# Cybersemiotics

# Why information is not enough!

**A Trans-Disciplinary Approach to Information, Cognition and Communication Studies, Through an Integration of Niklas Luhmann's Communication Theory with C. S. Peirce's Semiotics.**

**Søren Brier, CBS**

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## Summarizing the book's view of the subject area and Cybersemiotics[1]

The scientific endeavor in the post-modern age is becoming increasingly complex and trans-disciplinary. Researchers and practitioners within the fields of the arts and the natural, medical, and social sciences have been forced together by new developments in communication and knowledge technologies that have broken the traditional limits of professional knowledge. They are further forced together by problems arising from the limitation on the kinds of knowledge that we have cherished so far. The shortcomings of traditional information and communication analysis based on data or information-flow theories are raising fundamental problems with respect to the construction and organization of knowledge systems. New concepts of communication can help us understand and develop social systems as self-organizing and self-producing networks, and we need a deeper

understanding of the ethics and aesthetics foundational to the existence of these new systems. Instead of the communication of information we might speak of a jointly actualized meaning.

It is important to find a genuinely non-reductionist interdisciplinary view of knowledge that allows different kinds of knowledge to interact in a non-ideological way. Only then may we develop a new view of cognition, signification, information, and communication and the relation between culture, nature, and our own bodies. It is difficult to change the way we think of the world, of our society, and of our own lives. But as Gregory Bateson has pointed out this is the major key to change, and many things point to the need for such a change if we are to survive and make the leap to a new global culture.

Information science conceptualizations have so far been developed mainly within the interdisciplinary framework called cognitive science. Cognitive science is fundamentally a logical and algorithmic research program of information processing in humans, animals and machines that builds upon Norbert Wiener's cybernetics, Shannon and Weaver's information theory, Szliard's bit and von Neumann's idea of the computer, Alan Turing's concept of computation, classical set theory, the idea of natural kinds, and on a logical view of semantics. It fits within what Lakoff (1987) characterizes as objectivism: ontologically, epistemologically, linguistically and cognitively.

Sometimes theories of neural networks are seen as an alternative paradigm of cognitive science when compared to more positivistic and logical approaches to semantics. But here they will both be treated as parts of the research program of cognitive science, Artificial Intelligence (AI), and within that, the information-processing paradigm. Often we come upon the distinction between hard and soft AI. Both are focused on the creation (hard AI) and simulating (soft AI) of artificial intelligence and expert systems. One important difference between these and neural networks is that neural networks emphasize the sub-symbolic part of information processing as foundational for perception and thus provide a pre-logical foundation for conscious, symbolic and logical information processing. But all have a syntactic and logical conception of symbols and representation, as opposed to pragmatic and phenomenological conceptions of semantics and signification.

This book presents an analysis and discussion of the epistemological and ontological problems of attempts to found information concepts on the implicitly mechanistic idea that the physical sciences hold the key to the nature of reality and information. The phenomenological-cultural and the biological aspect of meaning must somehow be integrated. I will show the need to involve the area of biology if

we wish to have a more comprehensive understanding of cognition and communication. The study of animal cognition in the ethological paradigm is producing important results. It is furthermore shown through an analysis of the ethological and the Batesonian understanding of cognition and behavior that it is impossible to remove the fundamental epistemological position of the observer through a definition of information as neg-entropy. I will show how the works of ethologists open towards an alternative scientific explanation of the nature of information and cognition. This work is an attempt to bring forth a new integrative and non-reductionist perspective of the apparent paradoxes of human knowing and to celebrate self-referential processes as basic to the understanding of our own foundations.

In general, paradigms of information are crucial to our understanding of self, consciousness, communication and our relation to nature (ecology and evolution). Concepts of information and information science are furthermore important to our understanding of computers and other electronic communication technologies and networks, such as the Internet, that now constitute an important part of our lives. The theoretical foundations of these domains are dependent on the understanding of information, cognition, and communication among animals and humans and with machines, organizations, and society and hopefully they can contribute to a better understanding of communication problems in the so-called human-machine interface. Let us look briefly at the history of the present situation.

