Sign Systems Studies
29.1

Тартуский университет
Tartu Ülikool

Труды по знаковым системам

Töid märgisüsteemide alalt

29.1

Тарту — Tartu
2001

University of Tartu

Sign Systems Studies

volume 29.1

Editors: Peeter Torop
Mihhail Lotman
Kalevi Kull

TARTU UNIVERSITY PRESS

Tartu 2001

Sign Systems Studies is an international journal of semiotics and sign processes in culture and nature
Periodicity: one volume (two issues) per year
Official languages: English and Russian

Established in 1964

Address of the editorial office:

Department of Semiotics, University of Tartu
Tiigi St. 78, Tartu 50410, Estonia
e-mail: *semiotics@ut.ee*
Information and subscription: http://www.ut.ee/SOSE/sss.htm

Together with this printed version,
an electronic issue of this journal has been issued by
under www.upress.uni-kassel.de
ISBN 3–933146–63–1 (online-edition)

kassel university press

ISSN 1406–4243
ISBN 9985–56–576–2

Tartu University Press
Tiigi 78, Tartu 50410, Estonia

Sign Systems Studies 29.1

Sign Systems Studies 29.1

Sign Systems Studies 29.1

ISSN 1406–4243
ISBN 9985–56–576–2

Table of contents[1]

[1] This issue on ecosemiotics and semiotics of nature has been edited by Winfried Nöth and Kalevi Kull.

General ecosemiotics

Cultural ecosemiotics

Semiotic perspectives of the ecological crisis and globalization

Topics in biosemiotics

Reviews and comments

Introduction: Special issue on semiotics of nature

In the history of 20th century semiotics since Peirce and Saussure, there have been two views of how nature should be approached from a semiotic perspective, the view of cultural, and the view of general semiotics.

The view of cultural semiotics is the one developed in the tradition of semiotic structuralism. Based on anthropocentric and logocentric foundations, cultural semiotics investigates in how far nature is interpreted from a cultural perspective and in how far various cultures interpret the same natural phenomena differently. This approach is essentially the one adopted by Umberto Eco (cf. Nöth 2000), Juri Lotman (2001; e.g., p. 252), and more explicitly by the Paris School of Semiotics. In their *Dictionary of Semiotics*, Greimas and Courtés (1982: 375) adopt this approach to the semiotics of nature in a programmatic way, when they describe the study of the "Natural world" as follows: "Nature is […] not a neutral, but a strongly culturalized […] and at the same time relativized referent (since ethnotaxonomies give different 'visions of the world'). This means that the natural world is the place for the elaboration of a vast semiotics of cultures".

In contrast to the cultural semiotic perspective of nature, the perspective of general semiotics investigates sign processes in nature as semiotic processes *sui generis*. Foundations of this tradition have been laid by C. S. Peirce, C. Morris, and T. A. Sebeok, and on the basis of this broader concept of semiotics, new fields of semiotic research have been explored during the last decades, which have led to a considerable extension of the field of semiotic research. Semiotics is no longer *only* concerned with signs that depend on culture and cultural codes, since it has advanced to a theory of sign processes in culture *and* in nature. Contributions to this extension of the semiotic field come from the *history of semiotics* with its long tradition of the study of *natural signs*, which were sometimes defined in sharp opposition to other

signs, but sometimes as a branch of the general theory of signs. Research in *zoosemiotics* and *biosemiotics* has proceeded with the lowering of the semiotic threshold from human semiosis to semiotic processes whose agents are animals and micro-organisms, in fact all living cells. More recently, the question has been raised whether precursors of semiosis should even be sought in the inanimate or prebiotic world and whether semiotics should also include the field of *physicosemiotics*: autocatalytic systems, dissipative structures, and other processes in dynamic physical systems, which testify to the possibility of a spontaneous increase of order in nature, and accordingly become the topics of study in the search for the origins of semiosis in a field of protosemiotic studies.

The papers presented in this issue of *Sign Systems Studies* on the semiotics of nature are based on the broader approach to the topic founded in general semiotics and in transdisciplinary collaborations of semioticians with biologists, ecologists, philosophers, linguists, and scholars in language, literature and the media. These are the result of two joint semiotic ventures by Winfried Nöth, Director of Research Center for Cultural Studies of the University of Kassel, and Kalevi Kull from the Department of Semiotics of the University of Tartu. The first was the jointly organized workshop on *Ecosemiotics: Studies in Environmental Semiosis*, which took place in the framework of the Nordic-Baltic Summer Institute for Semiotic and Structural Studies at Imatra, Finland, on June 16–17, 2000 (cf. Nöth & Kull 2000). The second was the German-Italian Colloquium on *The Semiotic Threshold from Nature to Culture* at the Research Center for Cultural Studies of the University of Kassel, from February 16–17, 2001, with the support of the Deutsche Forschungsgemeinschaft, Bonn, and Dr. Luigi Volta, the Director of the Istituto Italiano di Cultura at Frankfurt/Main. Thanks are due to these generous sponsors who made the international extension of the semiotic cooperation between Kassel and Tartu to Bari (Ponzio, Petrilli), Houston/Texas (Deely), Brazil (Santaella), Switzerland (Ljungberg), Denmark (Brier, Emmeche, Hoffmeyer), and other countries possible. The decision of the publishers of *Sign Systems Studies* to include this special issue in their publication schedule is gratefully acknowledged.

References

Greimas, Algirdas Julien; Courtés, Joseph 1982 [1979]. *Semiotics and Language.* Bloomington: Indiana University Press.

Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–371.

Lotman Yuri M. 2001. *Universe of the Mind: A Semiotic Theory of Culture*. (Translated by Ann Shukman, introduction by Umberto Eco.) London: I. B. Tauris Publishers.

Nöth, Winfried 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–343.

— 2000. Umberto Eco's semiotic threshold. *Sign Systems Studies* 28: 49–61.

Nöth, Winfried; Kull, Kalevi 2000. Discovering ecosemiotics. *Sign Systems Studies* 28: 421–424.

Winfried Nöth
Kalevi Kull

Protosemiotics and physicosemiosis

Winfried Nöth
University of Kassel, FB 08,
Georg-Forster-Str. 3, D-34117 Kassel, Germany
e-mail: noeth@uni-kassel.de

Abstract. Protosemiotics is the study of the rudiments of semiosis, primarily in nature. The extension of the semiotic field from culture to nature is both necessary and possible in the framework of Peirce's semiotic theory. Against this extension, the critique of pansemiotism has been raised. However, Peirce's semiotics is not pansemiotic since it is based on the criterion of thirdness, which is not ubiquitous in nature. The paper examines the criteria of protosemiosis in the domain of physical and mechanical processes.

1. Protosemiotics

Protosemiotics is the study of protosemiosis, i.e., of protosemiotic processes. What is protosemiosis? The Greek form *proto-* means "first", but in modern scientific terminology, several more specific meanings are associated with the prefix *proto-*. Linguists, e.g., define the common ancestor of the languages of a family as a *protolanguage*. Biologists use the prefix in the sense of "archetypal", as in *protomorph*, and in chemistry, *proto-* designates "the first or lowest of a series, [i.e.,] one having [...] the smallest relative amount of the element indicated in the name to which it is prefixed", as in *protochloride* (*Webster's IIIrd New Int. Dict.*). Along these lines, we can define protosemiosis as the most rudimentary process of semiosis, a process that barely fulfils the minimum requirements of semiosis and is hence just above the semiotic threshold between the semiotic and the non-semiotic world, if such a threshold exists at all.

Although, as far as I see, the term *protosemiosis* has not yet found its way into any encyclopedia of semiotics, it has occasionally been used in semiotic theory, albeit without precise definitions. Irmengard Rauch (1999), in her recent book entitled *Semiotic Insights*, has two chapters on "Protosemiotic" and on "Protosemiotists" in which she discusses medical semiotics as *protosemiotic*, and classics of modern semiotics such as Peirce or Saussure as protosemioticians.

Closer to our definition of *protosemiotics* is the way Giorgio Prodi (1983) discusses "protosemiotic interactions in nature". Protosemiosis, according to Prodi, is essentially a synonym of biosemiosis" (Cimatti 2000: 362–64). The central argument of Prodi's protosemiotic theory is that life is "natural semiosis". Prodi first elaborated this thesis in his study *Le basi materiali della significazione* of 1977, unaware of Charles Sanders Peirce's much earlier contributions to his field of research.

2. Protosemiosis and the semiotic thresholds

In the context of Italian semiotics of the 1970s, however, Prodi's protosemiotics was a bold extension of the semiotic field whose delimitation had been laid down within much narrower confines by Umberto Eco's authority. Eco defends the thesis of a relatively high semiotic threshold. Eco's semiotic threshold between the semiotic and the non-semiotic field is the dividing line between culture and nature. His criteria of separating the two worlds are essentially the arbitrariness of the sign and the possibility of using it for the purpose of lying (cf. Nöth 2000b). Others who have been in favor of a high semiotic threshold are the semioticians in the tradition of Husserl's phenomenology. According to this tradition, human intentionality and "meaning endowing acts" are the criteria of sign use (cf. Nöth 2000a: 36).

The history of semiotics since the 1960s, partly under the influence of Thomas A. Sebeok, has seen a lowering of the semiotic threshold in several stages (Nöth 2000a). From its earlier restrictions to the study of human language and culture in the domain of *anthroposemiotics*, it advanced with *zoosemiotics* to the study of animal communication, with *phytosemiotics* to the study of sign processing in plants, and with *biosemiotics* to the study of semiosis in microbiological processes. Notice that this lowering of the semiotic threshold since the 1960s

actually means only an extension of the research field of a semiotics in the tradition of structuralism. It is not an extension of the field outlined by Peirce, whose semiotic philosophy covered the study of semiosis in nature, culture, logic, and language. The lowering of the semiotic threshold in semiotics during the last decades hence went parallel with the rediscovery of Peirce's broad concept of semiosis.

Today, even the possibility of semiosis in the prebiological world is a topic on the semiotic agenda. The domain of study has been dubbed *physicosemiotics* by Walter A. Koch (1987: 67) or *physiosemiotics* by John Deely (1990: 32). Deely (2000: 3) calls research in this domain "the final frontier of semiotic inquiry", but he also admits that the adherents of this recent extension of the semiotic field are still a small "radical faction" of semioticians. There are two domains of the nonliving world in which the nature of protosemiosis may be considered, one is the field of physical or chemical processes and of cosmological evolution (Nöth 2001b), the other is the world of machines (Nöth 2001c).

3. Pansemiotics?

The larger, more conservative, faction of semioticians condemns the extensions of the semiotic field beyond human culture as "pansemiotic" (Baltzer 2000), some beginning their critique at the biosemiotic, others definitely at the physicosemiotic threshold. With the label of pansemiotism, the critics want to imply that the concept of semiosis becomes a useless theoretical tool if every process in our world is defined as a process of semiosis. However, to describe Peirce's universal semiotics as a pansemiotic theory is a gross simplification. Semiosis, in the framework of Peirce's theory, presupposes thirdness, but the world does not only consist of phenomena of thirdness, but also of phenomena of firstness and of secondness, which are not yet semiotic phenomena, although they may have "quasi-semiotic" characteristics, since Peirce's theory of continuity does not establish a mere dichotomy between semiosis and nonsemiosis, but distinguishes many transitions between genuine and degenerate or quasi-semiosis.

Physicosemiotics is the scandal of conservative semioticians. The idea that semiosis should be possible in the inorganic world is a contradiction in terms to all those who postulate that human intentionality

or at least life is the essential semiotic threshold. There are not many semioticians who subscribe to the allegedly pansemiotic theory that there might be semiosis as a genuinely triadic process in nature before life is there to interpret signs (see above, 3.).

Nevertheless, Charles Sanders Peirce is the crown witness of both the advocates and the opponents of this theory: Thomas Short (1998: 49), the renowned specialist in Peircean semiotics, affirms that semiosis, according to Peirce, can only be anthropo- or zoosemiosis, because there is "no basis for the assertion that semiosis occurs outside of living things". On the other hand, no less renowned Peircean scholars, such as Helmut Pape (1989), Klaus Oehler (1993), and Lucia Santaella Braga (1994, 1996, 1999a), affirm that the origins of semiosis, according to Peirce, begin before life. Between the two camps we find Felicia Kruse (1990: 220). She gives evidence of many instances of Peirce's extension of the theory of semiosis from living nature to the physical universe, but believes that it remains unclear whether Peirce actually wants to extend the theory of semiosis from the living to the material world or whether he merely wants to point out analogies between processes in the organic and the inorganic world.

4. Protosemiosis in organisms

No doubt, Peirce was a biosemiotician (cf. Nöth 2001a: § 3). Peirce's semiosphere certainly includes the whole biosphere, and his idea that biological protosemiosis begins with the *purpose* of a microorganism in its selective reaction to its environment has been the guideline of biosemioticians in the extension of their semiotic field from perception and cognition to processes of cell biology, metabolism, genetics, or immunology. Conservative biosemioticians establish a semiotic threshold at this point. Without life there can be no semiosis, they argue. Some of them suggest that there is a domain of presemiotic transition between the physical and the biological world, which they call *information*. "Before semiosis there was information", was, e.g., Thomas Sebeok's argument in 1986 (Sebeok 1986: 15; cf. von Uexküll 1997: 449, who refers to this domain of protosemiosis by the term *semiotics of information*), although, a year earlier, the same author had still considered the possibility of a semiotic dimension of physics when he wrote under the influence of Archibald Wheeler's

theory of the participatory universe: "Possibilities for aligning physics and semiotics are slowly beginning to swim into focus, and by this I mean to forecast that the means of entry to the universe will be found in the classical adage, *Nosce te ipsum*: the key is concealed within ourselves" (Sebeok 1985: 20).

The premises of the view that protosemiosis takes place in an organism that "reads" its environment is not in essential disagreement with radical constructivism and its theory of the subject that constructs its own environment (cf. Uexküll et al. 1993). However, when it comes to consider the role of the environment in this process, the radical contructivists are less radical than Peircean semioticist, who are willing to face the no less radical question whether final causality exists only in the purpose of the sign interpreter or whether it also exists in the sign before it is interpreted or even in the object of the sign.

5. Is there final causality in objects that serve as a potential sign?

The question whether there is final causality also outside of the mind of an interpreting subject is of relevance to the interpretation of natural signs which have no sender like the smoke that indicates fire. Do natural signs have a purpose?

It has been argued that every natural object is a *potential* sign since there is always the possibility that some interpreter may take some object as a sign of something else. Does this mean that every object in nature is endowed with a semiosic teleology? Is there a protosemiotic final causality inherent in the potential of all natural objects to serve as signs?

Based on the semiotics of the late Scholastic semiotician Poinsot, Deely (1990: 90–91; 1994: 198) develops the thesis that physicosemiosis is the potential of natural objects to be taken as signs. One of Poinsot's semiotic maxims was: "It suffices to be a sign virtually in order to signify in act". From this principle, Deely derives the argument that not only the interpreted, but also the uninterpreted nature is endowed with semioticity and that this semioticity is a virtual one. Semiosis in the physical world is hence a "virtual semiosis". The "action" of the virtual sign is directed towards its interpretation somewhere in the future, but its effect, namely an actual interpretation, de-

pends largely on chance (Deely 1994: 199–200). A still undiscovered fossilization of a dinosaur bone in my garden would be such a virtual sign, says Deely. It is, so to speak, dormant until it comes to life in an actual instance of sign interpretation, but it is nevertheless a sign. Deely (1994: 174) even attests a triadic nature to this natural sign: *A*, the sign, is the bone of the dinosaur. *B*, its object, is the once living dinosaur to which it once belonged. *C*, its interpretant, is the present geological stone formation which was once a real bone.

However, if semiosis exists already in a natural phenomenon *before* it is interpreted as a natural sign, such a virtual sign is really defined independently of its actualization in a future interpretation, and in fact, Deely (1994: 174) goes so far as to argue that the undiscovered fossil in my garden already constitutes a semiotic triad before and independently of its future interpretation: this triad consists of the ancient bone as a sign, the dinosaur as its object, and its present state of fossilization as its interpretant. It is hard to see in how far this triad is more than a concatenation of two dyads of a very different kind, namely a cause-effect relationship which connects the present fossil with the bone seventy million years ago (see also Short 1998: 48) and part-whole relationship between the bone and the animal, whose bone was later fossilized.

The actualization of this potential of natural objects to be interpreted as signs depends on chance, since the number of natural objects with a potential semioticity to some interpreter is infinite, and the chances of these objects to be interpreted as signs depend on the interpreters' fortuitous encounter with these objects. Chance, however, belongs to the category of secondness. It can only be the source of efficient causality, which is dyadic, not of final causality, which is triadic. Hence the so-called potential sign as such is not a sign endowed with teleology.

In this context it is interesting to note that today research in autocatalytic shows that biosemiosis cannot have its roots in chance. Stuart Kauffman (1995), e.g., gives evidence from mathematics, where the improbability of the chance encounter of elements of matter to create life can been demonstrated by probability calculus. If life did not originate from chance, it cannot be expected that protosemiosis in general can have its origins in chance.

6. Teleology in natural signs

But how can final causality, "the purpose of a sign", be at work in a natural sign which does not have a sender? One of the effects of teleology in any semiosis, according to Peirce, is the control that the object of the sign exerts on the outcome of its interpretation, i.e., the interpretant. The natural object imposes, so to speak, cognitive constraints on the interpreter, and such restraints cause a restriction of the possibilities of its interpretation. Ransdell (1977: 173) illustrates such an effect of protosemiotic teleology in the interpretation of a natural sign with the example of traces on the ground which indicate the former presence of a tiger. According to Ransdell, the (dynamical) natural object in this situation exerts a kind of control on the interpreter by means of "further signs whose unquestioned interpretation can go towards determining the correctness or incorrectness of the interpretation in question. Such further signs might be, for example visual percepts of the animal, its smell, its roar [...] and so on". Hence, it is not the subject that constructs its environment, but subject and object presuppose each other like lock and key. The dynamical force of semiosis has its source both in the interpreter and in the object of the natural sign. Semiosis does not originate in an autonomous interpreting subject, but both in the so-called subject and the object with which it is confronted.

With different arguments, Prodi's (1988) in his account of biological protosemiosis equally ascribes semiotic autonomy to the object of the sign in relation to its interpreter. Protosemiosis, according to this model, is based on the logic of the complementarity between a selecting A, the interpreter, and a selected B, the sign:

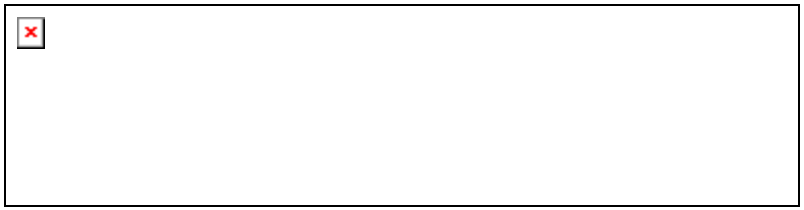

Figure 1. Protosemiosis according to Prodi (from Cimatti 2000: 363).

