Cybersemiotics: A Semiotic-systemic Transdisciplinary Approach

Søren Brier

Journal article (Publishers version)

CITE: Cybersemiotics: A Semiotic-systemic Transdisciplinary Approach. / Brier, Søren.I: Studia kulturoznawcze, Vol. 1, Nr. 7, 2015, s. 247-265.

Link: http://issuu.com/kulturoznawstwo/docs/sk_7_calosc_net/1

Søren Brier

Copenhagen Business School

Cybersemiotics: a semiotic-systemic transdisciplinary approach

Introduction on the view of Peirce's transdisciplinarity

Struggling under the legacy of Shannon's (1949) and Wiener's (1963) statistical definitions of information, the disciplines and philosophies of Information Science have faced, and continue to face, great difficulties in inserting the subjective first person experiential aspect of reality into our contemporary view of the concept of "information." The need to do so is clearly there, since Information Philosophy aims to develop the kind of knowledge that gives unity and system to the whole body of human, social and natural sciences. This will be best done, I will argue in this paper, through a critical examination of the bases of our convictions, prejudices, beliefs and the methods we use in the sciences, and through the re-development of those beliefs and methods based on the "pragmaticist" framework of scientist and philosopher Charles Sanders Peirce (1839–1914).[1]

Peirce's ontological foundation is semiotic rather than informational, in that information is seen as an aspect of semiosis. He shows that the starting point for the concept of information must be not only mathematical and logical but also phenomenological, within a realist – but not mechanistic – worldview connected with an empiricist and fallibilist view of knowledge (Ransdell, 1989). Peirce – at the same time contributing to the development of modern logic

[1] I use here using the classical Peirce scholar reference system, where **CP** refers to C.S. Peirce [1994 (1866–1913 and 1931–1935)]: *Collected Papers of Charles Sanders Peirce.* **W** refers to C.S. Peirce (1982-): *The Writings of Charles S. Peirce: A Chronological Edition*, Vol. 1–6. References take the form CP or W n. m. where n and m indicate volume and page number respectively. **EP** refers to C.S. Peirce (1998): *The Essential Peirce*, Vol. 1 and 2, Peirce Edition Project, Bloomington: Indiana University Press.

and science as well as inventing a transdisciplinary semiotics that embraced phenomenology – contributes to healing the split between science (presently in the form of information science) and phenomenology.

Peirce integrated his semiotics with a pure mathematical analysis of phenomenology through which he coined three "new" basic categories: Firstness, Secondness and Thirdness (Esposito, 1980). (We will return to explain the categories later.) He furthermore viewed logic, aesthetics and ethics as basic normative sciences necessarily connected with the metaphysics that is developed for any philosophy of cognition and communication (CP 5: 121).

This led him to develop a highly original view of logic as the study of the essential nature of signs. But logic is semiotic in his view, and his triadic categorical theory viewed the dynamics of objective mind as a dynamic, triad-based web of signs (Raposa, 1989: 146). Such a view sets Peirce's understandings as clearly distinct from logical positivism, from Hegel's dialectical objective idealism and from Marx and Engels' developed dialectical materialism, though Peirce's three categories were close in many ways to Hegel's process logic dialectics of thesis, anti-thesis and synthesis and their further development in dialectical materialism. The important difference is Peirce's concept of Secondness or brute *is*-ness (or singular actuality) that is not explainable by law. An example is how a specific grain of sand came to be between our teeth when eating at the beach. Law cannot exhaustively explain why this specific grain of sand was to be at that spot in that time. But the experience of its actuality that manifests as physical resistance when chewing is very acute! Peirce's pragmaticism combines his theory of logic as semiotic with evolutionary theory, and thereby creates a philosophy that improves considerably on Schelling's, who was one of his important influences.

Stjernfelt (2014) points out that one of the most important lessons to take from Peirce's semiotics is its vast reorientation of the whole domain of sensation, perception, logic, reasoning, thought, language, images, etc. towards the semiotic chain of reasoning as its uniting primitive phenomenon. The point of pragmaticism is that this development of reasoning may be formally described, independently of the materials in which it may be implemented. This view implies that (logical, but not necessarily language-based) reasoning capacity is developed through evolution in nature, and that propositions are thus not primarily entities of language, nor do they presuppose any conscious "propositional stance." Consciousness and language should instead be seen as a kind of semiotic scaffolding, serving and increasing reasoning, as Stjernfelt (2014) argues. Thus language, images, perception and even consciousness should be re-conceptualized for the roles they may play in the "chain of propositions" (both natural and cultural) that constructs the reasoning processes. Ontologically, this means that evolution is neither completely random nor completely

mechanical, but is a development of the reasoning powers of the universe. This is a move away from reductionist pure physicalism into a broader philosophical framework that can encompass a transdisciplinary view of *Wissenschaft*,[2] man and universe.

It is Peirce's view of the sign as a real and dynamically developing relational and reasoning process that makes him argue that there is nothing in thought or in sensation which was not first in signs (Deely, 2013: xxvii). This vision of a non-reducible triadic process relation – which is not primarily driven by the human subject's consciousness and therefore provides a foundation for biosemiotics – is fundamental to Peirce's pragmaticist philosophy. The Sign as an irreducible triad is a syllogism. The major premise is the Representamen relation; the minor premise is the Object relation and the conclusion is the Interpretant. This is a dynamic transformative process. It is not just a mechanical conveyor belt, because the information is acted upon and "thought about" (interpreted) from input sensation to result. It is this conception of semiosis that makes inter- and transdisciplinarity possible. The best way to explain cosmogony and evolution is as a dynamic interaction between the three categories, or universes as Peirce also calls them. None of the categories can be reduced to another, but cosmogonically viewed they are derived from each other.

Since Firstness is a state of absolute possibility and radical indeterminacy as close to nothingness as possible, it is an absolute permissibility with no cause outside itself. From here Secondness emerges as one of many possibilities, as difference, other, individuality, limit, force and will. Thirdness is the mediating habit-taking aspect of evolution that contributes to the creation of an emergent order theoretically somewhat differently modeled than Hegel's dialectical evolution and the dialectical materialism of Frederick Engels' (1873–1886) dialectics of Nature. In contrast to Engels, Peirce's categories also have a phenomenological aspect (CP 5: 469).