Ever since Norbert Wiener published *Cybernetics or Control and Communication in the Animal and the Machine* in 1948 scientists and scholars have been searching for a consistent information science that extends their methods and knowledge production of science to the domain of cognition and communication. They hope to find a scientific way of approaching relations among man, machine, culture, and nature that goes beyond the classic territory of science. Comparative psychology and behaviorism were among the first attempts at an objective psychology. With the search for artificial intelligence, the behavioral and neuro-sciences took the concepts of planning and programming behavior more seriously (Miller, Gallanter and Pribram 1970). This resulted in the development of modern cognitive science and its information-processing paradigm. Information science as we now know it is an attempt to build a new science based on an objective concept of information. Although Shannon’s information theory is the best known, the basis for objective information sciences has been primarily Wiener’s statistical neg-entropy information concept in connection with the entropy concept of Boltzmann’s statistical interpretation of thermodynamics. There is a growing plea for a universal

information theory, supported recently by Tom Stonier (1990, 1992, and 1997). This paradigm is based on Wiener and Schrödinger's (1967) neg-entropic information concept, which unites the entropy concept of thermodynamics with the informational entropy concept and perceives objective information in nature as organizing "power". The theoretical framework seems to be a blend of thermodynamical and evolutionary-systems view that combines matter, energy, and information as objective ontological components in an emergent evolutionary dynamics.

The program has made progress as a method of conceptualizing and dealing with the inner, outer and social realities of living systems in such a way that knowledge representation becomes computer compatible and manipulable. Further, development of the theories of feedback, attractors, dissipative structures, and self-organization within mathematics, thermodynamics, and cybernetics and other functionalistic sciences has been fruitful to the understanding of the functioning and organization of complex and non-linear systems. The hope is to explain qualia, life, and consciousness as emergent phenomena resulting from the evolution of material, energetic, and informational systems by employing non-equilibrium thermodynamics, non-linear systems dynamics, deterministic chaos theory, and fractal mathematics as analytical tools. This development has helped mechanistic and functionalistic science create better models of the cognition and communication of living systems, viewing the systems from an un-embodied informational perspective not really including connotative and emotional aspects of cognition and communication.

But this cognitive information paradigm has – to its followers – unexpected and great difficulties in modeling the semantic dimension of language, perception, and intelligence and their influence on cognition, communication, and action. To many scholars and scientists this is a symptom of the limitations of the foundation of the research program and demonstrates the need to discover a broader foundation for information science in order to encompass the phenomenological[2] and social aspects of cognition, language, and communication, as well as the biological nature and behavior of living systems.

Many scholars diagnose the great problem of the cognitive sciences to be the complete separation of subject and object in the cognitive process since the days of Descartes. In contrast, Konrad Lorenz and Niko Tinbergen's science of ethology created a biological theory of innate cognition and communication based on an evolutionary theory of instinctive motivation, perception and action. Thus analyzing this line of inquiry may shed new light on the nature of cognitive systems.

Lorenz was inspired by Jacob von Uexküll who pointed out that somehow the cognition of living systems partly creates the “reality” it is living in. He talked about the animal's "Umwelt", an idea not far from the concept of "life world" in human phenomenology. Like Lorenz, the Danish bio-psychologist Iven Reventlow was looking for new foundations for an extended ethological theory of cognition. Reventlow did his work in Denmark during and after World War II, when Lorenz’ ethology was entering its mature phase as a normal science. We will follow the progress Reventlow made in this area and the paradox of the creative power of cognition he uncovered with his conception of the “rependium.”

But Reventlow too realized the limits of his approach and at the end of his research started to look for new interdisciplinary concepts to bridge the inner and the outer reality of living systems. As one of his pupils I turned to the new cybernetics of Bateson, to Maturana and Varela's theory of “autopoiesis", and to von Foerster's “second-order cybernetics” in search of broader foundations.

Gregory Bateson’s cybernetic concept of the mind as a system of differences traveling in cybernetic loops, together with his definition of information as "a difference that makes a difference", was to some a major step away from Wiener’s objective first-order cybernetic foundation of the cognitive and information sciences. It also provided an impetus toward the development of what Heinz von Foerster came to call *second-order cybernetics*. Second-order cybernetics defines information as something an observer notes as internally created in an autopoietic system and which has formed structural couplings in reaction to perturbations from the environment. This account is a clear step away from the objectivistic, denotative, and logical theories of information and language, and moves toward more constructivist theories, going beyond social constructivism by moving into biology or even beginning with biology and moving from there towards sociology.