Cimatti (2000: 363–364) summarizes Prodi's ideas on this protosemiotic constellation as follows: "At the beginning neither *A* is a subject nor is *B* an object, since the subject is such only in respect to something which counters it (an object), just as an object needs […] a subject in order to define itself as such".

7. Protosemiosis in complex physical systems

Dynamic systems theory and the theory of complex systems have shown that teleology also exists in physical and chemical processes. Spontaneous self-organization occurs in dissipitative structures. *Order out of Chaos* is physically possible, as Prigogine & Stengers (1984) have shown. Other evidence of the possibility of growth of complexity in physical nature, which was previously thought to be a characteristic of life only, has been provided by Stuart Kauffman's (1995) above-mentioned research in autocatalytic processes. According to Bruce Weber & Terry Deacon (2000), there is even evidence of *memory* in physically chaotic systems (see also Weber & Depew 1999: 56), and memory is, of course, an eminently semiotic process.

Peirce was himself involved in biophysical research of teleological processes in which he saw proof of a "tendency toward bringing about an ultimate state of things" (CP 7.471) and the possibility of "chance begetting order" (CP 6.279; cf. Santaella Braga 1999b). He did not use the term physicosemiosis to describe these processes, but one of his conclusions was that "mind acts on matter" (CP 7.370, 8.259; Santaella Braga 1999a: 513).

Short (1998: 45) underlines that teleology is not a sufficient, but only a necessary criterion of semiosis, but more important than this difference between the processes in the inorganic and the organic world is what they have in common: a tendency towards self-control, self-reference, growth towards future states independent of initial states, but with a telos from the beginning on.

In spite of their common foundation in teleology, there are, of course, also differences between anthroposemiosis and physicosemiosis (or -quasisemiosis), but these differences are only a matter of degree. As Oehler (1995: 26) points out: "Human acts of cognition differ from other self-referential and self-correcting processes by virtue of their greater degree of self-reference and self-correction. Human beings achieve this superiority through the creation of symbols, which represent and control our habits of action".

8. Protosemiosis in machines

Is there protosemiosis in nonliving systems, in machines, computers, artificial intelligence, or at least in artificial life? There is no doubt that computer semiotics is a branch of cultural semiotics insofar as it is concerned with the interface between humans and computers, but is information processing *within* "intelligent" machines also sign processing, or is it merely signal processing? Are machines becoming *autonomous* agents in processes of semiosis?

Peirce had some radical ideas on machine semiosis (Nöth 2001c). He who often used the term "logic" as a synonym of "semiotic", developed a theory of "logical machines" in 1887, based on machines invented by Jevons and Marquand. His conclusion was that these devices as well as the calculating machines of his times were "reasoning machines" (Ketner 1988; Skagestad 1993, 1999; Tiercelin 1993). Since reasoning seems to be a process of semiosis, we might conclude that these machines were semiotic machines. However, Peirce suggests that they are not, although he goes so far as to conclude that "*every* machine is a reasoning machine" (*ibid.*: 168). Is reasoning then possible without semiosis? Elsewhere Peirce gives the answer: a machine, such as the Jacquard loom, although capable of reasoning and calculating like humans, is not capable of "the triadic production of the interpretant" and operates hence only as a *quasi-sign* (CP 5.473). The machines that Peirce discussed in 1887 were *deterministic*, or as Heinz von Foerster (1993) calls them, *trivial machines*, whose output is completely determined by their input. Such machines are only capable of *quasi-semiosis* and not of genuine semiosis.

In the age of Artificial Intelligence and Artificial Life, we have *nontrivial machines*, which are capable of learning, and whose output is no longer completely determined by their input. I cannot deal much further with the semiotics of machines here (but see Nöth 2001c) and must restrict myself to pointing out one of the radical conclusions at which Peirce arrives in this context. Instead of only asking whether machines can think like humans, he raises the question of whether humans are not also like machines in certain protosemiotic respects. Restricting himself to the human faculty of calculating and of solving syllogisms, of which machines of his time were already capable, his answer was: "A man may be regarded as a machine which turns out,

let us say, a written sentence expressing a conclusion, the man-machine having been fed with a written statement of fact, as premiss. Since this performance is no more than a machine might go through, it has no essential relation to the circumstance that the machine happens to work by geared wheels, while a man happens to work by an ill-understood arrangement of brain-cells" (CP 2.59).

In accordance with his synechistic theory of the gradual evolutionary transition between mind and matter, Peirce does not only conclude that the human mind, when solving a mathematical or logical problem, works like a mind machine, but also that the calculating and the logical machines of his time were "reasoning machines". This similarity between human thought and the merely mechanical "reasoning", according to Peirce, can be explained by the common evolutionary heritage of biological and physical nature: both the human brain and the physical laws of mechanics have evolved under the same cosmological constraints so that a certain degree of similarity between the operation of both can be assumed (cf. Nöth 2001c). The mode of sign processing common to humans and machines is diagrammatic iconicity: "The secret of all reasoning machines is after all very simple. It is that whatever relation among the objects reasoned about is destined to be the hinge of a ratiocination, that same general relation must be capable of being introduced between certain parts of the machine" (Peirce 1887: 168).

In this respect, however, not only a logical machine, but "every machine is a reasoning machine, in so much as there are certain relations between its parts, which relations involve other relations that were not expressly intended. A piece of apparatus for performing a physical or chemical experiment is also a reasoning machine, with this difference that it does not depend on the laws of the human mind, but on the objective reason embodied in the laws of nature. Accordingly, it is no figure of speech to say that the alembics and cucurbits of the chemist are instruments of thought, or logical machines" (*ibid*.).

Peirce did not believe in the dualism between mind and matter. He defended the general principle of continuity between both, called *synechism*. Instead of a spontaneous origin of semiosis, there must have been continuity between mind and matter. However, in spite of his vision of a "universe perfused with signs", Peirce also postulated many subtle differentiations between processes of *genuine* semiosis, *quasi-semiosis* and "degenerated" semiosis. In this perspective, the semiotic threshold is not a question of a dualism between two worlds,

but one of the many stages and steps of transition from one to the other.

9. Metaphysical protosemiosis and the continuity from mind to matter

Mind, thought, and genuine semiosis are basically synonyms to Peirce (Santaella Braga 1994). Protosemiosis hence has its origin in the origin of mind. But where does mind begin? Did it not evolve from matter? Peirce defends the general principle of continuity between both, which he called *synechism*. He did not believe in any dualism between mind and matter. Consequently, instead of a spontaneous origin of mind there must have been continuity between mind and matter, but which came first in cosmic evolution?

Peirce's answer to the riddle of evolutionary primacy is a metaphysical one: mind comes first, matter last. Semiosis is hence the origin, matter the end of cosmic evolution. The logic behind this metaphysical cosmology derives from the order of the three universal categories. Mind, considered as the pure possibility of thought (Potter 1967: 17, 135), not yet as a real event of thinking or even reasoning in a human being, must come first because it belongs to the category of firstness, of possibility, and spontaneity. Matter can only come last because it belongs to the category of thirdness, which is the one of habit and necessity.

Peirce's metaphysical account of evolution describes the beginning as a *chaos*, a state of qualitative continuities still without regularity (CP 1.412, 6.215). This state of pure continuous *firstness* was then interrupted by discontinuities. These discontinuities entered the scene as instances of secondness like "flashes" (CP 1.412). The ensuing repetition of such singular occurrences of chance lead to habits, regularity, order, hence to thirdness (CP 1.414). Some irregularities were eliminated in evolution, others became more and more regular.

This is why Peirce can say that *matter* is *mind* frozen "to regular routine" (CP 6.277). His logic of evolutionary cosmology urges the conclusion that the end of the universe is reached at a point where matter is completely bound in regularity, resisting any spontaneous variation and influence by chance. This end state of order is by necessity the end of evolution, the death of the universe.

References

Baltzer, Ulrich 2000. Handbuch der Semiotik. *Internationales Archiv für Sozialgeschichte der deutschen Literatur online* [http://iasl.uni-muenchen.de]

Cimatti, Felice 2000. The circular semiosis of Giogio Prodi. *Sign Systems Studies* 28: 351–379.

Deely, John 1990. *Basics of Semiotics*. Bloomington: Indiana University Press.

— 1994. *New Beginnings: Early Modern Philosophy and Postmodern Thought*. Toronto: Univ. Press.

— 2000. The impact of semiotics on philosophy. Manuscript of a lecture given in Helsinki.

Eco, Umberto 1976. *A Theory of Semiotics*. Bloomington: Indiana University Press.

Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press.

Foerster, Heinz von 1993. *Wissen und Gewissen: Versuch einer Brücke*. (S. J. Schmidt, ed.) Frankfurt am Main: Suhrkamp.

Kauffman, Stuart 1995. *At Home in the Universe*. Oxford: Oxford University Press.

Ketner, Kennteh Laine 1988. Peirce and Turing: Comparisons and conjectures. *Semiotica* 68: 33–61.

Ketner, Kenneth Laine (ed.) 1995. *Peirce and Contemporary Thought*. New York: Fordham University Press.

Koch, Walter A. 1987. A plea for evolutionary cultural semiotics. In: Escbach, Achim; Koch, W.A. (eds.), *A Plea for Cultural Semiotics*. Bochum: Brockmeyer, 53–131.

Koslowski, Peter (ed.) 1999. *Sociobiology and Bioeconomics.* Berlin: Springer.

Kruse, Felicia E. 1990. Nature and semiosis. *Transactions of the Charles Sanders Peirce Society* 26: 211–224.

Nöth, Winfried 1977. *Dynamik semiotischer Systeme*. Stuttgart: Metzler.

— 2000a. *Handbuch der Semiotik*. Stuttgart: Metzler.

— 2000b. Umberto Eco's semiotic threshold. *Sign Systems Studies* 28: 49–61.

— 2001a. Ecosemiotics and the semiotics of nature. This vol.

— 2001b. Semiogenesis in the evolution from nature to culture. To appear in: Violi, P.; Ala, M. (eds.), *Origin of Semiosis.* Turnhout: Brepols.

— 2001c. Semiotic machines. To appear.

Nöth, Winfried (ed.) 1994. *Origins of Semiosis.* Berlin: Mouton de Gruyter.

Oehler, Klaus 1995. A response to Habermas. In: Ketner (ed.), 267–271.

— 1993. *Charles Sanders Peirce*. München: Beck.

Pape, Helmut 1989. *Erfahrung und Wirklichkeit als Zeichenprozeß*. Frankfurt am Main: Suhrkamp.

Peirce, Charles Sanders 1887. Logical machines. *American Journal of Psychology* 1(1): 165–170. [Also in: C. S. Peirce 2000, *Writings*, vol. 6, N. Houser et al. (eds.), Bloomington: Indiana University Press, 65–72.]

— 1931–1958. *Collected Papers*, vols. 1–6 (C. Hartshorne, P. Weiss, eds.), vols. 7–8 (A. W. Burks, ed.). Cambridge, Mass.: Harvard University Press. [Quoted as: CP.]
Potter, Vincent G. 1997 [1967]. *Charles Peirce on Norms and Ideals*. New York: Fordham University Press.
Prigogine, Ilya; Stengers, Isabelle 1984. *Order out of Chaos*. New York: Bantam.
Prodi, Giorgio 1977. *Le basi materiali della significazione*. Torino: Einaudi.
— 1983. Lingua e biologia. In: Segre, C. (ed.), *Intorno alla linguistica.* Milano: Feltrinelli, 172–202, 308–319.
Ransdell, Joseph 1977. Some leading ideas of Peirse's semiotic. *Semiotica* 19: 157–178.
Rauch, Irmengard 1999. *Semiotic Insights*. Toronto: Toronto University Press.
Santaella Braga, Lucia 1994. Peirce's broad concept of mind. *European Journal for Semiotic Studies* 6: 399–411.
— 1996. Semiosphere: The growth of signs. *Semiotica* 109: 173–186.
— 1999a. A new causality for the understanding of the living. *Semiotica* 127: 497–518.
— 1999b. Peirce and biology. *Semiotica* 127: 5–21.
Sebeok, Thomas A. 1985. Vital signs. *American Journal of Semiotics* 3(3): 1–27.
— 1986. *I Think I am a Verb.* New York: Plenum.
Short, Thomas L. 1998. What's the use? *Semiotica* 122: 1–68.
Skagestad, Peter 1993. Thinking with machines: Intelligence augmentation, evolutionary epistemology, and semiotic. *Journal of Social and Evolutionary Systems* 16(2): 157–180.
— 1999. Peirce's inkstand as an external embodiment of mind. *Transactions of the Charles S. Peirce Society* 35: 551–561.
Tiercelin, Claudine 1993. *La pensée signe: Études sur C.S. Peirce.* Nîmes: J. Chambon.
Uexküll, Thure von 1997. Biosemiosis. In: Posner, R. et al. (eds.), *Semiotik*. Berlin: de Gruyter, 447–457.
Uexküll, Thure von; Geigges, Werner; Herrmann, Jörg M. 1993. Endosemiosis. *Semiotica* 96(1/2): 5–51.
Weber, Bruce; Deacon, Terrence 2000. Thermodynamic cycles, developmental systems, and emergence. *Cybernetics and Human Knowing* 7(1): 21–43.
Weber, Bruce; Depew, David J. 1999. Does the second law of thermodynamics refute the neo-Darwinian synthesis? In: Koslowski (ed.), 50–75.

Протосемиотика и физикосемиозис

Протосемиотикой называется наука о началах семиозиса в природе. В рамках пирсовской семиотической теории расширение семиотического поля из культуры в природу необходимо и возможно. Такое расширение подвергалось критике как пансемиотизм, но семиотика Пирса не пансемиотична, так как опирается на критерий *thirdness*, не обнаруживае-

мый везде в природе. В статье рассматриваются критерии протосемиозиса в физических и механических процессах.

Protosemiootika ja füsikosemioosis

Protosemiootika on teadus semioosise algetest, seda eeskätt looduses. Peirce'i semiootikateooria raames on semiootilise ala laiendamine kultuurist loodusesse ühtviisi vajalik ja võimalik. Sellist laiendamist on kritiseeritud kui pansemiotismi. Peirce'i semiootika ei ole siiski pansemiootiline, kuna põhineb *kolmasuse* kriteeriumil, mida kõikjal looduses ei leidu. Artiklis uuritakse protosemioosise kriteeriume füüsikalistes ja mehhaanilistes protsessides.

Physiosemiosis in the semiotic spiral: A play of musement[1]

John Deely
University of St. Thomas, 3800 Montrose Boulevard,
Houston, Texas 77006, USA
e-mail: deelyj@stthom.edu

Abstract. A main question for semiotics today is how far does the paradigm for the action of signs, *semiosis*, extend. There is general agreement by now that semiosis extends at least as far as awareness or cognition occurs, which includes the entire domain of animal sign usage, or *zoosemiosis*. The open question today is whether semiotics is broader still, and on this question two positions have emerged. The comparatively conservative position would extend semiotics to the whole of living things. This extension was first formally proposed and argued under the label *phytosemiotics*, the study of an action of signs in the realm of vegetable life. The conservative faction has rallied around the label of *biosemiotics*. The more radical faction argues that even this extension leaves something out, namely, the physical universe at large which surrounds and upon which depends all life. The radical argument is that what is distinctive of the action of signs is the shaping of the past on the basis of future events, a shaping that can be discerned even in the rocks and among the stars — a veritable physiosemiosis, theoretical justification and practical exploration of which marks the final frontier of semiotic inquiry.

It may well be that nothing has so retarded the contemporary development of semiotic consciousness as has Peirce's erroneous identification of the causality proper to sign with the old "final causality" of Aristotle, despite Peirce's juxtaposition of this term with the more

[1] "Musement" here is used in the sense outlined by Peirce 1908: 452–465.

accurate expression "ideal cause",[2] which, however, still misses the exact mark, though it has the advantage at least of being, so to speak, in the right ballpark.[3] Well, it is a question of time. For this particular failure on Peirce's part is but a vestige of that distinctively Cartesian heritage in philosophy which Peirce, singularly among the moderns, strove mightily to overcome. And even though the Peirceans themselves have in the main so far resisted the radically postmodern historical consciousness that Peirce embodied explicitly in his "ethics of terminology" and practically in his own person and the rest of his work, it can only be a matter of time till the foundational facts of our semiotic heritage emerge into more general consciousness. Once there, they will coerce those in whose awareness they lie unearthed to settle upon the causality truly proper to signs in order to understand their action and the consequences of action predicated upon that causality.

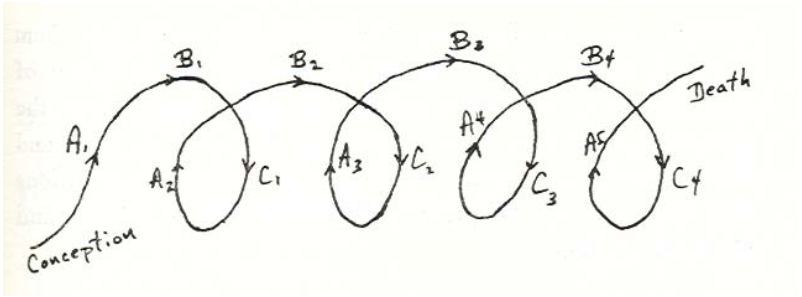

Figure 1. A = "abduction"; B = "deduction"; C = "induction".

[2] Peirce c.1902: CP 1.211: "The signification of the phrase 'final cause' must be determined by its use in the statement of Aristotle [here the editors insert a footnote which, upon pursuit, proves useless] that all causation divides into two grand branches, the efficient, or forceful; and the ideal, or final. If we are to conserve the truth of that statement, we must understand by final causation that mode of bringing facts about according to which a general description of result is made to come about, quite irrespective of any compulsion for it to come about in this or that particular way; although the means may be adapted to the end. The general result may be brought about at one time in one way, and at another time in another way. Final causation does not determine in what particular way it is to be brought about, but only that the result shall have a certain general character."

[3] Discussion with references in Deely 1994b: 157–172, esp. 158n5 for the Latin background. See, in Deely 2001b, the Index entries: *causality; cause*, in Latin thought; and esp. *objective causality*.

Aristotle himself, can I safely say, did not speak of "ideal causality". If Krempel can be trusted,[4] and he often can in historical if not philosophical matters, the context for understanding such a causality probably did not exist before Simplicius on the Greek side and Avicenna on the Arabic and Latin side drew the distinctions which make possible the full contrast in principle between objective and physical being, with the consequences for our understanding of the original philosophical notion of "reality" that this contrast entails. In any event, despite his serious pokings about in the ashes of late Latin scholasticism and the foundations of explicitly semiotic consciousness that he found there and incorporated creatively into his own seminally postmodern establishment of semiotics, the full character of "ideal cause" among the Latins as a subordinate subspecies of extrinsic formal cause eluded Peirce's voyages of discovery.[5] Nonetheless, we know now, or at least are in a position to say, that extrinsic formal cause, in contrast with intrinsic formal cause, is as such not part of the make-up of subjectivity, and hence indirectly at most tied to the doctrine of substance from which the original doctrine of final causality ("teleonomy", as I expect to become the new standard expression for what was central to Aristotle's original notion; see Deely 2001b: 65–66) is hardly separable.