1. The integration of semiotics in nature by Cybersemiotics

It is well-known that we do not see "data" (Popper, 1995, 1976). We see instead things, forms, classes, and behavior, for the concepts of our languages inform our sense experiences and cognitions and what we consider meaningful and can perceive (Küppers, 1990). On this basis, Bateson's (1973) definition of information "as a difference that makes a difference" is still valid. Information

[2] As the concept of science tends to be interpreted to mean the natural or quantitative sciences, I prefer the German word *Wissenschaft*, as it – like the Danish *videnskab* – encompasses the social, technical and life sciences and the humanities as well.

is what one receives in reply to a question of living. Integrating cybernetics and Peircean semiotics, I agree with Bateson (1973), Maturana (1988a, 1988b) and Peirce [1994 (1866–1913)] that we must start our understanding of information with the process of knowing. Bateson's definition of information as a difference that makes a difference is very fruitful. His problem is that it makes nearly every cybernetic system a communicator and a knower, be it a homeostatic machine, an organism or an ecosystem or organization. The main achievement of Maturana and Varela's (1980, 1986) theory of autopoiesis – the understanding of living systems such as a cell as a self-generated and self-organizing and therefore organizationally closed system – is that they have conceptualized the basic limits of living and knowing, namely the autopoietic system, and have shown that there is a basic connection between living and knowing! In Maturana's vision, the autopoietic system is closed in its structure-dependent organization.

Once autopoietic reproduction begins, natural selection becomes possible, and survival knowledge – in the form of the readiness of structural couplings to act in an orderly way on certain disturbances from the environment – begins to emerge and grow. Those autopoietic structures that are connected to the ability to produce their own macromolecules create "semiotic closure," as solutions to survival problems and are kept as a kind of reaction potential within the organism (such as the molecular structures active in the DNA-RNA-protein-synthesis processes).[3] This enables the system to perpetuate its autopoiesis from one instant to the next through generations of self-production as a full-bodied individual and self-reproduction through the "digital coding" in the DNA that is transferred and blended in mating (Brier, 2008). Hoffmeyer and Emmeche (1991) called this phenomenon "code-duality," whereby the analogue code is the actual living body as phenotype, and the digital code is the genotype of the genome. These two codes then interact with and interchange with one another over time. One can thus say that *discreteness* and *continuity* are two irreducible complementary modes of thinking, and also of existence. Thus, autopoietic theory and biosemiotics can fruitfully be integrated, as autopoiesis gives a dynamic embodiment to semiotic interaction.

Thus, if we start from the level of life in the beginning, "knowledge" exists only as embodied in the inherent structural dynamics of the autopoietic entity. This distinguishes life from the rest of the non-living system in nature. This would then, over a long time, result in the precise tri-nucleotide "codes" which are used in DNA in all present-day organisms to determine specific amino acids to be produced by the ribosomes. But how exactly this is supposed to happen as a mechanical process we do not know and cannot explain. The gen-

[3] This is why Konrad Lorenz (1970–1971) in his development of ethology was so keen on viewing "instinct" as the connection between motivation and fixed action patterns.

eral idea in Peircean biosemiotics, however, is that starting from random noise, the autopoietic functions of the cell make it possible to filter selectively for useful functionality. As such, researchers often say that this process gradually built knowledge of the world "into" the DNA sequence. But such "information" cannot exist as a kind of reified and self-activating knowledge per se. It only functions as such, rather, if placed within a living cell with a full synthesis apparatus and a number of other functional cycles and organelles surrounded by membranes, as is characteristic of living systems.

Moreover, in mainstream molecular biology, the biological description of the above phenomena is carried out at a purely chemical level, and even though we cannot produce a living cell in our test tubes today, it is presumed that chemistry is all that there is to this development of agency. But the experiential agency is what we have been talking about so far as being missing from traditional biological science. It is a distinct domain, of a self-referential autonomous state, which cannot be reduced by the laws of the dual domains. A 'difference' cannot become knowledge before it has been interpreted to be so meaningful and important that an observer/knower attaches a *sign* relationship to it. Then it will indeed be a difference that "makes a difference" in Bateson's terms. We have thousands of aspects of our reality to which we have not yet assigned words, and which therefore cannot be easily communicated or thought about constructively. What is thus experienced is sign-vehicles, but not yet "information." Signs have to be interpreted, and it has to happen on at least three levels. At the most basic level, we have the basic coordination between bodies as a dance of black boxes with no insight of each other, but still it allows for meaningful exchange. This dance goes on at the next level, but this time in motivated instinctual sign plays of drive and emotionally based communication about meaningful things in life like mating, hunting, dominating, food seeking, territory, etc. Based on these two levels, a field of embodied interactive meaning is created, in which the socio-communicative system can modulate to conscious linguistic meaning.

2. Triadic, evolutionary, realist pragmaticist semiotics

Peirce attempted was to change our worldview in order to encompass the world of science and logic with the world of meaning and communication through a triadic evolutionary pragmaticist theory of semiotics. This new but unfinished approach has attracted a multitude of researchers to attempt to make a consistent interpretation of his scattered work. See for instance Apel (1981), Boler (1963), Brent (1998), Colapietro (1989), Corrington (1993), Fisch (1986), Deledalle (2000), Esposito (1980), Hookway (1992), Liszka (1996), Menand (2001),

Parker (1998), Savan (1987–1988) and Short (2007). All of these represent attempts to make sense of Peirce's deep philosophy.

The modern mechanistic ontology of science leaves us – as Monod (1972) concluded in his analysis of mechanical molecular biology – as "gypsies on the border of the universe." Peirce would have agreed with Monod that the mechanical view is insufficient as philosophical transdisciplinary ontology and epistemology even in an evolutionary setting. Peirce writes:

> [...] the universe is not a mere mechanical result of the operation of blind law. The most obvious of all its characters cannot be so explained. It is the multitudinous facts of all experience that show us this; but that which has opened our eyes to these facts is the principle of fallibilism (CP 1: 162).