The primary concern of second-order cybernetics and autopoiesis is the subjective element of the observation of an observing system. Von Foerster presented the nervous system as a closed functional system, because like Bateson he grasped that the real evolutionary and thinking system is the organism plus its cognitive domain, as Bateson pointed out. In his conceptual forerunner for biosemiotics Jacob von Uexküll called it Innerwelt and Umwelt. Maturana and Varela have, with their theory of autopoiesis, expressed the same phenomenon. According to them, living systems’ connections to their environments, plus their mutual communicative connections, can be conceptualized as “structural couplings”. These structural couplings organize the cognitive apparatus established through evolution. The “cognitive domain” is then the world of cognitive processes of a living system, and includes the

totality of structural couplings. Maturana and Varela declare that everything in the organism is structurally dependent. Unfortunately, partly because they do not want to use the objectivist category of information, they continue to use cybernetic explanatory terms even when they speak about the living system's cognitive domain. But their idea of dependence is a non-deterministic mechanicism. This is well explained by von Foerster when he says that even if we view the organism as a machine, it is not a trivial machine. A non-trivial machine is mathematically unpredictable because every time it runs a function it changes the state from which the function will run the next time. In this way the next run becomes unpredictable.

Like Jakob von Uexküll, both Maturana and Varela and von Foerster have difficulty in establishing a common universe because their theories are so bio-constructivist in their point of departure. They start from the organization and cognition of living systems and reflect on science from this point. When Maturana and Varela speak of reality, they see a multiverse, not a universe. When speaking about communication, they develop a theory of reciprocal and mutual structural couplings that they call languaging, i.e. the coordination of coordinations of behavior. Von Foerster refers to language as having the function of double closure. Every system is considered closed in relation to other systems; communication only works through mutual structural couplings, he says, inspired by his exchange of ideas with the systemic sociologist Niklas Luhmann. Socio-communication establishes its own socially shared Umwelt. Consciousness, according to von Foerster, is "con-science" that establishes mutual knowledge through the co-constructing of a world. When faced with the problem of solipsism in constructivism, von Foerster claims that there is no logical solution. One has to choose whether to consider other phenomena in one's Umwelt as part of one's own conception, or as independent systems.

But the basis of second-order cybernetics is still logical discrimination and the computation of differences. Luhmann (1995) creates a systems-theoretical model of social communication by incorporating parts of the bio-cognitive second-order cybernetics with parts of the autopoiesis theory of cognition. He extends the concept of autopoiesis in order to encompass the psyche and the social communicative system. He then reformulates the basic problem of psychology by asserting that cognitions and communications must be studied as phenomena based on three independent systems of inquiry; the biological, the psychological and the social – and their mutual interpenetrations. These are of qualitatively different natures. Luhmann (1990) argues that they are closed to each other and can only communicate through interpenetration. He develops the socio-communicative aspect and

criticizes the idea of a transcendental self. But he does not really develop a phenomenological theory of cognition, meaning, and signification within a reflective phenomenological theory of the embodied self and its existentiality, will, and emotions. He is inspired by Husserl, but not much by Merleau-Ponty. His interest is focused on the sociological aspects, partly ignoring the importance of the biological and psychological systems in generating signification and meaning.

Luhmann's systems theory is based on Spencer-Brown's dualistic philosophy of differences. This seems to make it incompatible with American pragmatic semiotician C. S. Peirce's triadic semiotics that seems to offer that trans-disciplinary theory of meaning and signification that the cybernetic-functionalistic informational approaches are missing. But in his seminal work *A calculus of self reference*, Varela sees that the necessity of a third element in autopoiesis theory and second-order cybernetics has been overlooked and adds that to the system in a way that makes it compatible with Peirce's semiotics and still keeps the connection to cybernetics and autopoiesis. From there he also worked with theories of embodied cognition until his too early dead.

Galilean science has dominated us for over three hundred years. It has shown that reality has aspects amenable to exact mathematical analysis. This has been an enormously productive insight. We must admit that even mind has its "sluggish" sides, especially in a primitive nervous system that may be partially describable by functional laws. This does not mean, however, that the content of all behavior and language can be transferred to computers, as some eliminative materialists (Churchland 2004) and functionalists believe. There is a "background problem" of individual and historical origin and the prerequisites for cognition and thereby science. In both physics and psychology (especially the latter) that which can be described formally has its background in that which is not formally describable: the hyper-complex phenomena, which besides the predictable and regular are also comprised of the spontaneous, unpredictable (chaotic), intentional, and unconscious.