The "formal cause" of a thing in the Aristotelian original scheme expressed the subjective coherence or structure which enabled one thing in particular to exist and to be recognized as existing as a particular thing or part of the physical universe as a whole, the "world of Secondness", in Peirce's terms. But existence in the order of Secondness, clearly, is prior to and more fundamental than being recognized as so existing, and so the original notion of "formal cause" was precisely that interior or subjective "glue" according to which one thing — anything — succeeded for a time in maintaining its identity, recognized or not. One and the same formal cause now considered as giving and maintaining the identity of a thing is an intrinsic formal cause, and now considered as enabling and specifying the correct objective recognition of the thing in question by another is an extrinsic formal cause serving as pattern and terminus for a relation of cognition based in (provenating from) an idea (or icon) formed within the subjectivity of the knower.

---

[4] Krempel 1952, contextualized semiotically in Deely 2001b: 229–230, 230n50.

[5] See Beuchot & Deely 1995; Deely 1995.

Extrinsic formal cause the late Latins identified under two guises. One, guiding the artist or builder in his or her work, they called an "idea", or, as we should say, a "blueprint" or "model" on the basis of and after which constructive work should go forward in realizing an embodiment in the world and order of things which would *be* the idea fully realized. But another, more fundamental realization of extrinsic formal cause was the notion of formal cause as *specifying or controlling awareness* to perceive (sensorially or intellectually, it makes no difference to the point) *this* rather than *that*. And I think it may already be clear from this juxtaposition that formal cause as specifying is prior to and more fundamental than formal cause as exemplar, even though later exemplars may be original or creative in specifying the awareness of an organism according to an objective world species-specific and never wholly reducible to the physical environment in its species-indifferent being.[6]

Now such a notion of formal cause, as extrinsic, means: extrinsic to the subjectivity of a knower, something specifying or guiding the awareness of some organism to be aware of one objective "reality" rather than another. The objective reality in question might have a subjective being, in which case the extrinsic formal cause would be embodied in some real object — let us say (by way of example), prey as food. But it might not have a truly corresponding subjective being, as when Ponce de Leon searched the Americas for the Fountain of Youth. It was not that he did not know what he was looking for, just that what he was looking for was not there to be found in the manner he believed it to be, namely, physically as well as objectively.

Even in such cases of delusion or error, the formal cause guiding and specifying our awareness, determining its content from without, does so without resorption into subjectivity; for the subjective idea as founding a suprasubjective relation always remains virtually and in principle distinct from and opposed (correlatively) to the terminus as such of the relation,[7] and every object as such exists precisely as and at the terminus of some relation of awareness linking it to but transcending the subjectivity of the knower, and indifferent to that knower's situation respecting "truth" or "error".

So we may correct Peirce as our modern master and postmodern guide, and yet say with him that we must understand the causality proper to signs (even though it is a blunder to call this "final causa-

[6] See, in Poinsot 1632, Appendix C, 379/15-382/26, esp. 381/34ff.
[7] Poinsot, *loc. cit.*

tion"[8]) as "that mode of bringing facts about according to which a general description of result is made to come about, quite irrespective of any compulsion for it to come about in this or that particular way; although the means may be adapted to the end. The general result may be brought about at one time in one way, and at another time in another way",[9] as long as the general character of the result is preserved.

Now wherever a "general character" of some event or situation is at issue, we are in the order of relations, and relations in just that sense that modernity followed nominalism in denying: relations as able to exist independently of the activity of the human mind, or any finite mind, for that matter. So relations too belong to the order of Secondness, even though they have that singularly indirect quality so familiar to the Latins, singled out by Poinsot as among the indispensable preliminaries to the doctrine of signs,[10] of being able to be effected or affected only indirectly by changes introduced into the subjectivity upon which the relation or relations in question find their foundation, from which they take provenance. These relations in the order of Secondness as such are always of a dyadic character, in Peirce's terms, no matter how many termini they may have. For example, a father whose offspring has died is no longer a father, while a father whose direct and living offspring are many is still but one father (to borrow the intriguing example cited by Thomas Aquinas[11]). For what makes a relation of Secondness real is precisely that both its "terms", that is to say, both its subjective foundation or basis and its terminus, have the being proper to physical realities as being what they are independent of the awareness enjoyed by or wanting to any finite mind.

But when we move from the universe of Secondness into the universe of Thirdness we do not leave all "real" relations behind, any more than we bring all real relations into our awareness. No. What happens is that we discover that many of the relations we dreamed of under the rubric of Firstness are only that, pure dreams, unrealities

[8] A sin against the ethics of terminology, as Peirce would be first to point out once the relevant elements of historical discourse became uncovered. See the statement of the "rules themselves" in Peirce 1903; commentary in Ketner 1981, with commentary and extended application in Deely 1998a and 1994a.

[9] Peirce c.1902: CP 1.211.

[10] Poinsot 1632: Second Preamble, Article 1, 88/8-27, esp. 18-26, & 89/13-20; 95/18-45.

[11] Aquinas c.1266/73: III, q. 3, art. 5; c.1269/72: Q. 1, art. 2, & Q. 9, art. 4. Poinsot comments on this point in detail in his *Treatise on Signs*; see Poinsot 1632: Appendix C, 384/34-387/25.

compared to what Secondness contains, and yet endowed with their own power and ambiguity in the realm of Thirdness. Here, many an unreal relation functions through its objective reality to signify and to affect behavior without by any means its physical unreality in Secondness being operative. If today we no longer burn witches, it is not that our ancestors succeeded in getting them all so much as it is a sea-change in socially permissible beliefs upon which the law is deemed able to act.

But here too many a real relation of Secondness, dyadic in its own order as physical, acquires a tercerity under which it becomes able to signify. Thus, to stick to examples common across the ages, smoke is an effect of burning, and as such a real and dyadic relation. But in experience this dyadic character of smoke as effect acquires a further quality it does not have apart from experience, namely, the character of transforming smoke as a mere effect into smoke — as we loosely if not carelessly say — a "sign" of burning, a "sign of fire". A sign of something burning is different from a flag as sign of country, in that our experience testifies as loudly as critical consciousness ever allows experience to testify that the relation between flag and country "depends upon us" in just that way that the relation between smoke and burning does not "depend upon us" but upon the being of something physical or real independently of us (even though mayhap not so independent of us that we might not, say, "put the fire out" etc.). So "relations of Thirdness" constitute the being of the universe of signs, regardless of whether they owe their whole origin to Firstness or to Secondness as well, that is to say, regardless of whether they are, as triadic relations, in whole or in part "real" or "unreal" in the scholastic sense deemed by Peirce of the essence of Pragmaticism (as incompatible with Nominalism in every guise) and distinguishing Pragmaticism as a species of thought from all varieties of Pragmatism as such.

Now one of the annoying traits of Peirce scholarship so far, in clinging to the a-historical trappings of modernity against the counsel and example of their guide in semiotic matters, is the effective maintenance of the "as if" pretense that the discovery was original with Peirce that signs consist in triadic relations. Far from it. We now know that this was the principal element — the notion of sign as a triadic relation — which Peirce acquired from his reading of later Latins that enabled him not merely to pick up the development where they had left it by the 17th century, but, more decisively, to advance the state of semiotic consciousness. He shifted the focus from the being unique to sign to the action consequent thereon, an action wherein the three

elements essential to signification are able to trade places in a spiral of growing consciousness wherein, ideally, each "sign" makes us aware not merely of something other than itself but of something more than we were previously aware of,[12] and becomes in its turn an object generating a new interpretant requiring yet a further sign, and so on, as Peirce says, *ad infinitum*, at least from the standpoint of finite consciousness.

Yet while it was far from original with Peirce to realize that a sign strictly is not a representation but a triadic relation within which some representation is made *to* something other *both* than itself *and* than the object it represents, it was the privilege of Peirce to assign names to these three "terms" united in the relation constituting the being proper to sign: the term represented he called the significate[13] or, more usually, the *object* (so that "object" and "object signified" come to the same thing, a decisive and far-reaching if so far little noticed consequence of semiotic analysis); the term representing he called the *representamen*;[14] and the term "represented to" he called the *interpretant*.

Mats Bergman of the University of Helsinki, with its third incarnation of the "Metaphysical Club", occasioned in a seminar with me in the Fall 2000 semester to investigate Peirce's derivation of this notion of the interpretant as the third term essentially united with representamen and object signified in the being proper to sign. Bergman's approach to the matter followed in essence the principle of historical layering embodied in the Semiotic Society of America Style Sheet,[15] that is to say, he conformed his discussion of the sources to the actual sequence of dates according to which they came into existence within the lifetime of their author, in this case, Peirce himself. And what he discovered was of the greatest interest theoretically.

To begin with, he found that Peirce's introduction of the term "interpretant" anteceded even the "New List" of 1867, and initially re-

---

[12] The point first caught my attention in reading Eco 1990: 28, in his critical distinction between "Hermetic Drift" (to which "deconstruction" tends but need not lead if pursued with sufficient historical insight — normally lacking among late moderns, nonetheless) and semiosis which is not degenerate. It is a point well-made, explicit in Peirce 1904: 8.332, and set in the lintel to the semiotic of John Poinsot (1632: Book I, Question 1, pars. 2 & 3, 116/14–117/17). See further Deely 2001b: 468, 471–2.

[13] Peirce 1905-6: CP 5.488n1.

[14] And here I will not enter again into the reasons why the pronunciation of this term common among the Peirceans, "represent-a-men" is incorrect, "represen-tamen" being the correct distribution of emphasis among syllables.

[15] In *The American Journal of Semiotics* 4(3/4), 1986, 193–215.

peated, if only nominalistically, the medieval confusion of the interpretant with some interpreter, or "subject", as Peirce actually termed the notion upon its first introduction in 1865; for the careful reader cannot fail to notice that even upon this first introduction of the term Peirce speaks of the Interpretant[16] "rather abstracting from the personal element". Further, Bergman found that, in this original context of introduction, Peirce was already onto the fact that the Universe of Thirdness is through and through of the character of representation — but that this character yet cannot be assimilated to idealism, as a consequence of the fact that the character of representation is not peculiar to mind but rather to objects as such. And here the sophisticated student of semiotics cannot but advert to the fundamental distinction between things as such in the order of Secondness existing independent of whatever relation they may have or not have with finite awareness, and things as objects — that is to say, things which have entered into determinate relations with cognizing organisms, whence they exist themselves as cognized or known within the texture of an objective world, an Umwelt (Deely 2001a).

In the universe of Thirdness, then, whatever *is* is representation, but self-representation ("ground") makes of things aspectually also objects, while other-representation makes signs not only of some objects respecting other objects but also of ideas and feelings as presenting objects within experience whether veridically or mistakenly insofar as Secondness is incorporated within Thirdness. In Bergman's own summary:

> His view, of course, is that things *can* be known, precisely as they are involved in representative relations. The idea of an *object* only arises within representation. Further, Peirce notes that the tendency to associate representation with mind (understood here as *our* mind) is on the wrong track altogether, as is shown by such examples as Aztec inscriptions that no one can read, or a natural formation on a rock resembling a face no one has seen or shall see.[17] According to Peirce, such instances are representations, whether they are actually comprehended by human beings or not. Using later terminology, what we have in such cases are signs without human interpreters. (Bergman 2000: 3–4)

Here we need to exercise the utmost care, and place now squarely before our minds Peirce's distinction (another decisive heritage of late Latin scholastic semiotics definitively established in if not before

[16] Peirce 1865: W 1.327.
[17] Peirce 1865: W 1.326.

Poinsot's *Treatise on Signs* of 1632) between "signs" strictly and loosely speaking. This is a distinction the importance of which has yet far from generally sunk in.[18] Strictly speaking, nothing that can be seen, heard, or pointed to is a sign according to its proper being! Strictly speaking, nothing that we commonly call "signs", as in "look for the sign for Exit 14", or "There's a sign for the barber shop" are in fact signs strictly speaking. When Maritain said[19] that animals other than human make use of signs but they do not know that there are signs, his utterance may have been more profound than he realized at the time.

For signs, we now know, consist strictly speaking in triadic relations as such, and triadic relations share one property in common with all relations, including pure dyadic relations in Secondness: they are directly inaccessible to sensation. We can perceive by sense related objects, but their relation prescissed in its proper being is an "object" only for understanding in its difference from perception. Relation apart from related things can be thought and understood intellectually, but it cannot be perceived. Thus, when we "see a stop sign", what we see in fact is a physical object that performs a definite function of representation within our objective world as constituted by customs and laws. The same red octagon attached securely to a post planted firmly in the ground would not be a stop sign for a cognitive organism unfamiliar with the habit structure constitutive of our objective world. Nor would it be a stop sign even for us were it not functioning as an item, one of three, bound up in an itself invisible relationship which is actually the sign strictly speaking. Or, if we prefer a more graphic metaphor to make the point, the visible red octagonal thing is "the mere body of the Sign, which is not essentially such", in contrast with the invisible triadic relation which is "so to speak, the Sign's Soul, which has its Being in its power of serving as intermediary between its Object and a Mind".[20]

---

[18] In Deely 2001b, see the Index entries for *definition of sign*, *sign*, and *sign-vehicle*.

[19] Maritain 1957. The point is thematized and expanded systematically in Deely 2000a.

[20] Peirce 1908: CP 6.455. In other words, sign loosely so called is technically and strictly a representamen, and what makes any item a representamen rather than a mere thing, say, or rather (or more) than an object signified, or rather than an interpretant, is not any intrinsic quality but its position or role within a triadic relation wherein it serves to *stand for* another by *representing it to* yet another again, actual or virtual (as we will see). Over time, changing contexts occasion shifts within the relation, whereby

Now, I think, we begin to perceive the true proportions of the problem at hand. Once the sign in its proper being has been intellectually distinguished from the prospectively sense perceptible component parts which, if they are "real", can be and be perceived even outside of and apart from a given sign-relation, but which cannot significantly function unless they are at least perceived within such a relation (so a conspirator, for example, can be falsely perceived, i.e., mistakenly identified, by being mind-dependently made an element in a triadic relation to which mind-independently he does not in fact belong), we are in a position to consider the action of signs in terms of the radical ground of its prior possibility in the being proper to relation.

Just here the ancient Greek discussion of relation, substantially begun by Aristotle in his pioneering attempt to draft a list of categories applicable to Secondness in its proper being, finds its bearing on the doctrine of signs. This is the case, even though, as we now know (thanks mainly to Eco and his collaborators[21]), in the ancient world of Greek philosophy there was no notion of "sign in general" such as Augustine introduced in anticipating the debate over nominalism and as Poinsot first vindicated in his demonstration that, even though the notion of relation was properly identified with a mode of real being, this notion yet stood apart as unique in Aristotle's list of categories in being irreducible to the order of mind-independent being.[22] Real, that is to say, physical, relations depend upon a *foundation* in subjective being and a *terminus* which also has the *further* status of subjectivity. But one and the same relation which was once physical can later be reconstituted objectively in thought despite the nonexistence of its terminus (the *pure objectivity there of*[23]) here and now. Such is the case with the bone of a dinosaur recognized as such. The bone provides the extrinsic formal cause guiding the mind of the paleontologist to form an objective relation terminating in the being of a dinosaur which, here and now, has no physical existence. Similarly, a purely objective relation or set of relations can be made to exist in the physical environment by a manipulation of the subjectively existing physical things here and now present. An irrigation system dreamed up in Firstness can be embodied in Secondness guided by Thirdness.

---

what one time occupied the foreground in representing (the representamen) moves rather to the background as Interpretant, or to the foreground of what is represented as Object, and so on.

[21] E.g., Eco et al. 1986.

[22] See Poinsot 1632: Second Preamble, Article 2, 95/18–96/36.

[23] See Deely 1975.

To see the point of all this for such a notion as that of physiosemiosis, that is, for understanding the possibility of an action of signs that over-runs the boundaries of any sort of finite consciousness and even the boundaries of phytosemiosis (the living world as including organisms which we have little reason to consider as cognitive beings), we need to follow Peirce in the manner in which, around 1895, he brings the notion of interpretant out of what Bergman calls hibernation:

> Peirce begins to emphasise the directionality of the activity of the sign, as proceeding from the object toward the interpretant. In effect, this means that semiosis is now understood as a process, in which interpretants are in some sense engendered through the mediating function of the sign. As open toward the future, this point of view differs from the position of the 'New List', where the unity of the proposition marked an end-state. In the new conception, there is an endless progression of thought-signs, acting variously in the roles of interpretant and sign. (Bergman 2000: 9–10)

In other words, having stabilized with a marked terminology the three elements or factors brought together whenever the sign achieves the being proper to itself, Peirce now begins to take seriously the shift implicit in this gain. He begins to develop the actual structure of the semiotic spiral which results from the instability of the subjective factors involved in signification depending, as they do, on a temporary occupation of a position or role within a relation which as such is indifferent to the subjectivity of its source vis-à-vis the order of objective being, the Umwelt. And he seems clearly to see that the situation requires a clarification of the fact that the root of the possibility of the Universe of Thirdness finds its original hold in the Universe of Secondess precisely in that insouciance toward mind which characterizes the being of Secondness in contrast no less to the being of the Universe of Firstness than to that of the Universe of Thirdness. For no matter where he turns, Peirce as semiotician finds himself confronted with the irreducible being of relation as suprasubjective and indifferent to provenating from nature or from mind, separately or together, and in whatever sequence of realization. The spiral of semiosis is not only the trajectory of life as marked by experiences. It begins now to appear as the trajectory of the very universe itself as giving birth to life in the first place, the future's way of taking account of and giving shape to the past.

"Let the Muser", Peirce counsels,[24] "after well appreciating, in its breadth and depth, the unspeakable variety of each Universe, turn to those phenomena that are of the nature of homogeneities of connectedness in each; and what a spectacle will unroll itself!". Yet these spectacles of musement within each universe, if the muser recovers enough from the stupendous spectacle to muse yet further on still, will find a semiotic universe to which Firstness, Secondness, and Thirdness all three, mayhap separated by analysis or in imaginary musings, together contribute in the actions consequent upon the being proper to signs. Thirdness, after all, proves not a universe apart from but inclusive of all that Secondness may contain and Firstness may dream, according to the saying of the Latins, *anima humana quodammodo omnia est*:

> From speculations on the homogeneities of each Universe, the Muser will naturally pass to the consideration of homogeneities and connections between two different Universes, or all three. Especially in them all we find one type of occurrence, that of growth, itself consisting in the homogeneities of small parts. This is evident in the growth of motion into displacement, and the growth of force into motion. In growth, too, we find that the three Universes conspire; and a universal feature of it is provision for later stages in earlier ones.

Peirce sees in this path a "humble argument" toward the existence of God. For my part, I see in it more immediately an argument for an action of signs in nature prior to advent of life, for which I have suggested the term "physiosemiosis". I have begun to suspect — it is only a musement — that semiosis may be the proper name for what we have heretofore studied under the rubric of "evolution". For while evolution designates the development of the universe from simpler to more complex arrangements and states, this has always been from the point of view of the present state of the world as determined by past developments. The idea of the past as shaping the present in leading up to it is the essential idea of evolution.