We do not have absolute certain knowledge about and based on absolute law, as many classical physicists tended to think. As Peirce begins his philosophy with observation and intersubjectivity, he denies that we have a special ability for introspection beyond those of language and sign games. All of our knowledge is intersubjective and the dichotomy of internal/external is not foundational (though it is useful in other connections). In the Peircean perspective, even our own self is a sort of sign that has developed through our whole life, summing up and structuring all our experience into what he in his terminology calls a symbol (Colapietro, 1989). Peirce views the universe itself as manifesting another of his sign types, namely as a grand argument – one which we and all living systems are trying to decipher.

Peirce's semiotic perspective opens up a much wider understanding of the complexity and meaningfulness of – not least – *human reality* within a philosophy encompassing both science and conjectures of meaning. Peirce was a systematic-architectonic philosopher (Murphey, 1961) and can be compared to Aristotle in breadth, to Kant in modern transcendental thinking, to Hegel and Schelling in evolutionary vision, and to Whitehead (1978) in process philosophy. He connects all of these aspects of philosophy into a new metaphysics including a new semiotic view of rationality in an evolutionary pragmatic framework (Peirce, 1980: 20–21, 54; see also Stjernfelt, 2012).

Peirce's *On a New List of Categories* (CP 1: 551) presents his categories as distilled from the logical analysis of thought, and regarded as applicable to being. His forerunners and idols are Aristotle and Kant. Aristotle listed ten categories and Kant twelve. Inspired by Kant, Peirce searches for the basic categories behind semiotic knowledge dynamics, and through extensive analysis over many decades, finds that there are three and only three categories of being, and thus of knowing (Colapietro, 1989). This is an aspect of Peirce's theory that is distinct from Husserl's. These three categories that he found are so general that he called them Firstness, Secondness and Thirdness.

The categories are Peirce's suggestion for a new and broader epistemological and ontological paradigmatic framework. Thus they have far-reaching consequences for his ontology as well as his theory of knowledge and semiotics. Peirce underlines that one needs to accept Thirdness (or "lawfulness") if one believes that any kind of general explanation – and therefore science – is possible. To know anything there must be a potentiality (Firstness), but also a hæcceity (Secondness) (an unexpected perturbation of the autopo-semiotic system) in the form of a difference (as Bateson, Spencer-Brown and Luhmann would all say); and then we realize that the difference has some regular relation to something else (Thirdness), and we interpret it as having meaning in our life (the difference that does makes a difference). Peirce here is inventing a relational process logic that puts part of his thinking close to Whitehead's *Process and Reality* (1978) but also to dialectical materialism, which unfortunately lacks a triadic concept of sign.

Thus we perceive the original fact of regularity of an object or process (physical, psychological or sociological) and we make an interpretant. The triadic connection is what emerges as a sign! The sign is a connection between a Representamen (a possible sign vehicle) and an Object (which can be almost anything, including an idea or the movement of a hand), and an Interpretation of, say, the hand movement, which we interpret as a greeting. Thus the hand moving has an independent existence as an object, but it has the potentiality of being a sign, namely the hand-waving of a greeting. This turns this object into a Representamen, and causes the real object to which it refers to be "a greeting" and the Interpretant to be "he greets me because he knows me/recognizes me and confirms our relationship." Thus Peirce's triadic semiotics is built on the three categories and as such is inseparable from them.[4]

3. Self-organization and semiotics

In thermodynamics, cybernetics, and especially second-order cybernetics, the principle of self-organization – which is also at the basis of the concept of autopoiesis and dialectical materialism – is often held to explain evolution and the emergence of new qualities such as life and mind (Jantsch, 1980; Deacon, 2013[5]). But the dissipative structures of non-equilibrium thermodynamics are a long way from the understanding of living experiential autopoietic systems.

[4] I write this because I often meet researchers who like Peirce's semiotics but not his categories, and think they can get the one without the other. I do not think that this is possible, unless they define another foundation that can explain how epistemological dynamics emerge from ontological dynamics.

[5] Deacon, however, tries to integrate with semiotics, though not a full Peircean semiotics.

We have observed the spontaneous creation of organic molecules in experiments. We have Manfred Eigen's (1981) simulations of hyper cycles with proteins, RNA, and DNA. We have observed the spontaneous generation of cell membrane-like structures. But we have not explained the qualitative otherness of life processes as such (Hoffmeyer, 1996, 2008), not even when we go from first-order cybernetics of observing systems with goals inbuilt to observe observing systems; which is what Heinz von Foerster (1984) called second-order cybernetics and Spencer-Brown (1979) calls studying *the form of the distinction*. Already in 1862 Peirce points out that no modern science is the study of the material alone but rather studies the "immaterial [relations] contained in the material" (Peirce W 1 50).

How can man read the secrets of nature? In CP 5: 488, Peirce makes a crucial distinction, namely that "all this universe is perfused with signs, if it is not composed exclusively of signs." Signs are not restricted to the living world alone in the sense that semiosis is also at work already in the pre-living development of the universe, but on another scale or what Deely (1997, 2006) calls physiosemiosis. The idea is not pansemiotic, but it means that sign relations emerge within a developing cosmogony, as part of the development of the capacity for reasoning in the universe.

Accordingly, this philosophy accepts the physical description of the processes in the early universe before life emerged, but it is not a physicalist perspective, as it sees such processes as being encompassed within a greater semiotic cosmogony. This is not pansemiotics, since it implies only that the possibility of semiosis lies in physics, but not that those possibilities are realized in all physical processes. Physiosemiosis explores the question of exactly where and how the possibility of semiosis lies in physics (Deely, 1997, 2006). This means that the overall endeavor of the theory of evolution is to explain how the connection between man and the universe, and between living systems' outer and inner natures, was driven by the universal development of semiotic reasoning in cosmogony (CP 1: 615; Sørensen, Thellefsen and Brier, 2012: 106–117).

