more and more complex and chromatic, more and more possibilities of tonal music were explored. Even Schoenberg's twelve-tone system was an extension of the exploration of tonal melody, harmony, and rhythm. After Schoenberg, composers began to explore serialization of all aspects of music. Sound itself, divorced from any tonal context, became a subject of composition. Music could be an exploration of sound and ways of organizing sound, irrespective of any other contexts. If listeners heard melody or harmony or rhythm, the experiences were considered to be those of the listener and not necessarily what the composer had composed. For example, Herbert

Brun, longtime ASC member and one of my mentors, spoke of composing events of sound rather than the sound of events—in other words, composing events which generated sounds rather than composing musical gestures. When John Cage composed 4'33" (four minutes thirty-three seconds), his famous piece where the performer remains silent and does not play, the intent was not that were would be four minutes and thirty-three seconds of silence; rather it was that the audience would notice that there would always be sounds, regardless of the venue, and that listeners could become aware of these sounds and could hear them as music (that is, organize them as music in their heads because that's what human beings do). Thus, in different ways, composers began to explore the compositional process itself rather than learning their craft and then using it to compose socially recognized musical items such as ballads, movie scores, orchestra pieces, and so on.

Exhibit 3: *What can happen in mathematics when the inventing of mathematics becomes a subject of mathematics?*

I imagine it looks like certain columns written by mathematician Lou Kauffman, which have appeared in this journal (2004 and 2014). In the Kauffman's column, two literary devices, Cookie and Parable, consider the circularity of certain mathematical concepts as well as the circularity of their own existence as it arises in the interaction between text strings and readers. Cookie and Parable (or, indeed, any literary characters) exist neither in the text strings nor in the reader; instead, they come about in the circularity of the interaction of the reader with the text. Kauffman is not only aware of this, he composes his dialogue with this in mind; and he makes this explicit for the reader, pointing out that Cookie and Parabel are text strings that exist only in the minds of those who experience them:

> Their consciousness comes to life only when they are read. And they have a tendency to fall back into the void as soon as they arise. They have much to say about the foundation of mathematics and the foundations of cybernetics. (2014 p. 71)

Of course all literary devices exist only in the experience of the reader; the reader probably knew that but not until Kauffman drew attention to it. Kauffman is pointing explicitly to the characters of Cookie and Parabel as existing only in us as we read the text. There is also another level here. Cookie and Parabel "have much to say about the foundation of mathematics and the foundations of cybernetics" (ibid.). The obvious meaning is that the platonic dialogue between Cookie and Parabel teaches us something of mathematics and cybernetics. Another possible meaning is that the concepts that Cookie and Parabel discuss are themselves things that arise only in the experience of readers as they read and contemplate the text—as does mathematics itself.

Exhibit 4: *What happens when, as a scientist, the place of the observer becomes the subject of one's observations?*

One answer is second-order cybernetics. Second-order cybernetics arises from the contemplation of the scientific exploration of cognition. Cybernetics originates in a stance of objectivity that discovers that its stance of objectivity is not defensible. This is an important point: second-order cybernetics ends up with a different stance than cybernetics started with, a change from a stance of objectivity to what Maturana (1988) refers to as objectivity in parenthesis--an objectivity that results from following the procedures of science but within the limitations of cognition that results from being a closed system.

The following four exhibits attempt to show that second-order cybernetics is one of a number of examples where a discipline developed to the point where its next logical object of study was (is) its own process (not withstanding that Lou Kauffman is simultaneously an intentional practitioner of both second-order cybernetics and mathematics).

In considering all four exhibits, it is interesting to note that those who seek a degree in painting can expect to be exposed to the history of painting. Similarly, someone who seeks a degree in music can expect to be exposed to the history of music. In both cases, the student may not appreciate the historical development of the practice, but she will have been exposed to it. Not so much in science. Few who study science are required to study the history and philosophy of science; few who become scientists are given the opportunity to be aware of science as a series of historical developments. One of those historical developments is the search for an objective understanding of cognition by scientists who were forced to conclude that the neurophysiology of cognition does not allow for objective knowing.

As this section points out, relatively recently, more disciplines have developed an interest in investigation making their own disciplines the subject of their own practice. In second-order cybernetics, when the neurophysiology of the observer can no longer support an objective view of the world, the observer becomes the subject of the research rather than what is observed. There are connections and patterns here that are worthy of further exploration by others.

The next section takes up questions of exploring one's practice across disciplines.

V. Across Disciplines: Looking At One's Own Practice and the Practice of Others so as to Forge Common Language

Entering into conversations across disciplines, as happened at the Macy Conferences, requires one to focus one's own practice in order to forge a common language in which to converse with others. One probably can't forge new language with which to speak to others outside one's own discipline without become explicit about one's own discipline. Further, conversing about the same topic from the point of view of different disciplines, each with its own problems, language, and methods, requires one to consider other ways of thinking about a topic.