In semiosis there is a question of something richer, something much more complex than the essence of that idea. There is a question, indeed, of the future as shaper of the past, according to the saying of Peirce:[25] "The existence of thought now depends on what is to be hereafter; so that it has only a potential existence, dependent on the future thought of the community". Within the context of evolution, the

[24] Peirce 1908: CP 6.464.
[25] Peirce 1868: CP 5.316.

"anthropic principle" has been advanced in recent years as a way of inferring from our existence to something about the process or processes of cosmic evolution. But indeed a semiosis at work throughout the whole of nature, and not just in the biosphere, would achieve the same thing with much greater illuminative power.

To see what I am trying to get at, let me call to your attention Peirce's own moves when he resumes, in the early 1900s, the idea of interpretant introduced a quarter century or more earlier. The original conception was in the context of the third of the three elements united in the being of sign as a triadic relation. The resumption looks rather to the action of signs as determining the position of a given element within the triad of significance, the semiotic triangle. The triangular being of a sign is now set in motion as a spiral of semiosis: getting an idea in the first place (abduction), which is then developed as to its consequences (deduction), and finally tested against experience (induction or "retroduction"), is now seen as resulting in yet a further abduction requiring further deductions and tests leading to further abductions ... and so on, ad infinitum, until death. The spiral, for the individual organism endowed with cognitive capacity, begins at or near conception (far nearer to conception than to birth) and ends at death. But now this metaphor of the spiral of semiosis is recast as model applying to the whole of reality, the very physical universe itself as the cradle of Firstness and Thirdness alike.

Watch the move. "Around the year 1904", Bergman (2000: 10) discovers, "Peirce begins to expand on his conception of the interpretant", and to introduce distinction of varieties thereof, including varieties that are not mental, which raises the possibility "that there might be representamens without mental interpretants — that is, that are not signs in the full sense of his definition".[26] In particular,

> Peirce explicitly notes that the interpretant need not actually exist to guarantee the reality of the sign; a being *in futuro* suffices. This is a central doctrine of the earliest semeiotic, which appears to have been temporarily ignored in the propositional analysis of the 'New List'. But a more radical change of outlook seems to be required by the path Peirce is pursuing; namely, the identification of various kinds of interpretants, some of which are *not* signs, cannot proceed comfortably on the basis of a sign-definition in which the interpretant is plainly characterised as a sign. Therefore, it is not surprising that Peirce once more redefines the interpretant; and this time in a far more general and suggestive way than before.

[26] E.g., Peirce 1903: EP 2.273.

As objects give rise to *repraesentamina*, Peirce considers, so representamens — which, remember, correspond to the casual and "loose" or common notion of sign — give rise to interpretants respecting their objects, completing the triadic relation or "semiotic triangle" in which the being of sign properly and strictly consists. So the interpretant, in closing the semiotic triangle, may be regarded as the "effect", the "proper significate outcome", of signs in the sense of representamina. The move seems simple, but the consequences are far-reaching:

> Three things should be noted at this point. The first is that this new conception of the interpretant as the proper significate effect of the sign leaves room for interpretants that are not signs, at least not in their primary function *as* interpretants. ... Secondly, this conception of the interpretant as effect is easier to generalise to various kinds of sign-processes, such as those we find in living nature, than the earlier definition, in which the interpretant was basically understood as a sign. The new approach almost automatically avoids the mentalistic undercurrent, which Peirce never quite managed to eradicate from the earlier position, while still having more substantial implications than his most formal definitions of the sign-relation. ... Thirdly, the communicative derivation leads to a dynamic, processual notion of the sign and its correlates, one which is not boxed up in the unity of the proposition. Peirce now emphasises that the object is in a relevant semiotic sense past in relation to the sign, while the interpretant in general implies a reference to the future[27] ... a significant directionality. (Bergman 2000: 12)

It is a matter of "critical commonsensism".[28] So naturally[29] "at this point a trained mind will demand that an examination be made of the truth of the interpretation; and the first step in such examination must be a logical analysis of the theory." Luckily, "logical analysis can be put to its full efficiency in Musement",[30] even though "strict examination would be a task a little too serious for the Musement of hour fractions, and if it is postponed there will be ample remuneration even in the suggestions that there is not time to examine; especially since a few of them" — such as the present one, the suggestion that a semiosis is possible even in the formation of rocks and stars, even in the earliest moments of a "big bang" — "will appeal to reason as all but certain".

Look at the strategy, as Bergman reconstructs it:

---

[27] E.g., Peirce 1907b: MS 318, p.176.
[28] See the Index entry *common sense* in Deely 2001b.
[29] Peirce 1908: CP 6.464.
[30] Peirce 1908: CP 6.461.

> Peirce's strategy here is to set out from a common-sense idea of what we mean by 'sign', from which he moves on to extend the term to phenomena and processes that would not normally be called signs.[31] Now the conception that Peirce takes to be the ordinary, unreflected idea of sign and sign-process is that the activity of signs takes place between human minds, or at least involves an utterer and an interpreter. Such a view may seem to be almost opposite to Peirce's generalised conceptions of sign and semiosis. But in fact Peirce considers this crude idea to contain the seed of truth. He observes that it is highly characteristic of signs that they function on the arena set up by two minds, or 'theatres of consciousness', of which one acts as an utterer and the other as interpreter.[32] However, he goes on to observe that they are not strictly speaking necessary for the being of signs. That is, he thinks that it is possible that there are sign-relations that do not actively involve utterers and interpreters, although he is not quite certain concerning the interpreter. What is beyond doubt, however, is that the interpretant cannot be simply identified with an interpreter.
>
> Peirce's aim is to abstract those ingredients of utterer and interpreter that are vital to the being of a sign. In other words, he is looking for elements that can *virtually* perform the significant roles of utterer and interpreter. The ordinary communicative act or interaction is taken as a paradigmatic case of sign-action, from which it is possible to extract the core components of the sign-relation. Given this assumption, Peirce begins his new derivation of the central components of the sign-relation. (Bergman 2000: 10–11)

"Elements that can *virtually* perform the significant roles of utterer and interpreter": the sophisticated reader can hardly fail to be struck with the intersemioticity here with the primal text of Poinsot: "it suffices to be a sign virtually in order to signify in act".[33] And with a single bound, we are back to the original argument advanced in support of the idea of a physiosemiosis,[34] an action of signs prior to the advent of life on earth, prior to the advent of planets or even stars in the galaxies of Secondness, an action of signs virtually coextensive with the physical domain of Secondness and active therein to make the advent of cognitive and eventually "rational" animals a matter of time,[35] and therewith both Firstness and Thirdness as semiosis actualized *modo explicito* and, eventually, thematically, in the birth of the fully *semeiotic animal*, as I suggest we should see (Deely 2001b: 736–7).

---

[31] Cf. Peirce 1907b: MS 318:163; Short 1981: 197.

[32] Peirce 1907a: EP 2.403.

[33] Poinsot 1632: Book I, Question 1, *praecipuum fundamentum*, 126/3-4.

[34] The original argument traces through Deely 1990, 1991, 1994, 1996, 1998, 1999, 2000, 2001b.

[35] an idea that should not come as pure novelty even to those encapsulated in circles centered on the coenoscopic physics and metaphysics of Aristotle and Aquinas, as I once (Deely 1969) took pains to demonstrate.

The being of the dinosaur, actually gone, is virtually contained in the petrified bone. And this rock, "transcendentally relative" to its origin in an extinct animal, survives here and now to specify the awareness of a future observer, who will be called a "paleontologist", as it happens, to form the idea whereby that extinct animal will come to be known, even in its absence, for what it was. The fossil, a "transcendental relation" in the terms of late Latin semiotic, a "representamen" in the semiotic parlance of postmodernity, so exists as to guide the sufficiently knowledgeable observer to an awareness of what once was — not just any observer, mind you; for all we know, it may have been just such a fossil bone perceived only as a suitable rock that David seized for his sling in the slaying of Goliath. The future, it turns out, has more than one way of determining the past in putting it to present use.

Just this indeterminacy is the key to semiosis as the play of relations among objects and things, things and objects, always redrawing the line between what is and what could be, what could be and what will be, and — especially — what will be unforeseeably from a present vantage, for "being can be said in many ways", and which way is determined not by an evolution from past to present alone but by a semiosis wherein the future determines the final outcome of what is now, shaping the past accordingly. For what "is now" determines a range of what it can be taken to be, in a play of interpretants to come; yet which parts of that range, if any (we can be fairly sure there will be some!), will be actualized depends upon chance intersections of causal lines whose very intersection is indetermined in the nature of things. So signs stand to the "present" — any present you please — as objects stand to the past, and interpretants to the future. It — the total Universe made up of the interplay of the three Universes; "being", if you will — appears, exactly as we have become increasingly aware since the 17th century trial of Galileo,[36] as one grand unfolding growth wherein the being proper to signs as rooted in the uniqueness of relation as a mode of being cannot but be virtually at play wherever

[36] In the wake of that trial did we all slowly become aware of what Peirce singles out (1908: CP 6.464) and Aquinas anticipated (c.1272/3: II. lect. 17. n. 451, Busa, vol. 4, p. 36) as a choice morsel for musement, "that every small part of space, however remote, is bounded by just such neighbouring parts as every other, without a single exception throughout immensity. The matter of Nature is in every star of the same elementary kinds, and (except for variations of circumstance), what is more wonderful still, throughout the whole visible universe, about the same proportions of the different chemical elements prevail."

there is interaction among cosmic elements, even down to the "lowest" orders of Brute Secondness.

Such is my musement, the hypothesis of physiosemiosis. After all, the threshold from conscious life to vegetable growths ("phytosemiotics"[37]) is a harder threshold speculatively to cross for semioticians than is that thinner boundary between the organic and the inorganic. If biosemiosis be credible, covering phytosemiosis along with zoosemiosis and anthroposemiosis, then a-fortiori physiosemiosis is credible as well, the final frontier in understanding the action of signs. If so, we should not only say, with Sebeok,[38] that semiosis is criterial of life, but of the whole of existence as comprising interacting individuals changing over time and leading to a growth in which consciousness itself appears as an advanced expression, the universe's way of coming to realize that its perfusion with signs may not be the whole of its being but is the whole of the reason its being grows over time. "Symbols grow", Peirce liked to point out, and so star-systems, planets, and ecospheres. And at the heart of all of them is the inexorable play of relations, the root of semiosis, whose trunk is the physical environment, its branches the biosphere, and its leaves the individual organisms with their miniature spiral of guesses, explications, tests, and further guesses, until death resorbs them into that larger process whereby the universe as a whole makes its tentative moves, develops the consequences, modifies them as circumstances warrant, and renews its tentatives, in an even larger spiral of semiosis.

This much seems true, regardless of Peirce's further suggestion[39] that "in the Pure Play of Musement the idea of God's Reality will be sure sooner or later to be found an attractive fancy, which the Muser will develop in various ways"[40]. For our movement of musement has gone in the other directions, not toward the highest growths of symbolic life but toward the origins of the prior possibility of such a life for finite beings at any level. Our "petite bouchée with the Universes" has taken the form of "considering some connection between two of the three [Firstness and Thirdness], with speculation concerning its

[37] See Krampen 1981; Deely 1987.

[38] E.g., Sebeok 1993.

[39] Peirce 1908: CP 6.465.

[40] The semiotician can hardly help to consider the musings of Aquinas and, before him, Augustine concerning the unity of God as consisting in a Triad of Subsisting Relations, personal, communicative, creative, conceivable as such by the finite mind (according to Aquinas c.1266/73: I. 28.) on the very ground in relation that makes finite semioses possible!

cause [the being proper to relation even in the order of Secondness]", the very kind of musement Peirce[41] "particularly recommends," although not at all for the particular reason he recommends it.[42]

Yet here we need to go into details, to argue particular cases, such as the formation of mountain ranges, canyons, or the migration of birds, as involving (*exactly* how?) semiosis. We have reached that point where our "play of musement" requires to be "converted into scientific study". But, as "that cannot be pursued in odd half hours",[43] we must for the nonce leave our physiosemiosis suspended, as it were, between philosophical belief and scientific conviction, confident nonetheless that it will not turn out to be another case of phlogiston, but an essential ingredient or layer in explaining the perfusion of signs through which the universe comes to be as it is and to be known to us insofar as it does.

References

Aquinas, Thomas i. 1252–1273. *S. Thomae Aquinatis Opera Omnia ut sunt in indice thomistico*, ed. Roberto Busa. Stuttgart-Bad Cannstatt: Frommann-Holzboog, 1980, in septem volumina: 1. In quattuor libros Sententiarum; 2. Summa contra Gentiles, Autographi Deleta, Summa Theologiae; 3. Quaestiones Disputatae, Quaestiones Quodlibetales, Opuscula; 4. Commentaria in Aristotelem et alios; 5. Commentaria in Scripturas; 6. Reportationes, Opuscula dubiae authenticitatis; 7. Aliorum Medii Aevi Auctorum Scripta 61.

— c. 1269/72. *Quaestiones Quodlibetales, Quodlibet* 4, in Busa ed., vol. 3, 457–465.

— c. 1266/73. *Summa theologiae*, in Busa ed., vol. 2, 184–926.

— c. 1272/3. *In libros de coelo et mundo*, in Busa ed., vol. 4, 1–49.

Beuchot, Mauricio; Deely, John 1995. Common sources for the Semiotic of Charles Peirce and John Poinsot. *Review of Metaphysics* 48(3) (March): 539–566.

Bergman, Mats 2000. Peirce's derivations of the interpretant. Paper presented in the "Theme Seminar in Philosophical Semiotics" at the University of Helsinki, Fall 2000 semester. [Page references are to the prepublication ms. on which the seminar session was based.]

Deely, John 1969. The philosophical dimensions of the Origin of Species. *The Thomist* 33 (January and April), Part I: 75–149, Part II: 251–342.

— 1975. Reference to the non-existent. *The Thomist* 39(2) (April): 253–308.

[41] Peirce 1908: CP 6.458.

[42] To wit, because (*ibid*.) "it will flower in time into the N.A."

[43] Cf. Peirce 1908: CP 6.459.

— 1987. On the notion of phytosemiotics. In: Deely, John; Evans, Jonathan (eds.), *Semiotics 1982*: 541–554; reprinted with minor revision in Deely; Williams; Kruse 1986: 96–103.
— 1990. *Basics of Semiotics.* Bloomington: Indiana University Press.
— 1991. Semiotics and biosemiotics: Are sign-science and life-science coextensive? In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *Biosemiotics. The Semiotic Web 1991*. Berlin: Mouton de Gruyter, 1992, 45–75.
— 1994. How does semiosis effect renvoi? *The American Journal of Semiotics* 11(1/2): 11–61.
— 1994a. *The Human Use of Signs; or Elements of Anthroposemiosis*. Lanham, MD: Rowman & Littlefield.
— 1994b. *New Beginnings. Early Modern Philosophy and Postmodern Thought.* Toronto, Canada: University of Toronto Press.
— 1995. Why investigate the common sources of Charles Peirce and John Poinsot? In: Spinks, C. W; Deely, John (eds.), *Semiotics 1994*. New York: Peter Lang, 34–50.
— 1996. The grand vision.[44] In: Colapietro, Vincent M.; Olshewsky, Thomas M. (eds.), *Peirce's Doctrine of Signs*. Berlin: Mouton de Gruyter, 45–67.
— 1998. How is the universe perfused with signs? In: Spinks, C. W.; Deely, J. N. (eds.), *Semiotics 1997*. New York: Peter Lang Publishing, Inc., 389–394.
— 1998a. The ethics of terminology. In: Colapetrio, Vincent (ed.), *ACPQ Special Issue on Peirce,* 72(2): 197–243.
— 1999. Physiosemiosis and semiotics. In: Spinks, C. W.; Deely, J. N. (eds.), *Semiotics 1998*. New York: Peter Lang, 191–197.
— 2000. A new beginning for the sciences. In: Perron, Paul; Danesi, Marcel; Colilli, Paul; Wattanabee, John (eds.), *Semiotics as a Bridge between the Humanities and the Sciences.* Ottawa: Legas Press, 95–108.
— 2000a. *What Distinguishes Human Understanding?* South Bend, St. Augustine's Press.
— 2001a. Umwelt. *Semiotica* 134 (1/4).
— 2001b. *Four Ages of Understanding. The First Postmodern History of Philosophy from Ancient Times to the Turn of the 21th Century*. Toronto: University of Toronto Press.
Deely, John N.; Williams, Brooke; Kruse, Felicia E. (eds.). 1986. *Frontiers in Semiotics.* Bloomington: Indiana University Press.
Eco, Umberto 1990. Unlimited semiosis and rift: Pragmaticism vs. 'pragmatism'. In: *The Limits of Interpretation*. Bloomington: Indiana University Press, 23–43.

[44] Presented on September 8 at the September 5–10 1989 Charles Sanders Peirce Sesquicentennial International Congress at Harvard University. This essay was first published in the *Transactions of the Charles S. Peirce Society* 30(2) (Spring 1994): 371–400, but, inexplicably, after the submission of corrected proofs, the journal repaged the whole and introduced such extreme errors as to make the text unreadable at some points. The correct version has appeared as chapter 7 of Deely 1995: 183–200.

Eco, Umberto; Lambertini, Roberto; Marmo, Costantino; Tabarroni Andrea 1986. Latratus canis or: The dog's barking. In: Deely, Williams & Kruse 1986: 63–73.

Ketner, Kenneth Laine 1981. Peirce's ethics of terminology. *Transactions of the Charles S. Peirce Society* 17(4): 327–347.

Krampen, Martin 1981. Phytosemiotics. *Semiotica* 36(3/4): 187–209.

Krempel, A. 1952. *La doctrine de la relation chez saint Thomas. Exposé historique et systématique*. Paris: J. Vrin.

Maritain, Jacques 1957. Language and the Theory of sign. In: Anschen Ruth Anda (ed.), *Language: An Enquiry into Its meaning and Function*. New York: Harper and Brothers, 86–101. [Reprinted in Deely, Williams & Kruse, eds., 1986: 51–62. Page references are based on the 1986 reprint as the most definitive English version.]

Peirce, Charles Sanders[45] 1865. Lectures "On the Logic of Science", published in W 1.162–302.

— 1867. On a new list of categories. *Proceedings of the American Academy of Arts and Sciences* 7, 287–298; in CP 1.545–559, with "notes on the preceding" continuing to 1.567; and in W 2.49–59.

— 1868. Some consequence of four incapacities. *Journal of Speculative Philosophy* 2: 140–157, reprinted in CP 5.264–317.

— 1895. Of reasoning in general. Published in EP 2.11–26.

— c. 1902. From the uncompleted book, *Minute Logic*, Chapter 1, "Intended Characters of this Treatise", as appearing in CP 2.1–118.