4. A Cybersemiotic theory of emergence

It has been argued (Emmeche, 1992) that we have not yet arrived at a well-functioning and consistent theory of *emergence*, which is a core concept in dialectical materialism and in system science and theory.[6] This lack of a good theory of emergence is a problem, as the task of such a theory is to explain

[6] See for instance also El-Hani (2008), where the need for a shift to a process ontology or to Peircean semiotic philosophy is suggested as a way out of this serious problem. The more quantum physical aspects are worked out in Penrose (1995) and Stapp (2007). Baer (2010)

how the qualities of life and sense experience and therefore qualia can be created in the course of evolution. I have pointed out that not even complexity theory combined with non-equilibrium thermodynamics and theories of self--organization (Brier, 2013c), even including autocatalysis and autopoiesis in a monistic and realistic setting, perhaps combined with general system theory where there is a holistic belief that the whole is more than the sum of the parts, can explain how the ability to experience and be aware of oneself and the environment can happen. I cannot deny that some computer science philosophers, such as Arrabales, Ledezma and Sanchis (2010), actually believe that there exist small beginnings of consciousness in the form of agency in AI robots, and try to construct scales to measure them. But the ability to experience and be aware of one's self is the next step to language-born self-consciousness for humans living in a culture.

The interpretation of causality derived from Peirce is that *efficient causation* can exist on its own as Secondness, but it is often found embedded in the formal causations of pattern fitting and signals described in information science, and then finally in the living world clearly by *final causation*, which becomes "conscious purpose" in human society (Brier, 2008, 2010a, 2012). Information seen as both protosemiosis in evolution, and quasi-semiosis when embedded in semiotic and linguistic processes, lies between the two. It is connected to *formal causation* and works through signals and dualities of patterns. It is thus not yet a fully triadic semiosis, but is still a level of interactive organization above that of the brute force of efficient causation.

5. The ontological basis of Cybersemiotics

Information theory is now an important part of the new science of consciousness research (Chalmers, 1996), but there is a lot of work to do for serious philosophy, considering how many central philosophical topics of mind, language, epistemology, and metaphysics are going to be affected by developments in biosemiotics. Peircean biosemiotics may contribute to a new transdisciplinary framework in understanding knowledge, consciousness, meaning and communication (Brier, 2011, 2012). But to do this, new elements have to be integrated, making it possible to unite the functionalistic approaches to information and communication coming from cybernetics, computer science and dialectical materialism with the semantic pragmatic approaches coming from the linguistic turn and semiotics. Concepts of closure, self-organization, and differentiation of biological, psychological, and social systems developed in second-order

attempts to combine quantum physical and process philosophy in his discussion of the physics of consciousness.

cybernetics and autopoiesis theory need to be integrated into theories of embodiment and Peircean biosemiotics (Brier, 2013c).

We thus have to embrace what Peirce (1994) called *cenoscopic science* or, to use Cantwell Smith's (1998) modern phrase, "intentional sciences" (further discussed in Brier, 2010a). This means that we need to integratively reflect our phenomenological point of departure for knowledge-creation in the sciences, because we are part and product of the self-same word we are investigating. It is therefore insufficient if we ourselves, as knowing beings, cannot be explained as an intrinsic product of the model.

6. The four aspects of reality in the Cybersemiotic Star

My theory and philosophy of science is that in a total transdisciplinary naturalism, all of the four approaches to understanding cognition, communication and the knowledge-creating process – i.e., the exact natural sciences, the life sciences, phenomenological-hermeneutic interpretational humanities and sociological discursive-linguistic perspectives – are equally important and have to be united in a transdisciplinary theory of information and meaningful semiotics. The model in Figure 1 that I call the *Cybersemiotic Star* graphically illustrates this understanding. It is based on the principle that a prerequisite of producing intersubjective knowledge such as *Wissenschaft*[7] is to accept the reality of language; autopoietic embodied experiential minds, culture as well as a non-cultural environment. Reflectively, we must realize that the discussion about transdisciplinary knowledge is carried on in a semiotic-linguistic discourse with other embodied and linguistically informed conscious beings, in a common praxis that takes place in a biological as well as a cultural signification sphere.

As a consequence of the widely shared perspective that humans are embodied, feeling, knowing, and culturally formed beings participating in semiosis and language processes in culture and nature, our analysis so far points to the fact that they can be seen as living simultaneously in at least basic four different worlds. One way to describe and classify these worlds – as much as possible in accordance with the currently received view of the many sciences mentioned – is to accept the reality of the following four aspects of our being:

The physicochemical part of the natural world that also constitutes the pure material-energetic aspect of our body.

The fact that our living embodied system in its ecological niche is the source of life, which we share with other living species. We are an embodied, embed-

[7] As mentioned I prefer the German transdisciplinary concept over the English "science," which tends to mean natural sciences.

ded, enacted product of ecology and evolution; with an extended mind also formed by cultural practices.

Our experiential world of feeling, will, drives, affects, and thoughts manifests as experiential mind, consciousness, and self-consciousness. We believe that this is partly produced by our embodied nervous system and formed by culture most strongly through our childhood.

The cultural world of communication, language, meaning, power, and technology, such as the informational machines we call computers, pragmatically viewed, connects our perception with our thinking, communication, and action in the social world. Thus we are embodied, extended, enacted and embedded.

Each of the four worlds has historically developed its own type of narrative, with its own fundamentalist and reductionist versions violating the possibility of transdisciplinarity. Physicists and chemists tend to view the universe as consisting only of matter, forces, and energy. Mechanistically oriented biologists extend this view into their subject area. But non-mechanistically oriented biologists tend to perceive living systems as the basic organizers of reality, possessing self-organizing, self-protecting, self-promoting capacities, as well as perception, instincts, and communication that physics and chemistry cannot (yet?) explain. This view of life as a foundational quality is why I insist that the natural and the life sciences are not the same.