Since we cannot avoid speaking of the nature of aspects of reality as a prerequisite for various scientific paradigms, I suggest it would be more fruitful to regard it not just as complex, but as hyper-complex. Reality, both in its entirety and its local manifestations, cannot be reduced to something simple, deterministic or random, material, or spiritual, or be contained in a linguistic or mathematical formulation. The spontaneous, intentional, anticipatory mind is an irreducible part of that same reality. We will never be able to completely separate subject and object, for our own science nor for the intentional systems we study. Because of reality's hyper-complexity, there will always be "noise" in all measurements that will affect our results unpredictably. We always make an arbitrary cut between the

observed system and ourselves (Bohr 1954), and between the observed system and its "environment" as we define it through our own experiences and our attempts to explain the "reactions" of the observed system(s).

In evolutionary philosophy – which does not deny that reality can possess "deep" but formally indescribable absolute features – we may see the development of even more complex and selectively unstable "far from equilibrium" individual-environment systems. Maturana and Varela's autopoietic systems are one example of nature's ability to reflect in ever increasing degrees the spontaneous, unpredictable and intentional sides of reality. This ability allows these systems to be centers of their own and to draw a line between themselves as systems and their environment. Through the use of language in society, systems can finally represent themselves socially, and by such means establish an individual, curious point of view from which to reflect on knowledge, existence, and meaning.

In Peirce's triadic, pragmatic, and evolutionary semiotics, phenomenology is integrated within the triadic theory of semiosis. Peirce operates with a triad composed of a sign vehicle (the Representamen), an Object (a certain aspect of reality), and an Interpretant that is a more developed sign in the mind of the perceiver/observer/communicator. All three are each a kind of sign and necessary to create cognition, information, and communication. They each belong to one of Peirce's three basic categories. Peirce considered Kant's (1990) twelve categories outlined in the *Critique of Pure Reason* too many, and he saw an unproductive dualism in the Kantian restriction of these categories to the human mind. Instead, Peirce's three categories are universal connections between the inner and the outer worlds. These three categories were so basic that he called them Firstness, Secondness and Thirdness.

Let me offer some examples of how Peirce viewed the fundamental relationships of cognition, evolution and signification through his triadic philosophy. In the sign process, Representamen is first, Object is second, and Interpretant is third. In Cosmogony, mind is first, matter is second, and evolution is third. In cognitive psychology, perception is first, experience is second, and understanding is third. Ontologically, chance is first, mechanical law is second, and the tendency to make habits is third. Peirce defines his Firstness as a chaos of living feeling with the tendency to assume habits. He also defines qualia and emotions as belonging to the category of Firstness. In Peirce's triadic philosophy feelings, qualia, habit formation, and signification are basic ontological constituents. He is therefore leaving the mechanical view of matter as "dead" and deterministically governed by mathematical, non-probabilistic laws. Matter has an inner aspect of living feeling, a hylozoistic view which he shares with

Aristotle. Peirce's paradigm should therefore be able to encompass both human languages and all biological sign communication and penetrate through chemistry to physics and the development of the universe in its protosemiotic stages, especially if could be combined with the results in cybernetics and information science that have been achieved since his death.

Peirce considers the whole developmental process of signs through history as well as in living beings through evolution. Through the *biosemiotic* view of Thomas Sebeok Peirce's semiotics can be extended to animals, where motivation makes it possible for something to stand for something else for somebody in a certain way. Here we encounter an obvious connection with Lakoff and Johnson's work. In their embodied cognitive semantics metaphor theory they work with "idealized cognitive models" (ICM) as the source of the meaning of messages. ICMs are based on lived social expectations. Similarly, Wittgenstein has pointed out that signification is created in language games set in systems by specific life forms. Language is for Wittgenstein functional or pragmatic in that it is what it *does*. There is no essence to language. It is a system of conventional signs. But language has a social foundation in the "forms of life", which are what undergirds his language theory[3]. The center of language meaning is the constantly shifting and dynamic "forms of life".