A community of multiple disciplines needs a common language to understand, and converse. SOC, RC, and BoC are examples of transdisciplinary language and thinking. The Macy Cybernetics Conferences (1946 to 1953), often invoked as a golden time for cybernetics, is an example of transdisciplinary work meant to benefit a profession, in this case, medicine. The Macy Foundation was (and is) not in the business of promoting basic research per se; it is in the business of holding conferences that will influence medicine in a positive way. As is well known, the Macy Cybernetics Conference participants were all invited; the participants were all well-established leaders in their fields, and none were trained in cybernetics. They were experts in their own areas, not in one another's areas; so they did not share methods, goals, or even a common vocabulary—as is typical of all silos. Yet they did find ways to muddle through and produce something of value. The Macy Conferences worked as a temporary learning community whose members did not share a common paradigm; but they came together as an interdisciplinary group to learn about one another's paradigms—and, in the process, to probably unavoidably explore their own. One challenge in the cybernetics community—a challenge put forward the planning committee led by Ranulph Glanville in the webpage invitation to the ASC 50th Anniversary Conference: ASC Cybernetics in the Future" (ASC, 2014)—is to make available to those outside cybernetics the experience of working in a transdisciplinary way.

An advantage of such opportunities is that to present and develop ideas that will be understood, the group must create language that can be understood by the other people in the room who are not in one's field. The result can be conversations and publications that are accessible to a number of fields. The forged language can be understood by people who participated in the conversations and, hopefully, (with effort) by others in the fields represented by the participants.

Transdisciplinary groups have structures and resources that allow us to work to develop ideas, processes, and products across disciplines—but these groups typically exist for a limited time and a limited number of meetings. The Macy Conferences were unusual in that they were held yearly for seven years (1946-1953). Seven years is a long time for support from a single source but a very short time for meetings in disciplines. The challenge is to keep the transdisciplinary meetings going—and I would see the ASC as one example of a transdisciplinary community within the larger community of readers of this journal.

If it is accurate that science has not been very open to transdisciplinary work, it is also true that some disciplines, including some science disciplines, are more open to transdisciplinary work. In this regard, I was very fortunate that my home field of educational psychology had already found a small place for Piaget by 1967, and for the work of Piagetian scholar Ernst von Glasersfeld, whose radical constructivism has roots both in philosophy and in Piaget's work. Piaget's work is also very compatible with Foerster's ideas about observing systems (otherwise known as second-order cybernetics). My simultaneous association with these transdisciplinary scholars was purely accidental and fortuitous; even so, learning to understand them was a tough slog and could not have continued to happen without being part of a number of communities where these related but diverse ideas, each presented in its own language, could be learned. The opportunity for this kind of learning to take place was what Ranulph Glanville wanted to create through conversation-based conferences. I didn't always see his point, but through the work involved in writing this paper, I am seeing it much more clearly. We can continue to undertake the messy business of becoming a learning community that reflects on itself through conversation-based conferences. This is a very unusual thing for a member of science and professional communities to do. In this regard, the separate and related communities of BCI, of the Foerster/Brun led heuristics seminars (which led to the creation of the Cybernetics of Cybernetics (Foerster, 1974) that was completed after I had left the group), seminars in music and composition taught by Herbert Brun, and both classes and teaching of educational psychology as part of my doctoral work, all served to make me transdisciplinary—and often left me very confused.

I was very fortunate in that Piaget and even radical constructivism found a place within educational psychology and also within the profession of public education (though a smaller place than I had hoped). This has taken many decades to accomplish, but it happened. It is happening elsewhere and it can happen in still more places. And we can be part of it in a deliberate and intentional way—if we can figure out how to do it. This can be done by choosing to figure out how to do it; doing it; revising, through reflective practice (Schön, 1983); and then doing it better or at least differently.

This section has considered a stance one can take with others to create transdisciplinary communication. The next section considers the ethical stance one chooses to take vis-à-vis others in the process of making cybernetics—including SOC, RC, and BoC—available to a wider group of interested others.

VI. Ethical Implications

My own position is very clear: I embrace science as a way to help us understand ourselves and our world. I embrace a larger view of science that investigates its own assumptions and methods. We are not stuck in an inevitable reality over which we have no power; we are responsible for the world in which we live. This does not mean that all ideas and methods are equal. Every set of ideas and methods may be more useful than another set of ideas and methods in achieving particular goals. We may be at a bottleneck in history in regard to our ability to solve problems of justice, conflict, and the environment/climate that we have created for ourselves. Acceptance of a view of human knowing based on the biology of cognition could help move us forward out of the bottleneck. Acceptance, however, cannot flow from an acceptance of the biology of cognition as a scientific truth. That would be a non-defensible assertion. If science does not uncover a "real" world, then no description of reality is privileged as the right and correct one. If no description of reality is privileged as the right and correct one, then the description of knowing as not having access to a "real" world cannot be privileged either, even if support for this view is rooted in the most rigorous science.