The social and cultural sciences, especially the dialectical and historic materialistic perspectives, as well as the radical social constructivist ones, tend to see the world as constructed from social, human, and linguistic interpretations – unless they are dualistic, accepting that nature is just as science describes it (Brier, 2008c). Thus, energy-matter-information, life, consciousness, and meaning become separated in different domains or descriptive worlds. But this is in conflict with our everyday world experience. Here they are not in any way absolutely separated. Thus we lack a transdisciplinary explanation of how they are integrated. The Cybersemiotic Star in Figure 1 is such a suggestion.

A model of how the communicative social system of the embodied, enacted, extended and embedded mind produces four main areas of knowledge that can also be understood to be the minimal prerequisites for interpersonal observation and knowing. Physical nature is usually explained as originating in energy and matter, living systems as emerging from the development of semiotic life processes (for the production of special proteins from DNA in the first cell). They differ from the non-living system by being what Stuart Kauffman calls "Kantian wholes." Social culture is explained as being founded on the development of new meaning and knowledge in language and practical habits; which is why the history of cultures and societies is not predictable. Finally, there is our experiential world, which in phenomenology is explained as deriving from the development of our individual life world and self-consciousness. All these

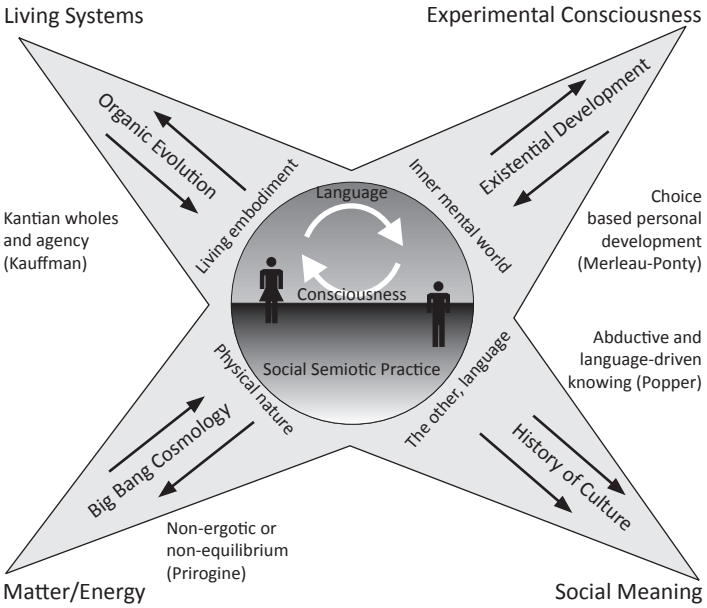

Figure 1. The Cybersemiotic star.
The model „breathes" between abductive ideas and empirical falsifications

types of knowledge, which are often considered incommensurable, are seen as models having their origin in our primary semiotic intersubjective embodied world processing of observing and interpreting within social communication and action, of which language is a part (Embodied, Enacted, Embedded, Extended semiosis). The arrows in the arms signify that the interpretations of the world are produced intersubjectively and empirically subjected to falsification tests, and those which fail go back into the socio-communication semiotic net and are revised and then tested again in a continual process of development of knowledge and skills. Thus it is a realist semiotic constructivism. The model is developed from Brier (2008) and is still under development.

One of the reasons for the separatist tendencies of the received views of natural and social science, as well as the humanities, may be that the traditions of science and the humanities were established before the theory of evolution came to be broadly recognized. As such, the incompatibility of these four dominant views in the western world's systematization of knowledge is a deep paradox in the modern worldview's attempt to build a "unified scientific narrative" of the world.

This is especially the case since it has been broadly accepted in all four worlds that the "unity of science" idea of the logical positivists failed because it was predicated on the excessively narrow epistemological foundation of verifi-

cationism combined with a physicalist reductionist philosophy of science. Karl Popper's critical analysis (Popper, 1959: 76) and argumentation for a falsificationist view of scientific knowledge has been accepted as a turning point in the break with the positivist unity of science, but not as providing any final solution to the problem. I am also close to Popper's three-world model (Popper, 1979) of a physical environmental world, an inner mental world and a world of objective knowledge. But I have added a fourth world, of life or living systems, and attempted to connect them through Peircean biosemiotics. Popper – whose conception of *Wissenschaft* was so close to Peirce's – did not use Peirce's full triadic pragmaticist semiotic theory, which I will argue placed severe limitations on his theory in the area of knowing.

Similarly, Thomas Kuhn's (1962) work on paradigms and their incommensurability has been generally accepted by philosophers of science and many scientists, but his revolutionary mono-paradigmatic view based on the history of the natural sciences has been changed into an acceptance of parallel co-existing paradigms especially in the realm of the social sciences and humanities. I have extended this view to include the social and the life sciences here, in order to put all forms of *Wissenschaft* on an equal standing, because I find it truthful to absolute naturalism and to be a necessary prerequisite for establishing a non-reductionist transdisciplinary view. But this is only possible because I extend the view of natural ontology with a cybernetic, system-theoretical and semiotic process view. The Cybersemiotic view thus recognizes and organizes the sciences and humanities in a framework different from anything that has been done before, through building upon Peirce's semiotic philosophy in combination with Luhmann's system theory (Brier, 2013a, 2013b, 2013c, 2013d).

My suggestion for finding a transdisciplinary commensurable framework for all *Wissenschaft* is to start in the middle, with our everyday embodied, embedded and enacted semiotic, social, and linguistic practices. This is very much a renewed version of the core of Peirce pragmaticism, integrating it with cybernetics and systems theory as they are integrated in Luhmann's special communicative and autopoietic integration (Brier, 2009, 2012, 2014). Near the end of 1896 Peirce accepted "the possible or *would-be's*" as real. This is much the same as the modern view of possibilities as propensities (Popper, 1990): that dispositions and tendencies are real, because when we say that a knife is sharp, we do not only mean now; we also mean that it would be sharp tomorrow if we tried to cut with it (Peirce, 1994). Peirce thereby rejected the nominalist view that the "possible" is merely a subjective limitation to our knowing. This acceptance of real possibilities puts Peirce in the Aristotelian wing of the realist camp as a three-category realist, no longer regarding the potential as what the actual causes it to be, and now distinguishing the generality of firsts from the generality of thirds.