Used by Wittgenstein only five times in the *Philosophical Investigations* (PI) the "forms of life" concept has given rise to interpretative disputes and contradictory readings. Forms of life can be understood as changing and contingent, dependent on culture, context, and history. This encourages to interprete forms of life as grounding a relativistic reading of Wittgenstein; on the other hand one can see it as the forms of life common to humankind. He explains that to be "the system of reference by means of which we interpret an unknown language"; clearly a universalistic turn. He recognizes that the use of language is made possible by the human form of life as opposed to for instance the life form of a lion, which he used in another example. This is the thread I as a biosemiotician want to follow. I see no problem in having interpretations of forms of life on the level of species, of cultures as well as subcultures in line with Bourdieu's habitus concept, which is the silent subconscious background for interpretation of concept, metaphors and life conduct. From there the next jump is to specific life situations like finding a mating partner, competing or even fighting for status and territory, hunting, fighting for one's own life and the life of the family, fleeing, taking care of the young. As we shall see these rather universal situations are the basis for the different specific motivations with which the ethologists work, which are connected to what we usually call 'conceptual schemes' and Lakoff's 'Idealized Cognitive Models' which we shall look further into in chapter 7. I see a pattern repeating

itself on various levels starting at the semiotic level, where Peirce talks of "ground", which is also valid for the biosemiotic levels where Lorenz talks about Innate Response Release Mechanisms (IRRM) with specific motivations. Since animals do not have language in the narrower sense, I have extended the concept of language games into the world of living systems as the pragmatic basis of meaning by creating the new concept of *sign games*. These are related to specific motivations and innate response mechanisms. In this way I advance the pragmatic criteria of meaning from humans into all living systems through ethology and biosemiotics. We can see that the forms of life are the *a priori*, the given, which differ depending on time and place, and consequently the language games reflect this changing nature, interacts and redefines it in an ongoing process.

Thus, at the present time, two non-mechanistic trans-disciplinary frameworks have drawn attention to their attempt to form a fruitful dialogue between Snow's two possible cultures. These are the second-order cybernetics and autopoiesis theory of von Foerster, H. Maturana, F. Varela, and N. Luhmann and C.S. Peirce's triadic semiotics in the form of biosemiotics, especially as developed by Thomas Sebeok, Jesper Hoffmeyer, Claus Emmeche and Kalevi Kull combined with pragmatic language theories like that of Wittgenstein.

The theory of autopoiesis solves some of Bateson's problems about for whom the difference makes a difference, even though the relation between mind and matter is still unclear. Maturana and Varela's concepts of autopoiesis and multiverse are invoked. But where deriving information from the concept of neg-entropy is too physicalistic[4], Maturana's idea of a multiverse is too close to constructivistic idealism. To develop a more fruitful non-reductionist worldview, it is shown that a more pragmatic understanding of physics, such as Prigogine and Stengers', where thermodynamics is understood as the basic discipline and mechanics as an idealization, opens for a non-reductionist conceptualization of chaos. This is not fully developed in their theory. My attention was therefore caught by C.S. Peirce's conception of pure chance as living spontaneity with a tendency to make habits, as a realistic but non-reductionist theory that comprises a solution to the worldview problems of Bateson, Maturana, Prigogine and Stengers, and the ethologists. A fruitful connection between second-order cybernetics and semiotics will then be possible through the new biosemiotics.

> "Biosemiotics can be defined as the science of signs in living systems. A principal and distinctive characteristic of semiotic biology lays in the understanding that in living, entities do not interact like mechanical bodies, but rather as messages, the pieces of text. This means that the whole determinism is of another type. ... The phenomena of recognition, memory,

> categorization, mimicry, learning, communication are thus among those of interest for biosemiotic research, together with the analysis of the application of the tools and notions of semiotics (text, translation, interpretation, semiosis, types of sign, meaning) in the biological realm." (Kull 1999: 386)

Thus it functions as a bridge between the technical-scientific and the humanistic-social parts of cybernetics, and can be used to develop a Cybersemiotics.

The Cybersemiotic paradigm attempts to unite the two paradigms of cybernetics and semiotics by utilizing both the sign and the information concepts and combining it with science on the one hand and the humanities on the other. By combining semiotics with second-order cybernetics, I argue that reality is full of innumerable differences that can become information for certain systems, and that signification is created inside autopoietic systems at the moment when a biologically, psychologically, or culturally meaningful interpretant is established. Differences in reality can only become meaningful based on choices made against the background of a field of meaning. As such the framework seems compatible with *critical realism*[5], but has not been related to it in any systematical way so far.

Within Peircean semiotics, information is not perceived to be transmitted through communication. Only representamens are transferred. Information is partly (re)created in the reinterpretation of signs by the receiver of intentional communication. Consequently utterance, meaning, and information are connected, but are different aspects of communication, as Luhmann also points out in his system theory of communication, which includes second-order cybernetics and autopoiesis theory within a larger framework.