— 1903. The ethics of terminology. In: *A Syllabus of Certain Topics of Logic* (Boston: Alfred Mudge & Son), 10–14; reprinted in CP 2.219–2.226 continuing 1.202.

— 1904. From a letter on 'signs and categories'. Printed in CP 8.327–341.

— 1905–1906. MS 283, partially published under the title "The Basis of Pragmaticism" in CP 1.573–574 (=MS 37–45), 5.549–554 (=MS 45–59), and 5.448n. (=MS 135–148).

— 1907a. Pragmatism. Part of MS 318 published in EP 2.

— 1907b. Pragmatism, MS 318.

[45] CP abbreviates *The Collected Papers of Charles Sanders Peirce*, Vols. 1–6, Charles Hartshorne and Paul Weiss (eds.); vols. 7–8, Arthur W. Burks (ed.). Cambridge, Mass.: Harvard University Press. The abbreviation followed by volume and paragraph numbers with a period between follows the standard CP reference form.

EP followed by volume and page numbers with a period in between abbreviates the 2-volume set of *The Essential Peirce: Selected Philosophical*, vol. 1 (1867–1893), vol.2 (1893–1913), eds. N. Houser & C. Kloesel. Bloomington: Indiana University Press, 1992, 1998, respectively.

W followed by volume and page numbers with a period in between abbreviates the ongoing *Writings of Charles S. Peirce: A Chronological Edition*, vols. 1–6, Max H. Fisch et al. (eds.). Bloomington: Indiana University Press, 1982, 1984, 1986, 1989, 1993, 2000 — of a projected 20 published so far.

MS are cited by number, using the pagination made by the Institute for Studies in Pragmaticism at Texas Tech University in Lubbock.

— 1908. A neglected argument for the reality of God. *The Hibbert Journal* 7 (October): 90–112; as rerpinted in CP 6.452–485.
— 1909. *A Syllabus of Certain Topics of Logic*, as partially reprinted in EP 2.
Poinsot, John 1985 [1632]. *Tractatus de Signis. The Semiotic of John Poinsot.* Berkeley: University of California Press. [References to the volume are by page number, followed by a slash and the appropriate line number of the specific section of text referred to.]
Sebeok, Thomas A. 1993. The sign science and the life science. In: Bernard, Jeff; Deely, John; Voigt, Vilmos; Withalm, Gloria (eds.), *Symbolicity*. Lanham: University Press of America, 243–252.
Short, Thomas 1981. Semeiosis and intentionality. *Transactions of the Charles S. Peirce Society* 17(3): 197–223.

Физиосемиозис в семиотической спирали: размышление

Центральным вопросом современной семиотики является вопрос о том, насколько далеко простирается парадигма знаковых действий, *семиозиса*. На данный момент существует всеобщее соглашение, что семиозис простирается по меньшей мере до пределов сознания или познания, охватывая таким образом и всю область использования знаков животными, т.е. *зоосемиозис*. Открытым остается вопрос, может ли семиотика быть еще шире, и тут имеются две точки зрения. Относительно консервативный взгляд распространил бы семиотику на все живое. Такое расширение было впервые предложено и обсуждено под эгидой *фитосемиотики*, которая является наукой о знаковых процессах на уровне растительной жизни. Это консервативное сообщество сплотилось вокруг *биосемиотики*. Более радикальное крыло утверждает, что даже такое расширение оставляет нечто за границей, а именно — физический универсум как таковой, от которого зависит и который окружает жизнь в целом. Радикалы считают для знаковых процессов характерным создание образа прошлого на основе будущих событий. Такое формирование образа можно заметить даже у камней и звезд в небесах — это и есть истинный физиосемиозис, теоретические положения и практические наблюдения которого намечают последний предел семиотического исследования.

Füsiosemioosis semiootilises spiraalis: mõttejoon

Keskseks küsimuseks tänapäeva semiootikas on, kui kaugele ulatub märkide toime, semioosise, paradigma. Praeguseks valitseb üldine kokkulepe, et semioosis ulatub vähemalt niikaugele kui teadlikkus või kognitsioon, hõlmates seega terve loomade märgikasutamise ehk zoosemioosise valdkonna. Lahtine on küsimus, kas semiootika võib olla veelgi avaram, ning selles küsimuses on välja kujunenud kaks seisukohta. Suhteliselt konservatiivne seisukoht laiendaks semiootika kõigele elusale. Selline laiendus pakuti esmakordselt välja ja selle üle arutati fütosemiootika sildi all, mis on teadus märgiprotsessidest taimse elu tasandil. Konservatiivid on koondunud biosemiootika ümber. Äärmuslikum seltskond väidab, et isegi selline laiendus jätab midagi välja, nimelt füüsilise universumi tervikuna, millest sõltub ja mis ümbritseb kogu elu. Radikaalide argument peab märgiprotsessidele iseloomulikuks mineviku kujundamist tulevikusündmuste põhjal. Sellist kujundatust võib märgata isegi kivide ja taevatähtede juures — see on tõeline füsiosemioosis, mille teoreetiline õigustus ja praktiline vaatlus märgib semiootilise uurimise viimast piiri.

"Matter as effete mind": Peirce's synechistic ideas on the semiotic threshold

Lucia Santaella
Center of Research on Digital Media, São Paulo Catholic University
R. João Ramalho 182, 05008-000 São Paulo, Brazil
e-mail: lbraga@pucsp.br

Abstract. Following Peirce's broad concept of semiosis as a foundation of a field of study, the semiotics of physical nature, it is argued that we have to explore the interconnections of Peirce's semiotics with metaphysics. These interconnections will be analyzed in five steps: (1) Peirce's radical antidualism and evolutionism, implied in his synechistic ideas, (2) Peirce's semiotic statement that "all this universe is perfused with signs if it is not composed exclusively of signs" (CP 5.448, n.1), (3) Peirce's bold statement that "matter is effete mind, inveterate habits becoming physical laws" (CP 6.24), (4) his theory of final causation, which can only be properly understood in the light of semiosis, (5) his metaphysics and his methodeutics in relation to semiotics. The laws of nature are discovered by abductive inference revealing an affinity between the human mind and the designs of nature. Hence, the formal laws of thought are not simply laws of our minds but laws of the intelligibility of things.

1. Introduction

Coined by Umberto Eco (1968), the metaphor of the semiotic threshold has been used to designate the boundaries of the research field of semiotics (Nöth 2000). For those who have accompanied the historical development of explicit semiotic studies from the 1950s to the present it is evident that these studies have undergone a continuous and gradual lowering of the semiotic threshold.

Under the influence of structuralism, semiotics first expanded to the domain of literary studies, especially to the semiotics of narratives,

poetry, and discourse in general. From verbal discourse, text semiotics then expanded to visual signs in films, paintings, mass communication, or fashion, and then to the domain of culture in general. From there, the expansion of the semiotic field went beyond the realm of human culture to the area of zoosemiotics. The ensuing insight that semiosis begins with life led to the development of the broad interdiscipline of biosemiotics, which gave rise to the semiotic study of a variety of sign processes such as microsemiosis, endosemiosis, mycosemiosis, phytosemiosis, and more recently ecosemiosis (Nöth 1998). Besides all these domains of the organic, with the development of computers and digital culture, the domain of nonliving systems from machines and computers to artificial intelligence and artificial life constituted a new challenge to semiotic research.

The most recent and still rather unexplored threshold of semiotics is the one of physicosemiosis. As far as I know, one of the first semioticians to call attention to this threshold was John Deely (1990). Referring to the new and startling vision that T. A. Sebeok has entertained since the 1960s about the convergence of the science of linguistics with the science of genetics, Deely stated that

> while Sebeok considerably propelled contemporary semiotics beyond the boundaries of a glottocentrically conceived anthroposemiosis and in the direction of considering sign processes as at work throughout the biological world, it still provided no ground for a notion of physiosemiosis, for seeing the action proper to the signs as already at work in the physical nature itself beyond the bounds of organic matter or prior to its advent. — To provide this further ground and to establish the Peircean broad conception of semiotics, therefore, would be the same thing. This other decisive step, taken together with the Peircean one of bringing the action along with the being of signs into thematic focus, is what is required to establish the full possibilities of a doctrine of signs. (Deely 1990: 86)

Since then, a new field of protosemiosis has emerged having as its object of study the precursors of semiosis in the inanimate world (cf. Nöth 2001a, 2001b). In this context, and following Deely's suggestions towards establishing Peirce's broad conception of semiotics as a foundation of the new semiotic territory of physiosemiosis, my argument is that for the development of this new domain, we have to explore the interconnections of Peirce's semiotics with his metaphysics. These interconnections should be analyzed in five steps:

(1) Peirce's radical antidualism and evolutionism, implied in his synechistic ideas, have to be taken to its ultimate consequences. According to these ideas, there is no separation or division, but

there are only differences of degree between nature and culture, between the organic and the inorganic, the psychical and the physical, the natural and the artificial.

(2) Peirce's disturbing semiotic statement that "all this universe is perfused with signs if it is not composed exclusively of signs" (CP 5.448, n.1) can only be properly understood in the light of synechism.

(3) Peirce's even more disturbing statement that "matter is effete mind, inveterate habits becoming physical laws" (CP 6.24) can only be properly understood in the light of his broad concept of mind and in the context of his theory of final causation.

(4) Final causation can only be properly understood in the light of semiosis. It is in Peirce's classification of signs, from quasi-signs to genuine signs, that we can find the basis of the analysis of the different degrees of semiosis ranging from the inorganic to the organic, from the physical to the psychical, from protosemiosis to the most developed form of semiosis, namely, the self-control that human reason can exercise over thought and conduct.

(5) Metaphysics and semiotics will appear even more deeply connected when we consider that Peirce's emphasis on continuity was vital to his evolutionary logic and pragmatism. His methodeutics, the liveliest branch of semiotics (cf. Santaella-Braga 1999a), highlights the scientific method as the prototype of final causation. The laws of nature are discovered by abductive inference revealing an affinity between the human mind and the designs of nature. Hence, the formal laws of thought are not simply laws of our minds but laws of the intelligibility of things.

These five steps are my working hypotheses for the development of a physicosemiosis based on Peirce. As this development is a task that will take some time to be accomplished in its whole, the present paper will be restricted to the discussion of the first step only.

2. Peirce's radical antidualistic metaphysics

Peirce's notion of synechism appears in his paper "The Law of Mind", which was included in the 1890–93 Monist series (CP 6.102–6.163). *Synechism*, a Greek coinage that contains the concept 'continuity', is the complementary opposite of *tychism*, another Greek word that con-

tains the meaning of 'chance'. Esposito (1973: 63) says that in later life, Peirce came to believe he had outlined a philosophical system that could serve as a matrix for his entire thought. The name he gave to that metaphysical system was synechism (CP 6.202). In a letter to William James, on November 25, 1902, when Peirce spoke of his "completely developed system, which all hangs together and cannot receive any proper presentation in fragments, he went on to describe synechism as the keystone of the arch" (CP 8.255–257; Potter & Shields 1977: 20).

Metaphysics is the first science in Peirce's architectonic classification of the sciences. It inquires into the nature of the objective world rather than into the structure of thought as his semiotics does. This means that there is a difference between thought and the world (Parker 1994: 52). Peirce's synechism, as we shall see, rejects this difference as being one of kind, but considers it instead as a difference only of degree.

Besides the development of his synechistic ideas, Peirce also gave ample thought to tychism or absolute chance. This latter was proposed because Peirce considered mechanistic and deterministic explanation insufficient in the light of his doctrine of categories. Despite its importance, tychism could not be taken as central to his metaphysics, since this centrality was due to synechism. That is why Peirce objected at having his metaphysical system as a whole called tychism. He explained that

> I object to having my metaphysical system as a whole called Tychism. For although tychism does enter into it, it only enters as subsidiary to that which is really, as I regard it, the characteristic of my doctrine, namely, that I chiefly insist upon continuity, or Thirdness, and, in order to secure to thirdness its really commanding function, I find it indispensable fully [to] recognize that it is a third, and that Firstness, or chance, and Secondness, or Brute reaction, are other elements, without the independence of which Thirdness would not have anything upon which to operate. Accordingly I like to call my theory Synechism, because it rests on the study of continuity. I would not object to Tritism. And if anybody can prove that it is *trite*, that would delight me [in] the chiefest degree. (CP 6.202)

Synechism is defined as "that tendency of philosophical thought which insists upon the idea of continuity as of prime importance in philosophy". Continuum, in its turn, is defined as "something whose possibilities of determination no multitude of individuals can exhaust" (CP 6.169–170; cf. Noble 1989; Myrvold 1995). A rudimentary form

of continuity is generality, since continuity is nothing but perfect generality of a law of relationship (CP 6.172).

Peirce frequently remarked that his pragmatism was intimately related to synechism, that is, his version of pragmatism leads to synechism in the sense that synechism includes pragmatism as a step. That is why Peirce emphasized the methodological aspect of synechism when he stated that synechism is not "an ultimate and absolute metaphysical doctrine", but like the pragmatic maxim itself "is a regulative principle of logic" (CP 6.173). While this maxim deals with the meaning of concepts, the synechistic principle prescribes "what sort of hypothesis is fit to be entertained and examined" (CP 6.173; Potter 1997: 71–72).

Despite the relevance of the methodological aspect of synechism and despite Peirce's statement that synechism is not an ultimate metaphysical doctrine, the principle of continuity envolves other aspects which are no less relevant. These are the ontological and the metaphysical aspects of synechism. For the purposes of this paper the ontological and metaphysical aspects are the ones I have chosen as the privileged path into synechism, leaving the methodological aspect to be discussed in the fifth step of my argument.

3.The ontology and metaphysics of synechism

In "The Doctrine of Necessity Examined" (CP 6.35–6.65, 1892), Peirce rejected the universality of the uniformity of nature and its consequent mechanism. According to Cosculluela (1992: 743), Peirce was against the suggestion that the observation of nature proves that determinism is true and claimed that observation merely shows that there is an element of uniformity in nature; it does not show that such regularity is "exact and universal" (CP 6.46, 1.55). "No observation or set of observations which human beings are physically capable of making can prove that every fact is precisely determined by law" (Cosculluela 1992: 743). In sum: facts do not conform precisely and uniformly to law.

Peirce did not deny that there are laws in nature. On the contrary, he asserted that laws of nature are real generals which means that there is an element of regularity in nature. The regularity of the laws, however, is constantly being violated to some degree (CP 6.59, 6.588). Peirce's tychism results from the imperfect regularity of nature

provoked by the "infinitesimal departures from law" with which nature is literally infected. The more precise our observations become, the more likely it is that we shall encounter facts which seem to depart from laws (CP 6.46). This is a proof that chance is an objective feature of nature.

Hookway (1997: 18–21) remarks that, since 1884, in his "Design and Chance" (W4: 544–554), Peirce was aware of the sporadic violation of the laws of nature in some infinitesimal degree. Noticing that chance is governed by the laws of the probability calculus, he argued that chance "has the property of being able to produce uniformities far more strict than those from which it works" (W4: 551). From the indication that certain laws of nature are "statistical facts", Peirce concluded that all known laws are statistical facts, although some laws are so well established that the deviations they do undergo are so rare and minute as to be unnoticed. Peirce's further step, which was taken in a supplement to "Design and Chance" (W4: 553), was to propose that the laws of physics may be "habits gradually acquired by systems". This anthropomorphic suggestion of habits of nature as an analogue of the processes whereby human beings acquire habits of conduct was not new, since it had already been endorsed in Peirce's manuscript "Methods of Reasoning" of 1881 (cf. Hookway 1997: 20).

From 1884 on, habits of nature became the central concept in Peirce's synechism at the same time that he became a defender of the relevance of anthropomorphic concepts in philosophy. "In fact, habits, from the mode of their formation necessarily consist in the permanence of some relation, and, therefore [...] each law of nature would consist in some permanence, such as the permanence of mass, momentum, and energy. In this respect, the theory suits the facts admirably" (W6: 210).

Hence, Peirce's insistence on the importance of absolute chance was appropriately counterbalanced by the role that habits perform in nature. In 1886, in a manuscript entitled "One, Two, Three: Kantian Categories", nature's tendency to take habits was clearly postulated:

> We must [...] suppose an element of absolute chance, sporting, spontaneity, originality, freedom in nature. We must further suppose that this element in the ages of the past was indefinitely more prominent than now, and that the present almost exact conformity to law is something that has been gradually brought about [...]. If the universe is thus progressing from a state of all but pure chance to a state of all but complete determination by law, we must suppose that there is an original elemental tendency of things to acquire determinate properties, to take habits. This is the third or mediating element between chance which brings forth First and original events, and law which produces

> sequences of Seconds. [T]his tendency must itself have been gradually evolved; and it would evidently tend to strengthen itself. (W5: 293)

In 1887, three years later, in his "A Guess at the Riddle" (W6: 166–210), "habit taking" did not "introduce something which is categorially distinct from law. This tendency is itself a law which explains the evolution of laws, including itself" (Hookway 1997: 20). At this point, Peirce could find his explanation for the evolutionary character of all laws, a character that comes from their being subject to growth and change.

> The tendency to obey laws has always been and will always be growing. [...] Moreover, all things have a tendency to take habits. [...] This tendency itself constitutes a regularity and is continually on the increase. In looking back into the past we are looking towards periods when it was a less and less decided tendency. But its own essential nature is to grow. It is a generalizing tendency; it causes actions in the future to follow some generalization of past actions; and this tendency is something capable of similar generalization; and thus it is self-generative. We have therefore only to suppose the smallest spur of it in the past, and that germ would have been bound to develop into a mighty and over-ruling principle, until it supersedes itself by strengthening habits into absolute laws regulating the action of all things in every respect in the indefinite future. According to this, three elements are active in the world, first, chance; second, law; and third, habit-taking. Such is our guess at the secret of the sphinx. (W6: 208)

This guess suggests that habit-taking or continuity, thirdness, is the bridge, that is, the mediation between possibility or chance, i.e., firstness and actuality or operative law, i.e., secondness. Peirce's categories should be understood here as categories of relation and modality rather than of substance and quality. They are neither limited within the mode of being of possibility alone nor within the mode of an individual thing or actual fact alone. According to synechism, there is nothing about actuality that just *is*. On the one hand, actuality always retains an element of arbitrary chance, an element of sporting which disposes it to be something other than what it is (Wells 1996: 233). On the other hand, the law of habit prescribes that actual events can not escape the governance of laws. However, the regularity of the laws are constantly being violated to some infinitesimal degree by the element of arbitrary chance. Hence, "in a dialectic of becoming, actual fact or existence, secondness, is only partially real; its destiny lies within the wider context of Thirdness" (Esposito 1973: 67). A thoroughgoing synechistic evolutionism implies that nothing escapes the guiding hand of habit-taking or thirdness.

In the light of synechism, thirdness means continuity, that is, relational thirdness (CP 6.190), which implies the interrelation of the three categories and their coexistence within thirdness. Thus, continuity should not be understood as generalization fully spread out or taken to the limit of generalization. Continuity is rather a dispositional state that infinitely tends toward such spreading out (Wells 1996: 234). This is possible because continuity encapsules the principle of discontinuity, since the originality of chance may violate the conformity of an event to the strict guidance of the law. That is why laws are approximations which retain a dispositional propensity for habit taking or continuity.