As early as 1905, Peirce integrated semiotics and pragmatism in the realist view that the communicative and semiotic mind, in combination with a concept of information, is that which binds all four worlds together. This semiotic view integrates the sciences' view of reality as well as the cybernetic, informational and systems views of reality into a single model in an attempt to avoid the inner inconsistencies described earlier. Cybersemiotics is built on the idea of Peircean evolutionary, pragmaticist semiotics as well as his phaneroscopy.[8]

It argues, among other things, that we are thus immersed in conscious communication forms, be they verbal or non-verbal. As the linguistic turn argues, we cannot get out of language and thereby culture and power. Even science becomes a social construction, which is historically true, as there have been longer times in culture where we did not have science than there have been with science. Empirical and mathematically grounded science is a rather modern invention, which really began in the Renaissance. Scientific knowledge has formed our rationality and cultural outlook on the world, up to the global discussion these days about the reality of global warming.

The socio-communicative "sciences" are founded on the basic belief that all knowledge is created through intersubjective discourses, which has spawned social constructivist paradigms believing that we ourselves more or less "create nature" and our view of our self through our discontinuous developing discourses. Structuralism and Marxism, for instance, consider human subjects as having very little causal effect on human practice, which is primarily seen as guided by social and cultural-linguistic patterns and forces.

Peirce's semiotics has in common with Critical Rationalism and Critical Realism (Bhaskar, 1997, 1998, 2002) the understanding that humans create knowledge intersubjectively together through language and praxis, but in a real world. Peirce recognizes that empirical testing of theories and the reality of our own route through evolution in the self-same reality we are investigating both have a considerable influence on forming the scientific knowledge which is the result of the process. We know about the world because we are the product of its cosmogonical development.

Likewise, Peirce and Popper both believe, through their doctrine of *fallibilism*, that though we need the belief in an ultimate truth as an ethical commitment in *Wissenschaft*, we are also aware that there can be no final proof of our knowledge being a universal true statement or model. It is rather, as Kant says, "a regulative idea." It is for this reason that the cybersemiotic model has a constructive movement going one way – from the social and phenomenological – as well as, on the other hand, empirical perturbations from the pragmatic aspect of reality. These two interact through time and make our knowledge system develop so as to be more and more encompassing.

[8] This is Peirce's name for his brand of phenomenology.

Ultimately, then, there are three forms of historical explanations simultaneously taking place here: 1. The cosmological (physico-chemical); 2. The biological evolution (of species and ecosystems); 3. The historical (socio-cultural). The natural sciences work towards finding one grand historical explanation, but so far we have not cracked the problem of the emergence of life and consciousness in evolution, and until we have accomplished that, we might have to accept that an all-encompassing explanation of the conscious meaningful human communication process cannot be provided from any of the corners of the model. When we cannot reduce our scientific explanations to one grand story, we just have to juggle with all four at the same time – as we do in our own lives, daily! But doing so is only possible in a transdisciplinary framework that integrates semiotics and systems. By erecting this framework, I hope to expand the dialogue between sciences, the humanities, the social sciences and philosophy, and the existential quest to broaden our concept of reason by finding common frames for the open, interactive and systematic pursuits of knowledge and meaning.

Acknowledgements

A special thanks to Don Favareau for improving the clarity of my thought and the English expression of my arguments in this paper in such a kind way.

References

Bhaskar, R.A. (1997 /1975). *A Realist Theory of Science*. London: Verso.

Bhaskar, R.A. (1998/1979). *The Possibility of Naturalism*. London: Routledge.

Bhaskar, R.A. (2002). *Meta-Reality: The Philosophy of meta-Reality*, Vol. 1: *Creativity, Laws and Freedom*. New Delhi – Thousand Oaks – London: Sage Publications.

Boler, J.F. (1963). *Charles Peirce and Scholastic Realism: A Study of Peirce's Relation to John Duns Scotus*. Seattle: University of Washington Press.

Brent, Joseph L. (1998). *Charles Sanders Peirce: A Life*. Bloomington, IN: Indiana University Press.

Brier, S. (2008). *Cybersemiotics: Why Information is Not Enough.* Toronto: University of Toronto Press.

Brier, S. (2009). Cybersemiotic Pragmaticism and Constructivism, *Constructivist Foundations*, 5(1), pp. 19–38.

Brier, S. (2010a). Cybersemiotics and the Question of Knowledge. In: M. Burgin, G. Dodig-Crnkovic (eds.), *Information and Computation: Essays on Scientific and Philosophical Understanding of Foundations of Information and Computation* (pp. 1–36). World Scientific Publishing Company (World Scientific Series in Information Studies).

Brier, S. (2010b). Cybersemiotics: An Evolutionary World View Going Beyond Entropy and Information into the Question of Meaning, *Entropy*, 12(8), pp. 1902–1920.

Brier, S. (2011). Ethology and the Sebeokian way from Zoosemiotics to Cyber(bio) semiotics. In: J. Deely, K. Kull, S. Petrilli (eds.). *Semiotics Continues to Astonish: The Intellectual Heritage of Thomas Albert Sebeok* (pp. 41–84). Paris – Den Haag: Mouton de Gruyter.

Brier, S. (2012). The Transdisciplinary View of Information Theory From a Cybersemiotic Perspective. In: F. Ibekwe-SanJuan, T.S. Dousa (eds.). *Theories of Information, Communication and Knowledge: A Multidisciplinary Approach* (pp. 23–49). New York – Berlin: Springer.

Brier, S. (2013a). Cybersemiotics: A New Foundation for Transdisciplinary Theory of Information, Cognition, Meaningful Communication and the Interaction between Nature and Culture, *Integral Review*, Vol. 9, 2(6), pp. 220–263.