One of the major challenges of any attempt to create a trans-disciplinary information science is uniting phenomenological aspects of signification and communication with their biological, sociological, logical, and physical aspects without reducing them to either the phenomenological or the mechanical. See Figure 1 for an illustration of the idea.

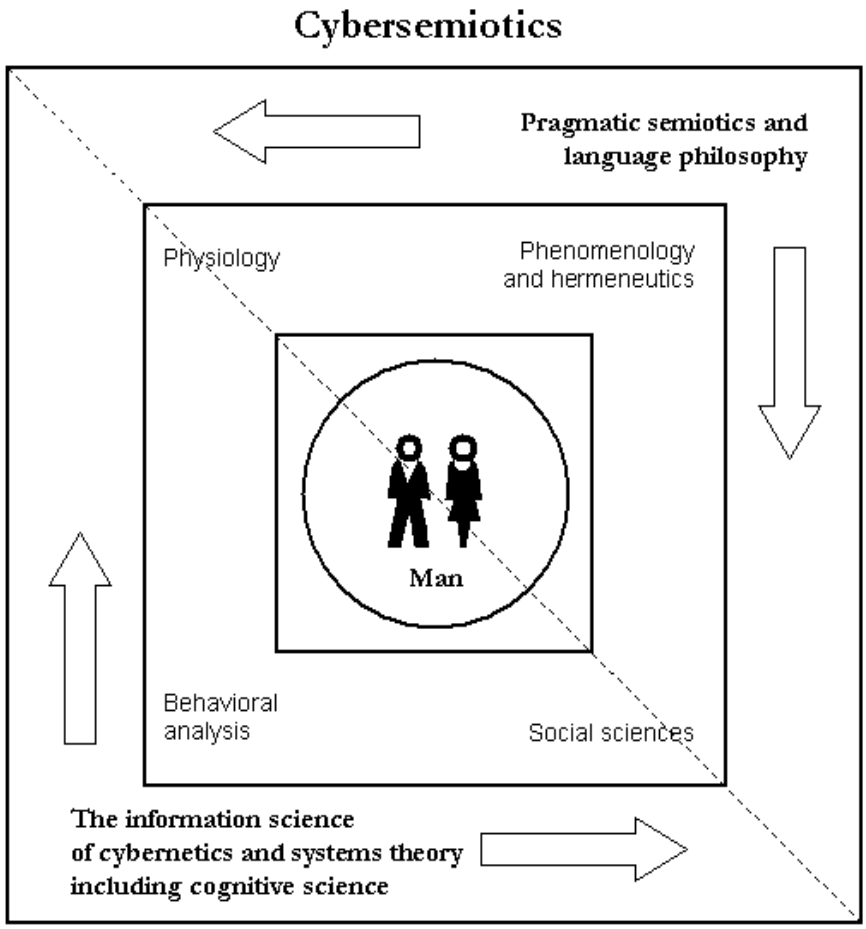


Figure 1: A view of cybersemiotics. This model illustrates how two major trans-disciplinary research programs have supplementary approaches to the subjects of information, cognition, signification, and communication. The inner square shows the four qualitatively different approaches to the study of information, cognition, communication, and signification in humans and animals. They are complementary and cannot be integrated into a single science of psychology or cognitive science. One is cybernetics and systems science's information-processing paradigm, which has been developed into the linguistic area. The other is the pragmatic semiotics of Peirce connected to pragmatic language philosophy like Wittgenstein's language games theory and the embodied cognitive semantics such as Lakoff and Johnson's experientalistic cognitive semantics. The first is a functionalistic approach based on an objective information concept and the other is a phenomenological approach based on a pragmatics concept of meaning. Thus cybersemiotics attempts to create a meta-framework uniting phenomenology and functionalism within a pragmatic, evolutionary non-reductionist triadic view of the self-organization of signs and signification

processes.

The Cybersemiotic paradigm combines a non-mechanistic universal evolutionary semiotic approach to epistemology, ontology, and signification with a systemic and cybernetic approach to self-organization, drawing on Luhmann's theories of social communication[6]. This combines a semiotics of nature with pragmatic linguistics in a second-order approach, reflecting the role of the observer as the producer of meaningful contexts that makes processes and differences informational. Bateson claimed that information is a difference that makes a difference, whereas Maturana and Varela clarified that structurally coupled autopoiesis is necessary for any cognition to take place. Like Peirce I will claim that an interpretant, and therefore a sign process, must be established to create signification, which differs from objective information because of its meaning content.