For Peirce, a system of philosophy must be able to account for the following distinctive traits of the observable universe: (a) growth and developing complexity; (b) variety; (c) regularity, i.e., laws of nature; (d) consciousness or feeling (CP 6.613,; Reynolds 1996: 404). His synechistic idea of habits of nature as a complementary opposite to chance, as we have seen, enabled him to account for the first three of these demands: growth, variety, and laws of nature. Although a better clarification of these issues implies the discussion of Peirce's concepts of efficient and final causation, I will not face this discussion now so that we can go straight to the forth issue, the existence of consciousness or feeling in the universe. Peirce vehemently rejected any dualistic separation of consciousness and matter since this would betray his synechism which prescribed a thoroughgoing evolutionism and, consequently, a radical antidualism. To suppose that dead matter was capable of feeling was a rather improbable hypothesis. How could Peirce find a route out of this dilemma?

Given a choice between Cartesian dualism and some variety of monism, philosophy must adopt the latter according to Peirce. There are three possible directions in which monism can be developed: (a) neutralism, which takes physical and psychical laws as independent of each other and stemming from some third *Urstoff*; (b) materialism, which takes the psychical laws to be derived from the physical, and (c) idealism, which take the physical as derived from the psychical. Occam's razor guided Peirce against neutralism. The first principle of scientific thought, that is, do not resort to the ultimate and inexplicable as an explanation, guided him against materialism. Objective idealism is the only rational alternative: "matter is effete mind" (CP 6.24; Potter 1997: 133). If "matter is effete mind", and physical laws are derived from psychical, there is only one kind of stuff in the universe

and that is mind, the great law of the universe is that of mind. What is the law of mind?

> Logical analysis applied to mental phenomena shows that there is but one law of mind, namely, that ideas tend to spread continuously and to affect certain others which stand to them in a peculiar relation of affectibility. In this spreading they lose intensity, and specially the power of affecting others, but gain generality and become welded with other ideas. (CP 6.104)

This is the tendency to generalize and to form associations which is also the tendency to form habits, itself a habit (CP 6.612).

> But no mental action seems to be necessary or invariable in its character. In whatever manner the mind has reacted under a given sensation, in that manner it is more likely to react again: were this, however, an absolute necessity, habits would become wooden and ineradicable and, no room being left for the formation of new habits, intellectual life would come to a speedy close. Thus the uncertainty of the mental law is no mere defect of it, but on the contrary its essence. (CP 6.148).

At this point, the law of mind appears as the prototypical dispositional state of continuity or thirdness, a kind of law that is proper of final causation. Leaving the discussion of final causation to the fourth step of my argument, let me now clarify the relation between mind and matter.

4. Mind and matter

What Peirce found out in nature and in thought is a general tendency of possibilities or chance events to turn into sequences of events that coalesce by taking habits (W6: 209–210). This is relational generality from which dynamism and growth generate. The prototype of this tendency is in the human mind, in the way ideas are associated in our minds which is analogous to the probabilistic laws of nature (Hulswit 2000: 7).

With chance, Peirce introduced rudimentary consciousness in nature. "Wherever chance-spontaneity is found, there in the same proportion feeling exists. In fact, chance is but the outward aspect of that which within itself is feeling" (CP 6.265). With the extension of the notion of habit-taking down to the world of chemistry and physics, down to the world of physical laws, Peirce accomplished to develop his evolutionism. Synechism amounts to the denial of an absolute separation of mind from world. Mind and matter are *termini* of a sin-

gle *continuum*, and so are the organic and the inorganic, the artificial and the natural, culture and nature. This expresses Peirce's radical antidualism. Hence, his monism on mind or objective idealism is not just an inversion of the physicalist conception of mind according to which mental states are simply physical states. What Peirce asserted is that all of reality, in an infinite series of differentiations, is governed by the law of mind (see Santaella Braga 1999b). He did not mean that matter has the substance of mind, neither "substance" in the old sense of a thing nor in the modern chemical sense. In sum: "The truth is, the mind is not subject to "law" in the same rigid sense that matter is. It only experiences gentle forces which merely render it more likely to act in a given way than otherwise would. There always remains a certain amount of arbitrary spontaneity in its action, without which it would be dead" (CP 6.148).

In contrast, what we call matter is merely mind so hidebound with habit (so regular) that it ceases to exhibit the same behavior of spontaneity and feeling which is so abundant in mind (CP 6.25; Reynolds 1996: 405–406). While mind is anarchic, matter is law-abiding. Synechism bridges the gap between matter and mind because when we suppose "matter to be but mind under the slavery of inveterate habits", the law of mind still applies to it. According to that law, consciousness subsides as habit becomes established, and is excited again at the breaking up of habit. But the highest quality of mind involves a great readiness to take habits, and a great readiness to lose them; and this implies a degree of feeling neither very intense nor very feeble" (CP 6.613). In sum: matter is mind

> whose habits have become fixed so as to lose the power of forming them while mind is to be regarded as a chemical genus of extreme complexity and instability. It has acquired in a remarkable degree a habit of taking and laying aside habits. The fundamental divergences from law must here be most extraordinarily high, although probably very far indeed from attaining any directly observable magnitude. But their effect is to cause the laws of mind to be themselves of so fluid a character as to simulate divergences from law. (CP 6.101, g)

Matter, on the other hand, "is not completely dead, but is merely mind hidebound with habits. It still retains the element of diversification; and in that diversification there is life" (CP 6.158). From this presence of mind in matter and vice versa, Peirce inferred the direct and indirect connections between matter and mind, between the physical and psychical aspects of matter and the reaction between mind and matter (see CP 6.268, 6.277). As it attributes to mind, one of the properties of

matter, extension, and attributes to all matter, "a certain low degree of feeling together with a certain power of taking habits", Peirce's hypothesis may be called materialistic. However, it differs from materialism because it does not suppose mind to be guided by blind mechanical law. Instead, it supposes "the one original law to be the recognized law of mind, the law of association, of which the laws of matter are regarded as mere special results" (CP 6.277).

In the light of synechism, human mind and physical matter are only the two extremes of a very subtle and complex range of differentiations in the continuous time-arrow that constitutes nature. Peirce took the time's arrow principles of mind as paradigmatic of any evolutionary process be it in mind or in nature. What he sought was a definition of an irreversible process which was sufficiently abstract to take in both the mental and the physical. Thus, mind has to be understood in a very broad sense (Santaella-Braga 1994). In the metaphysical context of synechism it is synonymous with continuity, in the logical context of semiotics, it is synonymous with semiosis. Mind is continuity and semiosis.

I have only discussed above the first step of my argument. This step is meant to function as a ground for the development of a physiosemiotics. Hence it is foundational for the discussion to be developed in the other four steps. However, these steps are a long task that will be left for the future. To conclude this paper, I will limit myself to advance a few remarks about the ideas to be developed.

In nature, secondness is law and thirdness is tendentiality to acquire new habits. That there is no pure or absolute secondness or brute reality in nature and in thought has to be stressed since this conclusion is of the highest importance for bio- and ecosemiotics and to understand why "all the universe is, in fact, perfused with signs if it is not composed exclusively of signs". For most Peircean semioticians this statement is a puzzling embarrassment as much as "matter effete mind" embarrasses metaphysicians. When, under the label of the dynamic object, semioticians claim for a non-semiotic realm to preserve the explanatory power of the concept of the sign, when they claim for an independent world of dyadic existence, semioticians are not only unaware of Peirce's synechism but they are also being loyal to their ingrained Cartesian soul.

As to the embarrassment with the statement that "matter is effete mind", if we conceive of mind as some mysterious ghostly substance lurking behind natural processes, matter as effete mind is, indeed, a most bewildering assertion.

As to the methodological aspect of synechism, it is worth advancing the idea that without a scientific metaphysics semiotics lacks a theory of the external world and of cosmic evolution. This lack has led semioticians to consider the dynamic object of human semiosis as a brute, formless reality external to our sense-perception. This is a serious mistake that comes from the ignorance that nature has a semiosis of its own to which human semiosis is connected through the thread of continuity and affinity. The process of nature and the process of thought are alike (Hookway 1997: 20). "There is in the being of things something which corresponds to the process of reasoning, that the world lives and moves, and has its being, in a logic of events" (NEM 4: 343–5).

References

Cosculluela, Victor 1992. Peirce on tychism and determinism. *Transactions of the Charles S. Peirce Society* 27(4): 741–755.

Deely, John 1990. *Basics of Semiotics*. Bloomington: Indiana University Press.

Eco, Umberto 1976. *La struttura assente*. Milano: Bompiani.

— 1990. *The Limits of Interpretation*. Bloomington: Indiana University Press.

Esposito, Joseph 1973. Synechism, socialism, and cybernetics. *Transactions of the Charles S. Peirce Society* 9(2): 64–78.

Hookway, Christopher 1997. Design and chance: The evolution of Peirce's evolutionary cosmology. *Transactions of the Charles S. Peirce Society* 33(1): 1–34.

Hulswit, Menno 1998. *A Semeiotic Account of Causation. The 'Cement of the Universe' from a Peircean Perspective.* Nijmegen: PhD dissertation.

— 2000. Peirce on causality and causation. In: Queiroz, João (ed.), *Digital Encyclopedia of Charles S. Peirce* (http://www.tr3s.com.br/peirce/).

— 2001. Semeiotic and the 'cement of the universe': A Peircean process approach to causation. *Transactions of the Charles S. Peirce Society*, forthcoming.

Johansen, Dines 1993. Let sleeping signs lie: On signs, objects, and communication. *Semiotica* 97: 271–295.

Kruse, Felicia 1990. Nature and semiosis. *Transactions of the Charles S. Peirce Society* 26(2): 221–224.

Myrvold, Wayne 1995. Peirce on Cantor's paradox and the continuum. *Transactions of the Charles S. Peirce Society* 31(3): 508–541.

Noble, N. A. Brian 1989. Peirce's definition of continuity and the concept of possibility. *Transactions of the Charles S. Peirce Society* 25(2): 149–174.

Nöth, Winfried 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–343.

— 2000. Umberto Eco's semiotic threshold. *Sign Systems Studies* 28: 49–61.

— 2001a. Máquinas semióticas. *Galáxia* (São Paulo) 1: 51–74.

— 2001b. Prosemiotics and physiosemiosis. *Sign Systems Studies* 29(1). (This volume.)

Parker, Kelly 1994. Peirce's semeiotic and ontology. *Transactions of the Charles S. Peirce Society* 30(1): 52–75.

Peirce, Charles Sanders 1931–58. *Collected Papers*. Vols. 1–6, Charles Hartshorne and Paul Weiss (eds.); vols. 7–8, Arthur W. Burks (ed.). Cambridge, Mass.: Harvard University Press. [References: CP, followed by vol., and paragraph number.]

— 1976. *The New Elements of Mathematics*, ed. by C. Eisele, 5 vols in 4. The Hague: Mouton. [References: NEM.]

— 1977. *Complete Published Works*, microfiche edition, ed. by K. L. Ketner et al. Greenwich, Conn.: Johnson. [Unpublished manuscripts. References: MS, using the pagination made by the Institute for Studies in Pragmaticism. Lubbock, Texas.]

— 1982ff. *Writings of Charles S. Peirce: A Chronological Edition*, vols. 1–6, M. Fisch et al. (eds.). Bloomington: Indiana Univ. Press. [References: W followed by vol. and page number.]

Potter, Vincent G. 1997 [1967]. *Charles S. Peirce on Norms and Ideals*. New York: Fordham University Press.

Potter, Vincent G. ; Shields, Paul 1977. Peirce's definitions of continuity. *Transactions of the Charles S. Peirce Society* 13(1): 20–34.

Santaella Braga, Lucia 1994. Peirce's broad concept of mind. *European Journal for Semiotic Studies* 6(3/4): 399–411.

— 1999a. Methodeutics, the liveliest branch of semiotics. *Semiotica* 124: 377–395.

— 1999b. A new causality for the understanding of the living. *Semiotica* 127(1/4): 497–519.

Short, Thomas 1981a. Semeiosis and intentionality. *Transactions of the Charles S. Peirce Society* 17(3): 197–223.

— 1981b. Peirce's concept of final causation. *Transactions of the Charles S. Peirce Society* 17(4): 369–382.

— 1999. Teleology and linguistic change. In: Shapiro, M.; Haley, M.C. (eds.), *The Peirce Seminar Papers*, vol. 4. New York: Berghahn, 111–158.

Suits, Bernard 1979. Doubts about Peirce's cosmology. *Transactions of the Charles S. Peirce Society* 15(4): 310–321.

Reynolds, Andrew 1996. Peirce's cosmology and the laws of thermodynamics. *Transactions of the Charles S. Peirce Society* 32(3): 403–423.

Wells, Kelley 1996. An evaluation of Hartshorne's critique of Peirce's synechism. *Transactions of the Charles S. Peirce Society* 32(2): 216–246.

"Материя как истощенный разум": синехистические идеи Пирса о семиотическом пороге

Принимая за основу исследования семиотики физической природы широкое пирсовское понимание семиозиса, автор статьи обосновывает необходимость изучения взаимосвязей пирсовской семиотики с метафизикой. Анализ этих взаимосвязей делится на пять этапов: 1) глубокий

антидуализм и эволюционизм Пирса, который содержится в его синехистических идеях, 2) семиотическое утверждение Пирса, что “вся вселеннная пропитана знаками или даже состоит целиком из знаков” (CP 5.448, n.1), 3) смелое утверждение Пирса о том, что “материя является истощенным разумом, закосневшими привычками, ставшими законами физики” (CP. 6. 24), 4) его теория о конечной причинности, которую можно правильно понять только в свете семиозиса, 5) его метафизика и методевтика в связи с семиотикой. Законы природы открыты посредством абдуктивных выводов, обнаруживших соответствие между человеческим разумом и оформлением природы. Таким образом, формальные законы мышления являются не просто законами разума, но и законами интеллигибельности вещей.

“Mateeria kui (välja)kurnatud mõte”: Peirce’i sünekistlikud vaated semiootilise läve kohta

Järgides Peirce’i avarat semioosise kontseptsiooni füüsilise looduse semiootika uurimise alusena, sedastatakse vajadus uurida Peirce’i semiootika seoseid metafüüsikaga. Neid suhteid analüüsitakse viies järgus: (1) Peirce’i sügav antidualism ja evolutsionism sisalduvana tema sünekistilistes ideedes, (2) Peirce’i semiootiline väide, et “kogu universum on märkidest läbiimbunud, kui ta just puhtalt märkidest ei koosnegi” (CP 5.448, n.1), (3) Peirce’i julge avaldus, et “mateeria on (välja)kurnatud mõte, panetunud harjumused, millest on saanud füüsikaseadused” (CP. 6. 24), (4) tema teooria lõplikust põhjuslikkusest, mida on võimalik õigesti mõista ainult semioosise valguses, (5) tema metafüüsika ja metodeutika seoses semiootikaga. Loodusseadused on avastatud abduktiivse järeldamise abil, paljastades vastavuse inimvaimu ja looduse kuju(nduse) vahel. Seega ei ole mõtlemise formaalsed seadused mitte üksnes vaimu seadused, vaid ka asjade mõistetavuse seadused.

Conway's game of life and the ecosystem represented by Uexküll's concept of Umwelt

Solomon Marcus

Section of Mathematical Sciences, Romanian Academy,
Calea Victoriei 125, 71102 Bucuresti, Romania
e-mail: solomon.marcus@imar.ro

Abstract. Inspired by a mathematical ecology of theatre (M. Dinu) and the eco-grammar systems (E. Csuhaj-Varju *et al*.), this paper gives a brief analysis of simple cellular automata games in order to demonstrate their primary semiotic features. In particular, the behaviour of configurations in Conway's game of life is compared to several general features of Uexküll's concept of Umwelt. It is concluded that ecological processes have a fundamental semiotic dimension.

Traditionally, ecology has been considered as making a sharp distinction between subject and object and, consequently, between the living being and its environment. This conception of an ecosystem can be illustrated by various mathematical models. Among these, however, a few are of special interest, for instance, one based on a theatrical scenario (Dinu 1974) and another that is expressed in terms of grammar systems (Csuhaj-Varju *et al*. 1994).

In Dinu's approach, an ecosystem is conceived as a biophysical structure including two different subsystems: a physical subsystem, the habitat, and a bio-subsystem, biocenosis, that contains the totality of populations existing in the respective habitat. An analogy between the behaviour of the biological communities and the behaviour of the characters in a theatrical play makes it possible to apply in ecology some mathematical models of the semiotics of theatre, as conceived

by Marcus (1967, 1969, 1970: 257–327) and Dinu (1968, 1970). The basic objects in the model are a set T of points, the territory, and the set S of all species living in T. A relation r associates to each species s in S a part of T, the area $r(s)$ of distribution of s. It is shown how the relations between species are influenced by the set of all possible biocenoses in T.

In the second model, proposed by Csuhaj-Varju *et al*. (1994) and further developed in several subsequent papers (e.g., Csuhaj-Varju *et al*. 1997), an ecosystem is an articulation of several agents and an environment. Agents are ruled by some evolution rules, by parallel rewriting and by a description, while the environment includes action rules, a sequential rewriting, a description, a parallel rewriting and some evolution rules. In this way, both the agents and the environment have the structure of an automaton and the whole construct is systemic. This includes self-referential behaviour and interaction between the agents.

The proposed ecosystem model shares the theatrical aspect of Dinu's model and the generative nature of Csuhaj-Varju's model. It adopts John Conway's famous game of life with its interpretation as an Umwelt in the sense of Jakob von Uexküll. The advantage of this procedure, as we show, stems from the fact that Conway's game of life fulfils many requirements to be considered as an Umwelt, together with its specific aspects contrasting "Umwelt" with "Environment" (Uexküll 1982; Marcus 2001).

From von Neumann to Conway

Conway's life automaton simulates the life-like behaviour by its capacity to permit self-reproduction. It is the simplest model in a series of such devices, inaugurated by von Neumann, whose first work in this respect was published in 1948, but we will refer here to his more comprehensive presentations (1958, 1966). We learn from Odifreddi (1997: 53) that Schrödinger (1944) and von Neumann (1948) had some influence on Watson and Crick (1953) with their famous discovery of the double-helix structure of DNA. Von Neumann (1958) tried to build a self-reproducing mechanical automaton by articulating three machines: A, B and C. Machine A is a universal constructor that, when fed the description $d(X)$ of a machine X, builds X. Machine B reproduces any description given to it. Machine C co-

ordinates *A* and *B*; given a description *d*(*X*), *A* builds a copy of *X*, while *B* reproduces a copy of *d*(*X*), after which the copy of *X* is fed the copy of *d*(*X*). Denoted by *D*, the resulting machine *A*+*B*+*C*, (*D*, *d*(*D*)) is self-reproducing. This presentation is attributed to Odifreddi (1997: 53–54), who observes that what von Neumann hypothesised and Watson and Crick confirmed is that this is a simplified representation of genetic reproduction: living cells contain universal constructors, basically the same for plants and animals, and only the genetic material (the program) is different; *d*(*X*) works like a segment of DNA that codifies the reproduction information, *B* (a special enzyme — RNA polymerase) has the function of duplicating the genetic material into a segment of RNA, while *A* (a set of ribosomes) builds proteins by following (a segment of RNA containing) the reproduction information. The resulting machine is a self-reproducing cell.