In other words, SOC, RC, and BoC are ethical when they apply their findings to themselves. Taken both individually and together, they suggest that there is no set of logical or empirical findings that can require us to think in a particular way. Belief in objectivity, regardless of how unnecessary it may be to do science (Maturana, 1988), is a result of human experience and of historical developments—and this belief was, and is, useful in creating support and respect for science—and scientists. A belief system does not have to be arguably correct for it to be useful; it only has to work.

When we embrace a set of ideas such SOC, RC, and BoC, it is because, for whatever reason, as participants in these projects, we prefer them. We can never prove that they are true. By offering our ideas to others as an alternative to their existing beliefs, we give others a chance to make choices. If we indoctrinate others as if our beliefs are correct and true, then we privilege ourselves. To privilege ourselves means to place ourselves above others, in a position of dominance—which easily becomes a form of violence, whether intellectually, emotionally, or physically. And we become liars. Heinz von Foerster liked to say, "Truth is the invention of a liar" (Foerster & Broecker, 2010, p. 19). Foerster's argument against truth was that truth leads to violence—and besides, it's unnecessary (Bunnell & Vogl, 2000; Foerster & Poerksen, 2002). Herbert Brun had a related saying, "Your belief makes me a liar" (personal communication). That is, your belief in what I say makes me into a liar—I only tell you what I know, not what is true—I can't know what is true. Concluding, our observations can result in extraordinarily useful descriptions of the world—even though we are unable to uncover a "true" or "real" world.

To conclude, to do anything in the way of indoctrinating others to our views is to invite the same potential for violence as every other view that is taken to be privileged. I can only offer SOC, RC, and BoC as interesting, useful, potentially convincing sets of ideas and tools for seeing, understanding, and acting. I cannot even say "we" because ethics implies the choices one makes oneself, not choices one imposes on others.

The final section attempts to summarize in a way that will reflect on this journey and where it has taken me, in the hopes that it will result in us reflecting on where the journey has taken us and to consider where cybernetics might go in the next 50 years.

VII. Endings and Beginnings

I began this column to express the deep sense of disappointment I have felt over the last several decades but have ended realizing that we need to keep working. Our insights can be useful in development of many different disciplines and activities. We might want to design ways to develop and share these insights. Develop and sharing go together; we cannot share what we know without also developing it in the process.

The method of working my way out of my sense of disappointment has been the application of second-order cybernetics to its own failure—and finding that no matter how I might want it to be, every part of the human world follows its own logic. The development of science seems not to follow a rational path but the path of wandering stream, directed in its way by its environment—an environment it changes over the course of time. The need is there. We are trying to give birth to something new. Albert Müller writes:

> The decline of Western cybernetics (caused by a lack of funding) finally lead to the creation of second-order cybernetics and to a constructivist epistemology in the early 1970s. This might be regarded as a major step in the history of science. (2012, p. 58)

From the perspective of the sciences, SOC, RC, and BoC may continue to be viewed as outliers. Viewed, however, from a cultural perspective, SOC, RC, and BoC are part of a wider set of professional reflective practices that is willing to examine its own practice as part of its practice. Can we invent ways of involving ourselves in the wider and parallel universe of practitioners who are already incorporating reflection on their own practice? Can we find sweet spots where others would want our participation? Can we find ways to cooperate with others to create educational experiences—including university education grounded in design, cybernetics, and systems science, as suggested by Stuart Umpleby (2014)? These are examples of ways to connect with others that could be developed by crowd sourcing within the SOC, RC, and BoC communities.

Piaget found that all learning is recursive, which means that all disciplines are recursive, including science. Our job is to help make the recursion a conscious and intentional part of practice. What I learned from reviewing the Macy Conferences is this: Our task is not to teach others; our task can be to collaborate with others, and, in the process, all learn, and in the process, all collaborate, and in the process—you've already gotten the point. A joke: How do you end up with a von Foerster? The Laws of Form got it partly right; the baby makes the same distinctions over and over by doing the same thing over and over: Pick up object, put it down; pick up object, put it down. But every time the object is picked up it is different—even if it's the same object. Therefore every action of picking up is the repetition of a new action. That is, the action is the same but not exactly the same. Piaget calls this a schema. And the schema changes and enlarges, and changes, even as it seems to be the same schema. Every time the baby crosses, the crossing is both familiar and something is added. It spirals all the way up from the baby's first action in the womb until it becomes a von Foerster (or whoever) in the present moment. This is the mechanism of learning and doing. Spiralarity: circularity with a twist. It's what intelligent life does.

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