Brier, S. (2013b). How to define an information concept for a universal theory of information, Proceedings of the 1st International Conference on Philosophy of Information, 19–21 November 2013, International Center for Philosophy of Information Xi'an Jiaotong University, China, International Society for Information Science, pp. 277–299.

Brier, S. (2013c). Cybersemiotics: A new foundation for transdisciplinary theory of consciousness, cognition, meaning and communication. In: L. Swan (ed.). *Origins of Mind* (pp. 97–126). Berlin – New York: Springer.

Brier, S. (2014). „Phenomenological Computation?" (Open Peer Commentary), *Constructivist Foundations*, 9(2), 15 March 2014, http://www.univie.ac.at/constructivism/journal/articles/9/2/234.brier.pdf [15.05.2015].

Brier, S., Joslyn, C. (2013). What Does It Take to Produce Interpretation? Informational, Peircean, and Code-Semiotic Views on Biosemiotics, *Biosemiotics*, 6(1), pp. 143–159.

Cantwell Smith, B. (1996). *The Origin of Object*. Cambridge: The MIT Press.

Cantwell Smith, B. (1996b). http://www.ageofsignificance.org/people/bcsmith/print/smith-godapprox4.pdf [19.11.2014].

Capurro, R., Hjørland, B. (2003). The Concept of Information. In: B. Cronin (ed.), *The Annual Review of Information Science and Technology*, 37, pp. 343–411.

Chalmers, D. (1996). *The Conscious Mind: In Search of a Fundamental Theory*. Oxford: Oxford University Press.

Colapietro, V. (1989). *Peirce's Approach to the Self: A Semiotic Perspective on Human Subjectivity.* Albany, NY: Suny Press.

Corrington, R. (1993). *An Introduction in C.S. Peirce: Philosopher, Semiotician, and Ecstatic Naturalist.* Lanham, MD: Rowman & Littlefield.

Damasio, A. (2010). *Self Comes to Mind: Constructing the Conscious Brain.* New York: Pantheon.

Davies, P., Gregersen, N.H. (eds.) (2009). *Information and the Nature of Reality: From Physics to Metaphysics.* Cambridge, Mass.: Cambridge University Press.

Deacon, T. (2013). *Incomplete Nature: How Mind Emerged from Matter.* New York: W.W. Norton & Company.

Deely, J. (1997). How is the universe perfused with signs? In: C.W. Spinks, J. Deely (eds.), *Semiotics.* New York: Peter Lang.

Deely, J. (2006). Let us not lose sight of the forest for the trees..., *Cybernetics & Human Knowing*, 13(3–4), pp. 161–193.
Deely, J. (2013). *Tractatus de Signis: The Semiotic of John Poinsot.* South Bend, IN: St. Augustine's Press.
Deledalle, G. (2000). *Charles Peirce's Philosophy of Signs: Essays in Comparative Semiotics*, Bloomington, IN: Indiana University Press.
Eigen, M. et al (1981). The Origin of Genetic Information, *Scientific American*, April, pp. 78–94.
Eigen, M., Schuster, P. (1979). *The Hypercycle: A Principle of Natural Self-organization*. Berlin – Heidelberg – New York: Springer.
El-Hani, C.N. (2008). Emergence and Downward Determination, *Cybernetics & Human Knowing*, 15(3–4), pp. 101–134.
Emmeche, C. (1992). Life as an Abstract Phenomenon: Is Artificial Life Possible? In: F.J. Varela, P. Bourgine (eds.). *Toward a Practice of Autonomous Systems: Proceedings of the First European Conference on Artificial Life* (pp. 466–474). Cambridge, Mass.: A Bradford Book, The MIT Press.
Engels, F. (1873–1886). *Dialectics of Nature*, transl. J.B.S. Haldane, 1939. International Publishers Co. (April 1968).
Esposito, J.L. (1980). *Evolutionary Metaphysics: The Development of Peirce's Theory of the Categories.* Athens – Ohio: Ohio University Press.
Fisch, M.H. (1986). *Peirce, Semeiotic, and Pragmatism*, ed. by K.L. Ketner, C. Kloesel, Bloomington, IN: Indiana University Press.
Foerster, H. von (1984). *Observing Systems*. California: Intersystems Publications.
Gadamer, H.-G. (1989). *Truth and Method.* London: Sheed and Ward.
Hoffmeyer, J. (2008). *Biosemiotics*. Scranton, PA: University of Scranton Press.
Hoffmeyer, J., Emmeche C. (1991). Code-duality and the semiotics of nature. In: M. Anderson, F. Merrell (eds.). *On Semiotic Modeling* (pp. 117–166). Berlin: Mouton de Gruyter.
Hoffmeyer, J. (1996). *Signs of Meaning in the Universe*. Bloomington, IN: Indiana University Press.
Hookway, C. (1992). *Peirce.* London – New York: Routledge.
Jantsch, E. (1980). *The Self-Organizing Universe: Scientific and Human Implications of the Emerging Paradigm of Evolution*. New York: Pergamon Press.
Kuhn, T. (1962). *The Structure of Scientific Revolutions*. Chicago: University of Chicago Press.
Küppers, B.-O. (1990*). Information and the Origin of Life*, Cambridge, Mass. – London: The MIT Press.
Liszka, J.J. (1996). *A General Introduction to the Semeiotic of Charles Sanders Peirce*, Bloomington, IN: Indiana University Press.
Lorenz, K. (1970–1971). *Studies in animal and human behaviour I and II.* Cambridge, Mass.: Harvard University Press.
Luhmann, N. (1990). *Essays on Self-Reference*. New York: Colombia University Press.
Luhmann, N. (1995). *Social Systems*. Stanford, CA: Stanford University Press.
Maturana, H., Varela, F. (1980). *Autopoiesis and Cognition: The Realization of the Living.* London: Reidel.

Maturana, H., Varela, F. (1986). *Tree of knowledge: Biological Roots of Human Understanding.* London: Shambhala Publishers.

Maturana, H. (1988a). Ontology of observing: The Biological Foundation of Self Consciousness and the Physical Domain of Existence, *The Irish Journal of Psychology*, 9(1), pp. 25–82.

