Title	System Science and the Cybersemiotic Model of Communication
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Citation	
Issue Date	2005-11
Type	Conference Paper
Text version	publisher
URL	http://hdl.handle.net/10119/3935
Rights	2005 JAIST Press
Description	The original publication is available at JAIST Press http://www.jaist.ac.jp/library/jaist-press/index.html, IFSR 2005 : Proceedings of the First World Congress of the International Federation for Systems Research : The New Roles of Systems Sciences For a Knowledge-based Society : Nov. 14-17, 2145, Kobe, Japan, Symposium 7, Session 4 : Foundations of the Systems Sciences Economic and Environmental Issues

System Science and the Cybersemiotic Model of Communication:

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Abstract

The present paper discusses various suggestions for a philosophical framework for a trans-disciplinary information, cognition and communication science. These are: the mechanical materialistic, the pan-informational, the Luhmanian second order cybernetic approach, Peircian biosemiotics and finally pan-semiotic approaches. The limitations of each are analysed. The conclusion is that none of them are satisfactory in themselves to encompass concepts of both (objective) truth and(subjective and social) meaning . A new combination in an enlarged framework is therefore sought. A Peircian-based biosemiotics with autopoiesis theory, second order cybernetics and information science is suggested in a five-levelled cybersemiotic framework. The five levels are 1) a level of Firstness, 2) a level of mechanical matter, energy and force as Secondness, 3) a cybernetic and thermodynamic level of information, 4) a level of sign games and 5) a level of conscious language games.

Introduction

The area of communication theories are one of the most complex, central to understand, humans, culture, meaning, truth and consciousness. It is central to the transdisciplinary ambitions of system science.

The purpose of transdisciplinary theories is to help us frame the problems of understanding man-machine interface, intelligence and linguistic interaction amongst other things by clearing up the epistemological problems of the difference between how digital machines function, and how living systems perceive, think and communicate. Furthermore, it is to find out what the physical, chemical, biological, psychological, and social foundations of communication are, which is a central part of system science

The relation and conflict between informational and semiotic approaches comes into focus in this context. I view the discussion as situated at the crossroad of the scientific worldview and the systems and cybernetic theory of information, general epistemology and the bio-psychological theory of cognition and semiotic theory of signification. The discussion has also been going on for some time within the context of the informational paradigm. Both the informational and the Peircian semiotic paradigms are transdisciplinary paradigms (1) suggesting solutions to our scientific problems of making a unified theory of nature, cognition and mind. The original mechanistic framework of classical physics did not encompass concepts of information and meaningful signs at all. The development of the scientific-technical information concept was the result of a mutual interaction and development within several

areas of cybernetics, communication technology and thermodynamics and the von Neumann computer. The physical ideas from Boltzmann's thermodynamics and from Nyquist (mathematical definition of noise) and Szilard (defining the bit) entered the foundation of information science and interacted with Norbert Wiener's new transdisciplinary framework of cybernetics and the new science and technology of computing (2).

Biosemiotics (3,4,5,6,7) the scientific study of signs and semiosis in living systems, transcends on one hand the pure chemical description of life in molecular biology and on the other hand the traditional idea that semiotics is only the study of signs in the language and culture human beings and includes. Instead biosemiotics include the whole realm of biology under semiotics. Life and semiosis are seen as co-existing. The biosemiotic doctrine accepts non-consciously-intentional signs in humans non-intentional signs, also between animals as well as between animals and humans, and signs between organs and cells in the body and between cells in the body or in nature. Thus the biological processes between and within animals transcends the conceptual foundation of physics and chemistry.

Previous Paradigms of Mater, Mind and Meaning

To clarify the problems, let us start by analyzing paradigms that attempt to explain the whole area from the foundation of nature to human intelligence, consciousness and communication, or put in another way, explaining from the laws of nature to the meaning of humans in culture I will look at the shortcomings of every paradigm. on this basis I will then construct a coherent framework, building on the viable parts of each. This is what I call Cybersemiotics. Finally, I will

present a model of the prerequisites for human communication, concentrating on the informational, semiotic and linguistic aspects of embodied human communications.

At present, I can see six basic significant models within the sciences trying to cover the whole range, from the basic patterns, laws and forces of inanimate nature to the phenomena of life and consciousness within one paradigm and a few all-encompassing basic concepts

1. The mechanical materialistic metaphysics that refuses to talk about information and signs in nature including animals. It often presumes that the phenomenon of thinking in meaningful signs, within humans, is not connected to consciousness or sometimes not even to intentionality. These understandings are often grounded in the view that these phenomena are illusory (eliminative materialism) or at least do not have any form of causal influence on the body. This means that they do not consider intentionality, free will and consciousness to have any real causal effects on things in the physical /real world, including our own bodies. The difference between the physical, the chemical and the biological level of reality is only seen as a consequence of organizational levels.