A short version of how integration between the different approaches can be made could be the following: Individuals interpreters see differences in their world that make a difference to them as information. Thus "the world" is the world of Heidegger (1962) in which the observer is thrown among things "ready at hand", through which a "breakdown" of the original unconscious unity become "present at hand". This situation is possible only by assigning signs to differences and interpreting them against a general non-reducible context. Living autopoietic systems do this by producing signs as parts of life forms. Signs can thus be said to obtain meanings through sign games. In the human social spheres forms of life give rise to language games. This part of social autopoiesis is what Luhmann calls social communication, employing what Peirce calls genuine triadic signs. Thus cognition and communication are self-organizing phenomena on all three levels: biological, psychological, and sociological/cultural. They produce meaningful information by bringing forth an Umwelt, which in cybersemiotics is called a signification sphere, connected to specific life practices such as mating, hunting, tending the young, defending etc. These characteristics distinguish cognition and communication in living systems from the simulations of these processes by computers. The forces and regularities of nature influence and constrain our perceptions and spark evolution. This process can be explained scientifically to some degree, but probably never in any absolute or classical scientific conception of the word, as Laplace thought. In my opinion, meaning cannot be defined independently from an observer and a world. Meaning is only created when a difference makes such a difference to the living system that it must make signs, join a group of communicating observers, and produce a meaningful world.

The semantic capacity of living systems (the ability to assign meaning to differences perturbing the system's self-organization) seems to be a prerequisite for the phenomena of cognition, communication, language, and consciousness. The ability of living systems to anticipate seems intricately connected with their ability to observe and perceive meanings by reducing complexity through signification. The phenomenon of imprinting in ducks is the standard example of programmed anticipation, but so are also some of the complicated mechanisms behind the way birds learn to sing. These anticipations are expectations of meaning and order related to the signification sphere that an organism constructs as its individual world. On this basis, events that perpetuate the living (autopoietic) system are reduced to meaning, i.e. as related to the survival and procreation of the individual living system in the future.

Thus it is no mystery that the electronic manipulation of human language has been the most complicated task of all and has crushed the dreams of classical hard AI. It has therefore become essential to discover the most important differences between the ways in which computers and living systems process signs. Recently, research in ethology and biological information systems was united in the formulation of a biosemiotics. Both biosemiotics and Lakoff and Johnson’s cognitive semantics demonstrate the essential role of the body and its perceptual motivation for signification and categorization. Computers do not – yet? – possess such a body of inner and outer sensations. When placed within a robot with sensors, they make the first move towards this direction, but they are not even autopoietic yet.

Cybersemiotics is a trans-disciplinary map for cognition and communication science, a meta-frame that encompasses the research programs of information theory, information science, Luhmann’s cybernetics system science, cognitive science (the information-processing paradigm as well as cognitive semantics), Peircean biosemiotics, pragmatic linguistics, and language game theory.

The basic method of this book is to take seriously the wishes, dreams, ideologies of these programs, in the hope of fulfilling their common goal of a unified information science. I will connect these within the new cybersemiotic frame to provide new inter- and trans-disciplinary connections and integration that do not reduce all cognitive and informational processes to information processes without meaning.

The benefits and shortcomings of each theory are analyzed and the productive sections of each are synthesized here. Synthesis is then broadened into a more comprehensive philosophical framework – constructed on the basis of Peirce’s semiotic philosophy – after the relevant adaptations and reconstructions of the expanded philosophical background have been made.

To make this bridge between the physico-chemical, the biological, the psychological, and the social level, new semiotic concepts are developed. These are “intrasemiotics” for the process of interpenetration between the biological and the psychological autopoiesis. It is “phenosemiotics” for non-conceptualized psychological process. “Thought semiotics” is the conceptualized self-aware psychological process created where the silent psyche and the conceptual and symbolic language system of socio-communication interpenetrate. “Signification sphere” is the world of meaningful semiotic relation for living systems (a semiotic version of Uexküll’s Umwelt concept). The information concept is only used in the cybernetic realm of Maturana’s protosemiotic languaging, and between chemical and dissipative structures and their interactions with the environment. Information is what Peirce would call protosemiotic processes that have not yet reached the full-fledged triadic state of genuine signs. In computers it is “quasi semiotic”, as it is created by semiotic beings. Finally a suggestion is made for a new five-leveled ontological view combining Peirce with modern science, information science, and humanities.