The questionable point of this model is the assumption of the existence of a universal constructor. This difficulty is transgressed by von Neumann (1966), who envisions a series of events taking place in a space of cells. In this respect, he uses a so-called cellular automaton, which is a potentially infinite, directed graph (space), whose nodes (cells) are finite state machines. Each cell can be in various states and the global behaviour consists of simultaneous, co-ordinated changes in the states of the individual cells. Specifically, von Neumann considers an automaton represented in a planar space with 29-state cells of a single type, each connected to the four orthogonally adjacent neighbours. He found a finite quiescent configuration (of around 200,000 cells) that, given any other finite quiescent configuration, reproduces it in a different part of the space, without erasing itself: he thus found a universal constructor for the class of quiescent configurations (Odifreddi 1997: 54–55).

Just as in von Neumann's order of ideas is Conway's life automaton, admitting self-developing configurations (Berlekamp *et al*. 1982; Poundstone 1984). The name reveals that it simulates life-like behaviour. It is also called Conway's game of life (GOL), because it has features of a strategic game. It consists of a planar space with each cell connected to the eight adjacent cells. Each cell has two states: 0 (death) and 1 (life). GOL is governed by two rules: (a) a dead cell is born when exactly three neighbours are alive; (b) a live cell survives if and only if two or three neighbours are alive. These rules dictate that the life of a cell is possible only if the number of living cells in its neighbourhood is neither overly small nor large. Both overpopulation and isolation produce death.

Three possibilities exist for a population in GOL: death, cyclic behaviour, and reproductive expansion. As Odifreddi asserts:

> Life is about as simple as it can be (it is well-known that 2-states cells with a von Neumann neighbourhood do not admit non-trivial self-reproduction), and it shows that self-reproduction does not need a complicated universe (since it is logically possible from simple physical models). (Odifreddi 1977: 55)

The game of life as Umwelt

Conway's GOL agrees with Jakob von Uexküll's concept of Umwelt in several respects.

(1) Like Umwelt, GOL makes no essential, intrinsic distinction between a population and its surroundings, between living beings and nature, between subject and object. Due to its capacity of expansion, a given population P is potentially everywhere; the surrounding $s(P)$ of P is potentially a part of P, because it includes cells which, in spite of being referred to as "dead cells", are only asleep, i.e., ready to wake up and become active in P. On the other hand, other cells, active in P, may fall asleep, moving from P to $s(P)$. Because the border between P and $s(P)$ is modified at each step, it is more convenient to consider that each basic square in the imaginary map of the eco-space created by P belongs equally to P and to $s(P)$.

(2) Like Uexküll's Umwelt, Conway's GOL is purely relational: nature is only indirectly perceived, via its relations to the living cells. The process to approach nature is purely semiotic. The evolution of the interplay between living cells and their neighbours is the only sign process by means by which nature is perceived by P.

(3) In contrast with classical ecology, where the ecosystem is relatively separated from the living beings to which it is associated, living beings are solitary in Uexküll's conception, the ecosystem of P being a product of P. This is what happens under GOL, where the initial configuration of P determines all its possible further evolutions. If the configuration of P tells us, by using rule (b), the possibilities of cells in P to survive, the configuration shows also, by rule (a), to what extent new living cells will be added to P.

(4) Like Umwelt, the configuration of P and $s(P)$ is permanently modified, although this fact also includes a remarkable particular case in which the respective configuration is stationary.

(5) Like Umwelt, the ecosystem represented by GOL is confrontational, because it has to face two opposite requirements: the difficulty of its emergence and the danger of its deterioration (by other ecosystems). No population is isolated in the world; different populations may clash. Any place potentially belongs to the ecosystem of any possible individual of any possible population. Even if we consider only one population *P*, rules (a) and (b) express two opposite trends, rule (a) shows the need of *P* to spread, while rule (b) expresses the need of *P* to survive, facing the danger to die.

(6) The possibility for *P* to spread beyond any limits in all directions, one of the basic trends in Conway's GOL, is in agreement with the openness of any ecosystem, so important in the modern mentality, and particularly in Uexküll's ideas about Umwelt.

(7) The theatrical metaphor, used by Uexküll in order to illustrate the confrontational nature of Umwelt, meets the attempts to view ecological processes as a theatrical performance (Hutchinson 1965; Dinu 1974).

(8) Uexküll's semantic atom, understood as the code that governs the life of a cell, has its analogy in Conway's GOL, which refers to cells placed in the squares of a checkerboard. As we have observed (Marcus 2001), this fact opens the possibility to take the semiotic atom as a unit of measure of the semiotic complexity of an ecosystem.

Both Umwelt and GOL display the features of life as viewed by Farmer and Belin (1992) and pointed out in the structure of von Neumann's cellular automaton; life is a pattern rather than a specific material object. Self-reproduction; metabolism; interdependence of parts in order to preserve identity, including the ability to die; ability to evolve; information storage of a self-representation (e.g., the self-description of the organism in DNA molecules which is interpreted in the protein/RNA machinery).

A requirement formulated by Farmer and Belin (1992), that of stability under perturbations and insensitivity to small changes, agrees only partially with the above approach above, because the principle of GOL is to accept only small changes having tremendous consequences (the "butterfly effect"; see the crucial role of the numbers 2 and 3 in the formulation of the rules (a) and (b)). This may mean that life is not always gradually separated from death, the move from the former to the latter may be chaotic, in the sense of the theory of non-linear dynamical systems.

Given the considerations above, we infer that — to the extent to which the life is a semiotic phenomenon, as conjectured by Thomas Sebeok, Jesper Hoffmeyer, Claus Emmeche, Winfried Nöth and Kalevi Kull and in agreement with the ideas developed by Jakob von Uexküll and John von Neumann — ecological processes also have a fundamental semiotic dimension.

References

Berlekamp, Elwyn R.; Conway, John Horton; Guy, Richard K. 1982. *Winning Ways, for your Mathematical Plays*. London: Academic Press.

Csuhaj-Varju, Erzsebet; Kelemen, Jozef; Kelemenová, Alice; Păun, Gheorghe 1994. Eco(grammar) systems: A preview. In: Trappl, Robert (ed.), *Cybernetics and Systems ´94*. Singapore: World Scientific Publ., 941–948.

Csuhaj-Varju, Erzsebet; Kelemen, Jozef; Kelemenová, Alice; Paun, Gheorghe 1997. Eco-grammar systems: A grammatical framework for studying life-like interactions. *Artificial Life* 3: 1–28.

Dinu, Mihai 1968. Structures linguistiques probabilistes dans l'étude du théatre. *Cahiers de linguistique théorique et appliquée* 5: 29–46.

— 1970. Contributions a l'étude mathematique du théatre. *Revue Roumaine de Mathematiques Pures et Appliquees* 15 (5).

— 1974. Éléments pour une écologie mathématique. *Informatica si modele matematice in stiintele sociale [Informatics and Mathematical Models in Social Sciences]* 3(1/2): 43–53.

Farmer, J. Doyne; Belin, Alletta d'A. 1992. Artificial life: The coming evolution. In: Langton, Christopher G.; Taylor, Charles; Farmer, J. Doyne; Rasmussen, Steen (eds.), *Artificial Life II*. (Santa Fe Institute Studies in the Sciences of Complexity, Proceedings 10.) Redwood City: Addison-Wesley, 815–840.

Hutchinson, G. Evelyn 1965. *The Ecological Theater and the Evolutionary Play*. New Haven: Yale University Press.

Marcus, Solomon 1967. Methodes mathématiques dans l'étude du drame. *T. A. Informations: Revue Internationale du Traitement Automatique du Language* 2: 86–87.

— 1969. Metode matematice in studiul dramei: Strategia personajelor I. In: *Metodologia istoriei şi a criticii literare*. Bucureşti: Editura Academiei, 163–170.

— 1970. *Poetica Matematica*. Bucuresti: Editura Academiei.

— 2001. On the logical and semiotic status of Jakob von Uexküll's concept of Umwelt. *Semiotica* 134(1/4).

Neumann, John von 1948. *The General and Logical Theory of Automata*. Cambridge: M.I.T. Press.

— 1958. *The Computer and the Brain*. New Haven: Yale University Press.

— 1986. *The Theory of Self-Reproducing Automata*. Chicago: University of Illinois Press.

Odifreddi, Piergiorgio 1997. Indiscreet applications of discrete mathematics. In: Bridges, D.S.; Calude, Cristian S.; Gibbons, J.; Reeves, S.; Witten, I.H. (eds.), *Combinatorics, Complexity, Logic: Proceedings of DMTCS'96*. Singapore: Springer, 52–65.

Poundstone, William 1984. *The Recursive Universe: Cosmic Complexity and the Limits of Scientific Knowledge*. New York: William Morrow.

Schrödinger, Erwin 1944. *What is Life?* Cambridge: Cambridge University Press.

Uexküll, Jakob von 1982. The theory of meaning. *Semiotica* 42(1): 25–82.

Watson, James D.; Crick, Francis H. C. 1953. Molecular structure of nucleic acids: A structure for deoxyribose nucleic acid. *Nature* 171: 737–738.

"Игра жизни" Конвея и представление экосистемы с помощью концепта *Umwelt*

Отталкиваясь от математической экологии в применении к театру (M. Dinu) и экограмматических систем (E. Csuhaj-Varju и др.), в статье анализируются игры, базирующиеся на клеточных автоматах, с целью демонстрации их семиотических свойств. Рассматривается поведение фигур в "игре жизни" Джона Конвея в сравнении с некоторыми свойствами модели *Umwelt* Юкскюля. Вывод — экологические процессы имеют семиотическое измерение.

Conway "elu mäng" ja ökosüsteemi esitus Uexkülli omailma mudeli abil

Inspireerituna matemaatilise ökoloogia rakendamisest teatri uurimisel (M. Dinu) ja ökogrammatilistest süsteemidest (E. Csuhaj-Varju *et al*.), analüüsitakse artiklis lühidalt rakuautomaatidel põhinevaid mänge, üritades demonstreerida nende semiootilisi omadusi. Vaadeldakse John Conway "elu mängu" figuuride käitumist ning võrreldakse seda mõnede Uexkülli omailma mudeli omadustega. Järeldatakse, et ökoloogilistel protsessidel on olemas semiootiline mõõde.

Ecosemiotics and the semiotics of nature

Winfried Nöth
University of Kassel, FB 08,
Georg-Forster-Str. 3, D-34117 Kassel, Germany
e-mail: noeth@uni-kassel.de

Abstract. Ecosemiotics is the study of sign processes (semioses) in relation to the natural environment in which they occur. The paper examines the cultural, biological, and evolutionary dimensions of ecosemioses on the basis of C. S. Peirce's theory of continuity between matter and mind and investigates the ecosemiotic dimensions of natural signs. Ecosemiotics and the semiotics of nature are distinguished from pansemiotism, and the coevolution of sign processes with their natural environment is discussed as a determining factor of ecosemiosis.

1. The scope of ecosemiotics

At the interface between semiotics and ecology, *ecosemiotics* is the study of *environmental semioses*, i.e., the study of sign processes which relate organisms to their natural environment. Ecosemiotics or *ecological semiotics* is related to several other ecosciences such as eco-ethology, human ecology, philosophical ecology, ecopsychology, ecological history or ecolinguistics (Nöth 1998, 1999). In contrast to these disciplines, which study various other aspects of the relationship between humans or animals and their *umwelt*, ecosemiotics focusses on how this relationship is mediated by signs.

In the field of semiotics at large, ecosemiotics is situated between the semiotics of culture on the one hand and the semiotics of nature on the other. *Culture* is involved since the way humans interpret their natural environment is determined by models developed in cultural history. *Nature* is involved not only since our own natural environ-

ment is the object of ecosemiotic research, but also since the orientation of organisms in prehuman life equally involves environmental semioses. The field of ecosemiotics hence overlaps with the fields of bio- or zoosemiotics, but there is a major difference between ecosemiotics and the other domains of the semiotics of nature, which can be accounted for in terms of the distinction between the semiotics of communication and the semiotics of signification (cf. Nöth 2000a: 228). *Communication*, defined as a sign process which involves a sender and a receiver, occurs not only among humans, but also between all other organisms throughout the whole biosphere. Not only cultural semiotics, but also bio- and zoosemiotics are hence concerned with processes of communication. *Signification*, by contrast, which concerns sign processes without a sender, predominates in ecosemiotics, where organisms interact with a natural environment that does not function as the intentional emitter of messages to the interpreting organism.

The study of signification in nature raises the question of the semiotic threshold (cf. Nöth 2000b): What are the semiotic and the nonsemiotic aspects of our natural environment? Is semiosis always or only sometimes involved in the interaction between organisms and their natural environment, or do we have to distinguish between semiotic and nonsemiotic environmental relationships? What is the role of natural and cultural signs in environmental semiosis? Should ecosemiotics subscribe to pansemiotic views, or should it contribute to the discovery of a threshold separating the semiotic from the nonsemiotic world. However the answer may be, ecosemiotics will be a study in sign processes that is not restricted to arbitrary and conventional signs. It will also, and perhaps primarily, be concerned with natural signs mediating between the organism and its environment. Ecosemiotics will have to be an approach to semiosis based on the assumption of a very low "semiotic threshold" between signs and nonsigns if it does not reject such a threshold altogether.

2. Cultural ecosemiotics

The structuralist tradition of 20th century semiotics restricted its field of research programmatically to arbitrary and conventional signs. Natural semiosis in the environment of humans was not an object of its study. The approach to signs was linguocentric, and Saussure

(1916: 113) declared, that thought considered before language, "is only a shapeless and indistinct mass, [...] a vague uncharted nebula". In this tradition, nature enters the semiotic scene only as a *referent* (or content substance) of language. Structures of nature are investigated as content structures of texts, in particular of mythical texts. In this sense, Greimas developed his *semiotics of the natural world*. The natural world, according to his semiotics, is merely "a place for the elaboration and practice of multiple semiotic systems" (Greimas & Courtés 1979: 375). This semiotics of nature is not a theory of natural semiosis, but a theory of how human culture interprets nature. Ecosemiotics in this vein is hence the study of the culturalization of nature. Let us call this approach *cultural ecosemiotics*.

The culturalization of nature has a long history. There are four main cultural models of a semiotic relationship between humans and their environment, the magical, the mythological, the metaphorical and the pansemiotic model (cf. Nöth 1990: 382, 188, 374). The *magical model* claims that human sign use can have a direct, unmediated influence on our natural environment. The magician emits a sign, such as "Let there be rain", and the natural environment changes according to his command. The *mythological model* tries to explain the relationship of humans with their environment by means of narratives. The myth tells us what we can, should, and must do with our natural environment. The *metaphorical model* semioticizes nature only metaphorically: nature is (not literally) an enigmatic sign, a cypher, a hieroglyhic, a riddle, a book, or a code, that has to be deciphered in order to be understood (Rothacker 1979). The *pansemiotic model*, by contrast, claims that *all* environmental phenomena are ultimately and "really" semiotic in their essence. Nature is nothing in itself, but it is a sign of something else, which is not nature. The Jewish-Christian tradition, e.g., taught that the signs which we perceive in nature are messages emitted by God (cf. Nöth 1998: 335–336).

The distinction between the metaphorical and the pansemiotic views of nature is a matter of degree. There are many degrees between a "real" belief in the semioticity of nature and a merely metaphorical way of referring to nature as a sign. In contrast to the magical model of natural semiosis, according to which the magician is a human *sender* of signs, whose *receiver* is in nature, the pansemiotic model considers *nature* as a sender of signs. For example, in the Bible nature is described as a book that we can read or as a code that we must try to decipher (cf. *ibid.*).

3. Foundations of biological ecosemiotics in Peirce

The extension of ecosemiotics from the semiosphere to the biosphere in general has been criticized as an undue semiotic imperialism. Hartmut Böhme (1996: 20–21), e.g., finds it necessary to draw a clear line of division between intentional sign use, of which only humans are capable, and nonintentional semiosis, presemiotic, or even "material" processes in nature, such as perception and metabolism, respectively. On this basis, we should distinguish between ecology, presumably as a natural science, and ecosemiotics, apparently a humanistic discipline. However, such a dividing line between the semiosphere and the biosphere is neither in accordance with general semiotics, at least in the tradition of Charles Sanders Peirce, nor with theoretical biology in Uexküll's tradition. (For von Uexküll's ecosemiotics see Nöth 1998: 338–340.)

No doubt, Peirce was a biosemiotician, as Hoffmeyer (1993) has convincingly shown, and Peirce's semiosphere certainly includes the whole of the biosphere. Among the agents involved in processes of semiosis he does not only mention animals such as "a chameleon and many kinds of insects" (MS 318: 205–206), microorganisms such as "a little creature" under a microscope (CP 1.269), but also "plants that make their living by uttering signs, and lying signs, at that" (MS 318: 205–206). There are three keys to the understanding of Peirce's bold extension of the semiosphere to the biosphere: the theory of semiosis as a process determined by final causation, Peirce's broad concept of mind, and his theory of evolutionary continuity from mind to matter (synechism).

3.1. Teleology (final causation)

Teleology or final causation is Peirce's common denominator of semiosis in nature and in culture (Short 1983; Pape 1993; Santaella Braga 1999). In human semiosis it appears in the form of intentionality and self-correction in the effort to approach the dynamic object of the sign to which we can never have any ultimate access. The principle of teleology in human semiosis is rather evident in the case of *communication* between a sender and a receiver, where we have the purpose of a sign producer and some effort of the receiver to under-

stand the message correctly. Ultimately, anthroposemiotic teleology appears, as Peirce puts it, "in the purpose of signs — which is the purpose of thought – to bring truth to expression" (CP 2.444n).

In the interaction of organisms with their environment, there is teleology in cybernetic processes which lead to homeostasis and equilibrium between the organism and its environment. Furthermore, there is teleology in any other tendency of the organism towards self-control, self-reference, directed growth with a telos from the beginning on, and finally in purposive behavior. In such interactions, the organism experiences its environment no longer in its immediacy as a merely material fact, but interprets the environmental world with reference to a third, a "meaning", purpose, or goal, which transcends the immediate environmental situation (see also Nöth 1994: 3f.). Such triadic processes involving the organism, its purpose and its environment are processes of semiosis according to Peirce.

Semiosis in this sense is by no means restricted to higher organisms, to culture and social convention. Any primitive biological organism already interacts semiotically with its environment when it *selects* or *avoids* energetic or material objects in its environment for the *purpose* of its own *survival*. Peirce goes so far as to see the presence of *mind* in this biosphere when he writes: "The microscopist looks to see whether the motions of a little creature show any purpose. If so, there is mind there" (CP 1.269; see also Santaella Braga 1994).