2. Pan-informational metaphysics where information is seen as an objective part of all nature and culture like matter and energy. Already in 1929 Szilard suggested a converse relationship between information and entropy, referring to Boltzmann's thermodynamics, or statistical mechanics. Shannon and Weaver, in fact, referred to entropy in their own work as well, mainly because of similarities with the equations that dealt with statistical events - equations originally written to describe the outcomes of games of chance. But it was Norbert Wiener who took the full step and declared that information not only is not matter or energy, but that thermodynamic

entropy is the opposite of the statistical concept of information (19) defined as neg-entropy. The result of all this was that information came to be viewed as the opposite of entropy (neg-entropy). Information could be understood as constructing order in the face of disorder. Dissipative structures can be seen as not only organized energy, but gathering information, and simultaneously dissipating energy and making entropy grow.

3. Thus, the concepts of energy, order, and information, on the one hand, and entropy, disorder, and loss of information on the other, became connected in such a way that we perceive information as having something to do with patterned organization and the reduction of uncertainty. Information is then seen as the organizational aspect of nature. Stonier (8) even talks about "the infon" as a basic constituent of nature; much like MacKay (9) SAW "the logon" as the unit of construction in the physical case.

This approach is most often developed within a first order cybernetics metaphysics, which sees the world coming into being as a self-organized system consisting of other self-organized systems. For Wiener and Bateson the breakthrough was to unite the theory of information with the Bolzmanian interpretation of thermodynamics and thereby overcoming the Cartesian duality of mind and matter, but they did not manage to develop this into a full-fledged metaphysics.

4. Many other cyberneticians working with this general model clearly take inspiration from Bertalanffy's (10) General Systems Theory. Here the anti-dualistic view is based on an organismic evolutionary worldview including a theory of emergence and holism with a belief in some kind of continuity between mind and matter that is quite close to Peirce's, but lacking his triadic philosophy. This metaphysical aspect seems to be overlooked by many modern theorists, such as Stonier. But how can such a notion dealing with the creation of form say anything interesting about the nature of discourse?

4. *The Luhmannian second order cybernetics approach* where nature is seen as a source of enumerable differences. Here the cybernetic system decides which difference should make a difference and become information in the organism and its social communication in the human society. Somehow there is a situation in which a cybernetic autopoietic system makes the first distinction by making a difference between the system and its surroundings. Luhmann (11) never explicates the nature of this Firstness before the first distinction as Peirce. Luhmann's idea is originally based on Spencer–Brown (12), who seems to work with a Buddhist inspired theory of the Void or Emptiness, which seemingly contains the potentiality of both mind and matter. But this aspect seems to be lost in Luhmann's theory. Inspired by Husserl, Luhmann embraces concepts of intentionality and meaning but in a Hegelian kind of functionalism minus the spirit. This paradigm, in my view then, is close to the Peircian semiotic view except that it does not have a triadic theory of the sign vehicle and lacks a developed theory about the biological systems' contribution to the generation of meaning (13).

5. *Peircian (bio)-semiotics* is specific from other semiotic paradigms in that it not only deals with intentional signs of communication but also encompasses non-intentional signs such as symptoms of the body and patterns of in-animate nature. It then encompasses both nature and culture. Peircian semiotics breaks with the traditional dualistic epistemological problem of first order science by framing its basic concept of cognition: - *Signification* - on a triadic semiotic philosophy. The triadic semiotics is integrated with a theory of continuity between mind and matter

(*Synechism*) where the basic three categories (*Firstness, Secondness and Thirdness*) are not only inside the perceiver's mind, but also in the nature perceived. This is connected to the second important ontological belief in Peirce's philosophy, namely *Tychism* that sees chance or chaos as basic characteristics of Firstness. This is finally combined with an evolutionary theory of mind (*Agapism*) where mind has a tendency to take habits in nature. Chaos or chance is seen as a First, which is not to be explained further (for instance by regularities). It is the basis of habit taking and evolution. The chaos of Firstness is not seen as the lack of law as in mechanicism and rationalism, but as something full of potential qualities to be manifested individually in Secondness and as general habits and knowledge in the dynamic objects and semiosis in Thirdness (14). This is the deep foundation of Peirce's pragmatism. With chaos as spontaneity at the foundation no laws will in reality be exact. There will always remain a little spontaneity on both the level of Secondness and Thirdness. As a result of the initiative and work of Thomas Sebeok (3,16), Peirce's semiotics is now interpreted as covering all living signifying systems in a biosemiotic approach.