1. The first level is that of quantum vacuum fields and their entangled causality. But the fields are not considered physically dead as usually done in physicalistic physics. Cybersemiotics conceives it as a part of Firstness, which also holds qualia and pure feeling.

2. The second level of efficient causation is clearly what Peirce describes as Secondness. This realm is ontologically dominated by physics as classical kinematics and thermodynamics. But for Peirce it is also the willpower of mind.

3. The third level of information is where the formal causation manifests itself clearly and where the regularities and Thirdness become crucial for interactions through stable patterns. This level is ontologically dominated by the chemical sciences.

4. On the fourth level, where life has self-organized, the actual semiotic interactions emerge, at first internally in multi-cellular organisms as "endosemiotics" and between organisms as "sign games".

5. Finally on the fifth level with syntactic language games, human self-consciousness emerges and with that rationality, logical thinking, and creative inferences (intelligence). Intelligence

is closely connected to abduction and conscious finality. Abduction is crucial to signification. It is the ability to see something as a sign for something else.

This book is based on the above-mentioned papers. My views have developed over the years. This book now represents the current state of my theory. The material is revised and rearranged, and no chapter refers to only one specific article.

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[1] In the nature of summary there will be a minimum of references. If you read a stand alone version of the summary there will be no reference list.

[2] I am using the term phenomenological whenever it is not connected to specific philosophers such as Husserl and Heidegger, to signify research on the experience of things, happenings, thinking and meaning.

[3] In PI § 23 he writes: "Here the term "language-game" is meant to bring into prominence the fact that the speaking of of *language* is a part of an activity, or a form of life.
Review the multiplicity of language-games in the following examples, and in others:
Giving orders, and obeying them_–
Describing the appearance of an object, or giving its measurements—
Constructing an object from a description (a drawing)—
Reporting an event—
Speculating about an event—
Forming and testing an hypothesis—

[4] Physicalism believes that mental properties are identical to or at least somehow realized, determined, or constituted by physical properties. Even if we experience ourselves as autonomous agents with beliefs and desires that act the way they do because they have those beliefs and desires we are a part of the physical world and obey the physical laws in the same 'mechanistic' way as any other physical system, and are therefore in the end a kind of 'automata'. (Walter et al 2003 preface). It includes various forms on 'none-reductive' physicalisms.

[5] I have taken this short description from the home page of the journal of critical realism: "Critical realist philosophy and social theory elaborate a general conceptual schema or meta-theory, via the immanent critique of other traditions and its own previous phases and the transcendental analysis of scientific and other human practices, for emancipatory science, i.e. science that makes genuine discoveries and can therefore help to promote human flourishing. It combines and reconciles epistemic relativism (all knowledge is socially produced, or transitive, and fallible) with judgmental rationalism (there are rational criteria for preferring one judgment or theory to another, genuine knowledge of the causally and/or existentially intransitive objects of science is possible) and ontological depth (the world is intransitive or irreducible to epistemology, transfactual or open, and stratified and emergent, hence differentiated and changing).

On such a view of the world, there is more to what is than what are known, more to laws of nature than regular succession, more to society than human agents and more to human agents than effects of society; and objective explanations need not be practically neutral.

Itself plural, open, and developing, critical realism is compatible with, and promotes, a wide range of emancipatory research programs (which incorporate additional premises), and explicitly espouses methodological pluralism; every science is a science only insofar as it deploys a methodology appropriate to the specificities of its object. Critical realism is accordingly also plural in its political affinities within a broad emancipatory remit. Emancipation refers to the historical process of freedom whereby people remove constraints on the fulfillment of their needs and seek to create the positive social conditions for the full

flourishing of their potential as a species. The theory of explanatory critiques and the dialectics of freedom (which are substantive as well as formal) suggest broadly how a unity of theory and political practice might be effected by movements for change, with realist science and social science playing an important role; while the recent work of a leading critical realist philosopher, Roy Bhaskar, elaborates a theory 'within the bounds of secularism, consistent with all faiths and no faith', of the spiritual presuppositions of emancipatory projects."

http://www.journalofcriticalrealism.org/index.php?sitesig=JCR&page=JCR_050_About_JCR 2. of April 2005

[6] Initiated by the death of Prof. Luhmann "Cybernetics & Human Knowing" did in the fall of 1999 produced a theme issue on Luhmann's approach to semiotics with his paper "Sign as Form" as central discussion paper.