Maturana, H. (1988b). Reality: The Search for Objectivity, or the Quest for a Compelling Argument, *Irish Journal of Psychology*, 9(1), pp. 25–82.

Menand, L. (2001). *The Metaphysical Club: A Story of Ideas in America.* New York: Farrar, Strauss and Giroux.

Murphey, M.G. (1961). *The Development of Peirce's Philosophy*, Cambridge, Mass.: Harvard University Press.

Peirce, C.S. (1885). One, Two, Three: Fundamental Categories of Thought and of Nature, Manuscript 901. In: *Collected Papers of Charles Sanders Peirce*, Vol. 1, par. 369–372 and 376–378; the Chronological Edition, Vol. 5, pp. 242–247.

Peirce, C.S. (1998). *The Essential Peirce. Selected Philosophical Writings*, Vol. 2. Bloomington, IN: Indiana University Press.

Peirce, C.S. (1931–1935). *Collected Papers of Charles Sanders Peirce*. Intelex CD-ROM edition (1994), reproducing Vol. 1–6, ed. by C. Hartshorne, P. Weiss. Cambridge, Mass.: Harvard University Press; Vol. 7–8, ed. by A.W. Burks. same publisher, 1958.

Peirce, C.S. (1982–2014). *The Writings of Charles S. Peirce: A Chronological Edition*. Vol. 1–6 and 8. Bloomington, IN: Indiana University Press.

Peirce, C.S. [1994 (1866–1913)]. *Collected Papers of Charles Sanders Peirce*. Electronic edition reproducing Vol. 1–6, ed. by C. Hartshorne, P. Weiss. Cambridge, Mass.: Harvard University Press, Vol. 7–8, ed. by A.W. Burks, same publisher, 1958. Charlottesville: Intelex Corporation.

Penrose, R. (1994). *The Emperor's New Mind*. Oxford: Oxford University Press.

Popper, K.R. (1979). *Three Worlds. The Tanner Lecture on Human Values*. Delivered at the University of Michigan, April 7, 1978. http://tannerlectures.utah.edu/_documents/a-to-z/p/popper80.pdf [26.12.2014].

Popper, K.R. (1959). *The Logic of Scientific Discovery*, London – New York: Routledge.

Popper, K.R. (1972). *Objective Knowledge: An Evolutionary Approach*. Oxford: Oxford University Press.

Popper, K.R. (1990). *A World of Propensities*, Bristol: Thoemmes.

Ransdell, J. (1989). Is Peirce a Phenomenologist? This paper appeared in print in a French translation by André DeTienne as "Peirce est-il un phénoménologue?", *Études Phénoménologiques*, 9–10, pp. 51–75. http://www.cspeirce.com/menu/library/aboutcsp/ransdell/phenom.htm#ref3 [22.04.2014].

Raposa, M. (1989). *Peirce's Philosophy of Religion. Peirce Studies*, No. 5, Bloomington: Indiana University Press.

Savan, D. (1987–1988). *An Introduction to C.S. Peirce's System of Semeiotic*, Toronto: Toronto Semiotic Circle.

Schrödinger, E. (1944). What Is Life?: The Physical Aspect of the Living Cell. Based on lectures delivered under the auspices of the Dublin Institute for Advanced

Studies at Trinity College, Dublin, February 1943. http://whatislife.stanford.edu/LoCo_files/What-is-Life.pdf [1.05.2015].

Searle, J. (1989). *Minds, Brains and Science*. London: Penguin Books.

Shannon, C. (1949). A Mathematic Theory of Communication. In: C.E. Shannon, W. Weaver. *The Mathematical Theory of Communication*. Urbana, IL: University of Illinois Press, 1949.

Short, T.L. (2007). *Peirce's Theory of Signs*, Cambridge: Cambridge University Press.

Sørensen, B., Thellefsen, T., Brier, S. (2012). Mind, Matter, and Evolution: An Outline of C.S. Peirce's Evolutionary Cosmogony, *Cybernetics and Human Knowing*, 19(1–2), pp. 95–120.

Spencer-Brown, G. (1979). *Laws of Form*. New York: Dutton.

Stapp H.P. (2007). *Mindful Universe: Quantum Mechanics and the Participating Observer*, New York: Springer.

Stjernfelt, F. (2014). *Natural Propositions: The account of Peirce's Doctrine of Decisigns.* Boston, Mass.: Decent Press.

Weaver, W. (1949). Recent Contributions to The Mathematical Theory of Communication. In: C.E. Shannon, W. Weaver (1949). *The Mathematical Theory of Communication*. Urbana, IL: University of Illinois Press.

Whitehead, A.N. (1978). *Process and Reality: An Essay in Cosmology.* New York: The Free Press.

Wiener, N. (1963). *Cybernetics*: *Or, Control and Communication in the Animal and the Machine.* Cambridge, Mass.: The MIT Press.

Summary

Since the critique of the logical positivists' unity of science for being too reductionist to be transdisciplinary, most scientists have abandoned this model. But other candidates have emerged. The first was evolutionary system science and cybernetics, which was instrumental in producing the new information science supporting the development of cognitive science, with computation as the central process. But the new info-computational transdisciplinary framework still lacks a phenomenological and hermeneutical foundation just as system science and cybernetics did. Peircean semiotics has this foundation and includes a theory of information and has a transdisciplinary scope, but lacks the self-organization theory developed in autopoiesis theory, which Luhmann uses in his new communicatively based system theory. Cybersemiotics integrates Peirce and Luhmann's paradigms into a new transdisciplinary framework encompassing the theory of mind as embodied, extended, enacted and embedded.

Słowa kluczowe: transdyscyplinarność, cybersemiotyka, paradygmat informatyczno-obliczeniowy, semiotyka Peirce'owska, teoria systemu Luhmanna, biosemiotyka, teoria umysłu 4E

Keywords: transdisciplinarity, cybersemiotics, info-computational paradigm, Peircean semiotics, Luhmann's system theory, biosemiotics, 4E Theory of mind