In the biosemiotic interpretation based on *the Peircian triadic semiotic philosophy,* semiosis thus works on a triadic basis in an evolutionary and pragmatic view. The unmanifest Firstness is seen as chaos of qualia, basic form and feeling with a tendency to take habits, which manifests through Secondness and Thirdness. Matter is seen as "effete mind". Matter and mind are united in the continuum of Firstness and develop through "Evolutionary love" into Secondness' manifestations of resistance, force, dualistic concreteness and impenetrability of objects. Secondness provides constraints on perception and cognition in the Thirdness of true triadic sign processes. The term, quasi-semiotic objects then recognizes systems in nature and culture,

working with differences, often in a form of coding, instead of physical causality on one hand and meaningful semiosis on the other. In nature, we are in this context dealing with systems of Secondness that have established an information level above the energetic and causal level of nature. The area, thus delimited from true semiosis, is part of what classical first order cybernetics considered its subject area: goal oriented machines and pattern forming self-organized processes in nature based on information. Still the exact role of the living systems in establishing true semiosis is not very clear in Peirce's theory and neither is the description of the special biological qualities that make this happen.

6. The pan-semiotic metaphysics claims further that all environmental phenomena are ultimately semiotic in their essence. The universe is perfused with signs as the famous quote from Peirce goes. Peirce's three categories are universal. Semiosis is everywhere; either because everything is semiosis in its nature or because the only way we can know anything is through semiosis. The latter is a pan-semiotic constructivism encompassing both culture and nature. The construction of reality is done by the human societies through living together in language. This kind of bio-social constructivism takes this approach very close to Maturana's bio-constructivist development of the autopoiesis theory from a cybernetic perspective. Thus it is close to becoming a human-centered metaphysics (a subjective idealism) with no explicit idea of what nature could be in itself or, to put it another way, what kind of external source there could be for the signs of nature.

The other version is the modern version of pan-semiotics claiming that signs are as real as atoms and energy; actually that latter are also signs. These signs grow by themselves as independent living beings growing by them selves. The pansemiotic interpretation takes

Peirce's statements of teleonomy in causality and that the universe is perfused with signs to mean that whenever there is Thirdness there is semiosis. Then there is also semiosis in inanimate nature. *Physio-semiotics,* as Deely (1) calls it, suggests that semiosis is the core of evolution and at the same time turning back to the original Greek conception of nature that in Aristotle's philosophy is hylozoist like Peirce's.. This means that although there are physical laws so rigid that they are almost pure Secondness, in most laws in evolving nature there is a basic telonomy, which has existed throughout evolution. Here classical physical laws are seen as universal, exact, and deterministic. Thermodynamic laws are by some (15) accepted as genuine statistical and biological "laws" much more teleonomic and semiotic in nature. The fundamental question is if Thirdness really has to bee seen as physiosemiosis?

We will have to define the qualitative differences between physicosemiosis (if accepted), phytosemiosis, zoosemiosis and antrophosemiosis. Biosemiotics has so far only wanted to encompass the last three of them. There are some profound similarities between Peirciean pansemiotics and the organismic view of Bertalanffy's (10) general system theory that also refused mechanism as a possible basis for a scientific theory of evolution. Prigogine's work and his fierce debate with mainstream mechanicists have shown that this is a central problem. The difference between the biosemiotic interpretation and a pan-semiotic one is that the biosemiotic interpretation is limiting the ability of true semiosis to living systems. Biosemiotics considers machine processes and pattern/signal interaction in nature only as quasi-semiotic (not true triadic) processes.

Critique of Current Approaches

The point then is that the description of these levels did exist in different areas of modern science, but they have never been connected in one theoretical or even paradigmatic framework, although this is what mainstream eliminative mechanistic science tries to accomplish but on an insufficient philosophical background. Or to be more precise, the present and past attempts have all had different problems and inconsistencies:

1. Although the classical mechanistic physics could describe certain connections, forces and regularities in nature mathematically, and later with the help of quantum mechanics the stability of matter, it is very difficult to think of actual evolution in a mechanistic worldview with rigid deterministic universal laws and a Newtonian reversible time (15).

2. This is solved in the thermodynamic atomistic view based on complexity, self-organizing dissipative structures and irreversible time. But here it is still difficult to understand how information and cognition can arise and self-organize from pure physical matter and energy.

3. In the pan-informational paradigm information as organizing power is present from the start. This makes self-organization and the emergence of cognition more understandable especially when it is established in general systems theory that has an organismic and emergent evolutionary worldview. But in this view it is still difficult to understand how living systems can arise as individual beings, how they treat information differently from mechanical cybernetic systems, and also what is the special quality of the semiotic creativity of self-conscious linguistic embodied beings.

4. In second order cybernetics and autopoiesis theory, the idea of closure on the biological, psychological and social communicative level explained by the concept of autopoiesis: living systems' self-organizing, self-maintaining and self-producing ability, much clarifies the special self-preserving ability and cognition as well as the creation of an individualistic point of view. The conception - especially of Maturana and Varela and also von Foerster - also comes close to Jacob von Uexküll's Umweltslehre (7). They all represent some kind of bio-constructivism. Unfortunately it tends to be rather idealistic, sometimes even solipsistic in certain formulations while, at the same time, it "paradoxically" insists on the material reality of a biologic(al) observing system.

5. In Peircian semiotic philosophy these levels can be bound together by Synechism, Tychism and Agapism combined with the evolutionary view of the interaction of Firstness, Secondness and Thirdness. The view of Firstness as a blend of mind and matter qualities and as containing qualia and living feeling with a tendency to take habits is crucial to understand the self-organizing capabilities of nature and how, what seem as "dead" matter, through self-organization in evolution can become autopoietic and alive and has cognitive/semiotic abilities and feelings (18). Re-interpreting Uexküll on this foundation creates a biosemiotics that is much more suited to encompass the phenomenological aspect of life and cognition, which is now conceptualized as signification (7). Still, aspects of the development of embodiment, which Uexküll did not think of, are partly missing. Concepts of closure and self-organization of biological, psychological and social systems and their differentiation, developed in second order cybernetics and autopoiesis theory, need to be integrated (6). Both Hoffmeyer and Emmeche do work with these aspects in the theory development, which

is already transgressing the original limits of biosemiotics.

These are some of my reasons for being skeptical about totalitarian and reductionistic explanatory paradigms like mechanicism, pan-informational and a pan-semiotic without thresholds, but also too radical forms of constructivism that are out of touch with any non-linguistic reality. This is why the discussion of the semiotic threshold in a Peircian framework becomes so crucial.

The cybernetic thinking of self-organization and system closure has, in my opinion, made an important contribution to our understanding of living systems. Already Jacob von Uexküll used some basic cybernetics in his "Funktionskreis". We can see the foundation laid both for biosemiotics and biocybernetics (second order cybernetics and autopoiesis theory) in Uexküll's work. But a combination of Peircian semiotics and modern cybernetics is necessary to make the theory broad enough in order to cover what is now called biosemiotics and to make the frame work develop beyond the present stage, encompassing the understanding of the problem of the semiotic threshold, which is a core-epistemological problem. But pure biosemiotics, in name and scope, is partly neglecting or ignoring the contribution of second order cybernetics and autopoietic theory. However, the cyberneticians, even as their work is combined and further developed into the area of human social communication as in Luhmann's work, instead tend to ignore the semiotic component too much. In my view, to be able to combine the fruitful work of both camps a broader foundation is needed. This is why I call my work *Cybersemiotics*.

The cybersemiotic approach that I am working on, attempts to unite cybernetic, systemic informational and semiotic approaches to deal with the problems of self-organization,

intentionality, selection of differences and constructivism avoiding solipsism and idealism. This is – among other things – done by giving decisive attention to the role of body hood in the construction of meaning using the viable parts of the above-described five views by combining informational, cybernetic and Peircian biosemiotic approaches in non-totalitarian or non-pan versions.

The cybersemiotic approach thus ascribes to a Peircian and Uexküllian biosemiotics and combines it with the theories of second order cybernetics (von Foerster) and autopoiesis (18 and 11) that are already visible in Uexküll's "Funktionskreis" (16). It uses a Peircian and ethological extension of Wittgenstein's pragmatic language theory to distinguish between the sign games of biological systems and the language games of humans. It acknowledges the independent being of Firstness and Secondness (what would normally be called the "physical world" but is now based in Peircian metaphysics). Finally it underlines that the cybernetic machines, such as computers and robots are not truely semiotic, but quasi or proto-semiotic. The machines lack autopoiesis, reproduction, code-duality and inner organization of membranes (19) and thus an individually and species based motivation and intentionality (4, and 20). Combining the results of modern science with Peircian biosemiotics the cybersemiotic framework operates with five levels of existence:

1. A primary chaotic level of continuity, quality and potentiality with a tendency to take habits (Firstness) This goes beyond the physical conception of vacuum fields that are still pure materialistic, but may be included as an aspect.

2. A "causal" level of matter, energy and causality by natural forces. This is Secondness that has, as its inner aspect, will and mental force.

3. An informational cybernetic system level of informational signals, which encompasses the goal-oriented mechanical systems described by first order classical cybernetics. Described from a cybersemiotic view, concepts of information as signals of differences only make sense as quasi signs.

4. The semiotic level belonging to all living systems (biosemiotics), which are so far the only systems capable of true triadic semiosis (producing signification spheres in sign games).

5. The level of conscious languaging systems (language games, arguments), to our knowledge so far only occupied by humans.

Sign-making is thus immanent in nature, but only manifest in full triadic semiosis in living systems. Cybersemiotics has, so far, sided with biosemiotics in not accepting physico-semiotics as a full-fledged semiosis. But it may be compatible with Deely's physiosemiotics. That remains the full developments of the theories to see if they will combine into one.

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