In spite of their common foundation in teleology, there are, of course also differences between anthroposemiosis and biosemiosis, but these differences are only a matter of degree: "Human acts of cognition differ from other self-referential and self-correcting processes by virtue of their greater degree of self-reference and self-correction. Human beings achieve this superiority through the creation of symbols, which represent and control our habits of action" (Oehler 1995: 269).

3.2. Mind and synechism

Mind, thought, and semiosis are basically synonyms to Peirce (Santaella Braga 1994). His radical thesis is: wherever there is semiosis, there is mind. Mind is not only in humans, but also in their natural environment. Peirce did not even believe in a dualism between matter and mind. Instead, he defended the general principle of continuity from nature to mind, which he called *synechism*. Instead of an opposition, there is continuity between the mind and the natural environment.

In times of ecological crisis, whose roots are in a Cartesian dualism between culture and nature, which has opposed humans to the rest of the natural world for centuries, Peirce's synechistic theory of semiosis in nature and culture offers a promising model of eco-ethical conduct (cf. Pape 1983: 8–9). It is a model which leads to the ecologically necessary insight that the human world is not opposed to the rest of nature, but that the relationship between humans and their natural environment is ultimately a relationship of the human being to him or herself (cf. Böhme 1992: 78).

3.3. Pansemiotism?

Peirce's theory of the continuity between mind and nature and his bold dictum that "the entire universe is perfused with signs, if it is not composed exclusively of signs" (CP 5.448, fn.) gives the impression of and idealist pansemiotism. However, Peirce is not a pansemiotician, since according to his triadic theory of universal categories, semiosis begins only with thirdness and not with firstness and secondness (cf. Nöth 2001: §3.). In particular, he distinguishes between those interactions of organisms with their environment which are only of a dyadic and those which are of a triadic nature, specifying that only triadic environmental interactions can be of a semiotic kind. A merely dyadic and thus nonsemiotic interaction occurs when the organism is confronted with something which presents itself as a "brute fact" or as the result of mere chance. The environment in such a dyadic relation is experienced as "eminently hard and tangible; [...] it is forced upon us daily; it is the main lesson of life" (CP 1.358). Only when such dyadic interactions become triadic relations is the organism–environment relation transformed into a semiotic one.

4. Ecosemiotics of natural signs

In the history of semiotics there has been a long tradition of excluding the natural environment of sign users from the study of sign processes. Two semiotic dualisms have been developed in this tradition to justify an opposition between the sign and its natural environment, the dualism of the sign vs. the nonsemiotic world and the dualism of the natural vs. the conventional sign.

The exclusion of nature from semiotic consideration is characteristic of the tradition of semiotic rationalism. It culminated in Saussure's dyadic sign model, which ignores the object of the sign and declares that the world beyond the system of arbitrary signs is unstructured.

The exclusion of nature in the dualism between natural and conventional signs is of a different kind. Nature is acknowledged in the category of the natural sign, but the argument is that there is *no* nature in conventional signs. Augustine, e.g., defines the conventional sign (*signum datum*) as not given by nature, but arbitrarily stipulated and reached by consensus (*non natura, sed placito et consensione significandi*) (Doct. Christ. II, 37; cf. Clarke 1987: 20). Nature is thus programmatically excluded from the study of most forms of sign use in human culture.

Peirce's synechistic semiotics disagrees with both dualisms. His theory of the iconic and the indexical signs is a theory of both natural and conventional signs in one framework. Peirce also rejects the opposition between signs and nonsemiotic objects. According to his theory of semiosis, the environment of sign user is always meaningful, since "all objects are objects of signs" (Oehler 1993: 132). Furthermore, the object is not a mere referent beyond the sign, nor is it a mentally constructed object as the constructivists would have it. In his theory of the real or dynamical object, Peirce postulates an object actually existing in reality, but nevertheless ultimately inaccessible to our mind, or accessible only by a never ending asymptotic approximation.

The theory of the dynamical object gives an account of how our natural environment influences a sign process. According to Peirce, the dynamical object affects or even determines the sign (CP 1.538, 4.536). The effect of this environmental determination of the sign is twofold (Hausman 1993: 157): There is an effect of cognitive constraint on the interpreter, whose possibilities of interpretation are perceptually restricted by the object. In scientific semiosis, e.g., such constraints "lead and sometimes compel investigators to acknowledge and adopt certain interpretations in preference to others" (*ibid.*). Furthermore, there is an effect of teleology in so far as the never really accessible dynamical object, although it "resist" interpretation, is at the same time the goal of sign interpretation (CP 8.183).

But how can teleology be at work in the interpretation of natural signs without a sender? In communication, as we have seen, teleology is rather evident since there is a *purpose* of a sign producer and an interpreter's effort to understand as the guiding principles of semiosis. In the interpretation of natural signs, the teleological effect comes

from the dynamical object, from the semiotic control which the natural object exerts on the outcome of sign interpretation, the interpretant. Ransdell (1977: 173) illustrates this effect of teleology in the interpretation of a natural sign with the example of traces on the ground which are as yet uncertain indicators of the presence of a tiger. The control of the object on the interpreter in this case occurs "by further signs the unquestioned interpretation of which can go towards determining the correctness or incorrectness of the interpretation in question. Such further signs might be, for example, visual percepts of the animal, its smell, its roar [...] and so on". Conventional signs and natural signs can thus be accounted for by the same semiotic principle.

5. Evolutionary iconicity between the human mind and its natural environment

Ernst Haeckel, who coined the term in 1866, defined ecology as the "science of the relations between the organism and the environmental outer world". It was Jakob von Uexküll (1928, 1940, 1980) who abandoned the dualism between the inner and the outer world with his constructivist thesis that the organism's inner world contains a cognitive model of its outer world so that the natural environment can so to speak be found within, and not, outside of the organism.

Peirce, too, defends an antidualistic view of the outer world within the organism. His argument is that there must be an "affinity of the human soul to the soul of the universe, imperfect as that affinity no doubt is" (CP 5.47). This statement sounds Paracelsian (cf. Nöth 1998: 335–336), but its justification is derived from science, especially from the theory of evolution.

Peirce's argument is that our knowledge of nature comes from our coevolution with nature which had the result "that the human intellect is particularly adapted to the comprehension of the laws and facts of nature" (CP 2.750). For example, we are able to understand the laws of mechanics not primarily because of scientific research in physics, but because these laws have molded our mind in its evolution and thus provided it with the capacity to the natural (abductive) discovery of these laws: "Our minds having been formed under the influence of phenomena governed by the laws of mechanics, certain conceptions entering into those laws become implanted in our minds, so that we readily guess at what the laws are" (CP 6.10).

There is hence a relation of an albeit imperfect iconicity between the human mind and its natural environment, and the evolutionary affinity between the human mind and its natural environment makes correct guesses about, and successful cognition of, nature possible. On these premises, Peirce finally concludes "that every scientific explanation of a natural phenomenon is a hypothesis that there is something in nature to which the human reason is analogous" (CP 1.316). Hence: "It is somehow more than a mere figure of speech to say that nature ficundates the mind of man with ideas which, when those ideas grow up, will resemble their father, Nature" (CP 5.591).

Peirce was an admirer of Emerson's poem *The Sphinx* (cf. CP 7.425). In this poem there is a line which may be read as an expression of the principle of iconicity between nature and the human being. If we take the enigmatic sphinx as a poetic symbol of the natural environment that humans want to explore and the poet whom the sphinx addresses as a symbol of the human being, we understand that the personified nature here expresses the insight that nature is in us. Emerson's Sphinx said it in the following words:

"Who taught thee me to name?
I am thy spirit, yoke-fellow;
Of thine eye I am eyebeam.

Thou art the unanswered question;
Couldst see thy proper eye,
Alway it asketh, asketh; [...]."

References

Böhme, Gernot 1992. *Natürlich Natur*. Frankfurt am Main: Suhrkamp.

Böhme, Hartmut 1996. Über vormoderne Naturkonzepte. *Zeitschrift für Semiotik* 18(1): 19–22.

Clarke, D. S. Jr. 1987. *Principles of Semiotic*. London: Routledge.

Deely, John 1990. *Basics of Semiotics*. Bloomington: Indiana University Press.

— 1994. *New Beginnings: Early Modern Philosophy and Postmodern Thought.* Toronto: Toronto University Press.

Greimas, Algirdas Julien; Courtés, Joseph 1982 [1979]. *Semiotics and Language.* Bloomington: Indiana University Press.

Haeckel, Ernst 1988 [1866]. *Generelle Morphologie des Organismus, Bd.2: Allgemeine Entwicklungsgeschichte*. Reprint. Berlin: de Gruyter.

Hausman, Carl R. 1993. *Charles S. Peirce's Evolutionary Philosophy.* Cambridge: Cambridge University Press.

Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press.

Kruse, Felicia E. 1990. Nature and semiosis. *Transactions of the Charles Sanders Peirce Society* 26: 211–224.
Naess, Arne 1989. *Ecology, Community, and Lifestyle: Outline of Ecosophy*. Cambridge: Cambridge University Press.
Nöth, Winfried 1990. *Handbook of Semiotics.* Bloomington: Indiana University Press.
— 1994. Introduction. In: Nöth, W. (ed.), *Origins of Semiosis*. Berlin: Mouton de Gruyter: 1–12.
— 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–343.
— 1999. Ecosemiotics and the semiotics of nature. In: Taborsky, E. (ed.), *Semiosis, Evolution, Energy.* Aachen: Shaker: 73–88.
— 2000a. *Handbuch der Semiotik*, 2. Aufl. Stuttgart: Metzler.
— 2000b. Umberto Eco's semiotic threshold. *Sign Systems Studies* 28: 49–61.
— 2001. Protosemiotics and physicosemiosis. This vol.
Nöth, Winfried (ed.) 1994. *Origins of Semiosis.* Berlin: Mouton de Gruyter.
Oehler, Klaus 1993. *Charles Sanders Peirce*. München: Beck.
Pape, Helmut 1989. *Erfahrung und Wirklichkeit als Zeichenprozeß.* Frankfurt am Main: Suhrkamp.
— 1993. Final causality in Peirce's semiotics and his classification of the sciences. *Transactions of the Charles Sanders Peirce Society* 29: 581–605.
Peirce, Charles S. 1931–1958. *Collected Papers*. Vols. 1–6 (C. Hartshorne & P. Weiss, eds.); vols. 7–8 (A. W. Burks, ed.). Cambridge, Mass.: Harvard University Press. [Quoted as: CP.]
— 1977. Complete Published Works, microfiche edition, ed. by K.L.Ketner et al. Greenwich, Conn.: Johnson. [Unpublished manuscripts. Quoted as: MS, using the pagination made by the Institute for Studies in Pragmatics, Lubbock, Texas.]
Ransdell, Joseph 1977. Some leading ideas of Peirce's semiotics. *Semiotica* 19: 157–178.
Rothacker, Erich 1979. *Das "Buch der Natur": Materialien und Grundsätzliches zur Metapherngeschichte*. Bonn: Bouvier.
Santaella Braga, Lucia 1994. Peirce's broad concept of mind. *European Journal for Semiotic Studies* 6: 399–411.
— 1996. Semiosphere: The growth of signs. *Semiotica* 109: 173–186.
— 1999. A new causality for the understanding of the living. *Semiotica* 127: 497–518.
Saussure, Ferdinand de 1969 [1916]. *Cours de linguistique générale*. Lausanne: Payot. [Engl. *Course in General Linguistics.* New York: McGraw Hill.]
Schmidt, Siegfried J. (ed.) 1987. *Der Diskurs des Radikalen Konstruktivismus.* Frankfurt am Main: Suhrkamp.
Sebeok, Thomas A. 1991. *A Sign is Just a Sign.* Bloomington: Indiana University Press.
Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.) 1992. *Biosemiotics*. Berlin: Mouton de Gruyter.
Short, Thomas L. 1981. Semeiosis and intentionality. *Transactions of the Charles Sanders Peirce Society* 17: 197–223.
— 1983. Teleology in nature. *American Philosophical Quarterly* 20: 311–320.

Uexküll, Jakob von 1940. *Bedeutungslehre*. Leipzig: Barth.
— 1973 [1928]. *Theoretische Biologie*. Frankfurt am Main: Suhrkamp.
— 1980. *Kompositionslehre der Natur.* Frankfurt: Propyläen.

Экосемиотика и семиотика природы

Экосемиотикой называется наука о знаковых процессах (семиозисе) в связи с той природной средой, в которой они имеют место. В статье рассматриваются культурные, биологические и эволюционные измерения экосемиозиса в рамках пирсовской теории о связи между материей и духом и прослеживаются экосемиотические измерения натуральных знаков. Проводится разграничение между экосемиотикой и семиотикой природы с одной стороны и пансемиотизмом — с другой. Коэволюция знаковых процессов с их природной средой описывается как фактор, обуславливающий экосемиозис.

Ökosemiootika ja looduse semiootika

Ökosemiootika on teadus märgiprotsessidest (semioosisest) suhtes looduskeskkonnaga, milles nad aset leiavad. Artiklis vaadeldakse ökosemioosise kultuurilisi, bioloogilisi ja evolutsioonilisi mõõtmeid, lähtudes Peirce'i mateeria ja vaimu vahelist jätkuvust käsitlevast teooriast, ja uuritakse loomulike märkide ökosemiootilisi dimensioone. Ökosemiootikat ja looduse semiootikat eristatakse pansemiotismist, ning märgiprotsesside koevolutsiooni nende loodusliku keskkonnaga kirjeldatakse kui ökosemioosist tingivat tegurit.

On the biological concept of subjective significance: A link between the semiotics of nature and the semiotics of culture

Zdzisław Wąsik
Adam Mickiewicz University,
Al. Niepodległości 4, 61-874 Poznań, Poland
e-mail: wasik@ifa.amu.edu.pl

Abstract. A logical-philosophical approach to the meaning-carriers or meaning-processes is juxtaposed with the anthropological-biological concepts of subjective significance uniting both for the semiotics of culture and the semiotics of nature. It is assumed that certain objects, which are identifiable in the universe of man and in the world surrounding all living organisms as significant from the perspective of meaning-receivers, meaning-creators and meaning-utilizers, can be determined as signs when they represent other objects, perform certain tasks or satisfy certain needs of subjects. Hence, the meaning of signifying objects may be found in the relation between the expression of a signifier and (1) a signified content, or (2) a signified function, or (3) a signified value of the cultural and natural objects subsumed by the interpreting subjects under the semiotic ones.

For Thomas A. Sebeok

Within the framework of this paper, a logical-philosophical approach to the subject matter of linguistic semiotics is juxtaposed with an anthropocentric view of interpersonal communication.[1] My special atten-

[1] The concept of subjective significance was developed earlier in few publications (Wąsik 1987, 1997) — with special reference to language and culture. Theoretically popularized from the perspective of a meaning-utilizer in the outline of semiotic lectures (Wąsik 1998), it took into account mainly the contributions of J. von Uexküll (1982 [1940]) and T. von Uexküll (1982a, 1982b, 1981, 1984). This paper constitutes an elaborated version of a lecture presented to Honor Professor Thomas A. Sebeok, on

tion goes, on the one hand, to instrumental functions of meaning-carriers and, on the other, to the utilitarian values of discourse practices of meaning-creators and meaning-utilizers in social interactions. Being engaged in subject-oriented investigations of axiological vs. praxeological semiotics conducted on the bordering zones between cultural sciences and linguistics, I have noticed that their roots should be traced in the essentialist and organicist functionalism originating in the epistemology of culture, sociology and biology (cf. Wąsik 1997: 347). Among the indirect influences on my study are Talcott Parsons' functionalistic theory of human action in a society (1949, 1951, cf. Parsons and Shils 1967[1951]) and Umberto Eco's (1979: 22–28) approach to culture as a collection of semiotic systems that fulfill communicative functions. However, the primary influences on the main topic — subject-related needs and the object-related values that mediate between the semiotics of culture and the semiotics of nature — are the Uexküllian (Jakob von Uexküll, 1864–1944) concept of "Umwelt" and his biological theory of "functional circles".

However, the information base compiled for the tasks of my first studies on the semiotic paradigm of linguistics had to be extended against the background of recent trends that appeared in the non-linguistic sciences of sign and meaning. In the meantime, a new neuroscientific turn had emerged unifying the frameworks of scholars in the domain of biology, psychology and anthropology, philosophy and even arts around the philosophy of mind and consciousness (cf. Andrade 1999; Brier 1999, 2000; Emmeche 1999; Stjernfeld 1999). Getting rid of a dualistic distinction between body and mind, biologically inclined scientists started to speak in favor of a monistic notion of the "embodied mind" (cf. the works of Popper 1994; Emmeche 1992; Emmeche & Hoffmeyer 1991; Hoffmeyer & Emmeche 1991; Hoffmeyer 1996).[2]

---

80 years — "From Fennougrian Studies to Biosemiotics" within the framework of the Nordic-Baltic Summer Institute for Semiotic and Structural Studies in Imatra, Finland, June 12–21, 2000 (Wąsik 2000).

[2] It is important to notice the topic of the conference at Bennington College in Vermont in early November 1999, which focussed on the embodied mind and the Baldwin effect. Philosophers of biology, semioticians, brain/mind specialists, and communication theoreticians convened there to evaluate the relevance of the suggestion of James Mark Baldwin (cf. Baldwin 1896), concerning the idea of adaptive evolution according to which "the ability of individuals to learn can guide the evolutionary process" (Kull 2000: 46). See a detailed account of David Depew (2000: 7): "The general idea of the Baldwin effect is that learned behaviors can affect both the direction and the speed of evolutionary change. If an organism chances during its lifetime to acquire habits or exhibit behaviors which permit more effective interaction with its

Besides, exploring bridges between biological and cultural sciences within the framework of semiotics, researchers started to pay more attention to comparative studies of habits and behavior of humans and animals (Biltz 1981; Ingold 1989; Chebanov 1994; Kull 2000). Still other subjects have evoked the interest of the practitioners of semiotic sciences within the span of the last two decades: social behavior in animals, animal and human ecology, cross-cultural studies, agricultural ecology, environmental policy (e.g., Ingold 1992, 1999; Teherani-Krönner 1996; Kull 1998b; Nöth 1996, 1998; Coletta 1999), etc.

This investigative attitude, which prevails mostly in semiotic conferences today, is based on a conviction of contemporary philosophers (cf., e.g., Searle 1983, 1992) that human beings and higher animals, similarly as all other organisms, constitute parts of biological order of nature. Between human beings and the remaining constituents of the living world obtains certain continuity (cf. also Kull 2000). From that point of view such peculiar properties of these animals as the possession of a highly developed system of consciousness, intelligence and the faculty of an intentional use of language, the capability of performing enormously subtle perceptional distinctions, the aptitude of rational thinking, etc., are seen as biological phenomena. Besides, all these properties are considered as phenotypic features of an organism resulting from the interaction of the genotype and the environment (cf. Dawkins 1982). They are products of biological evolution in the same measure, as all other phenotypic features. Shortly speaking, the self-consciousness is regarded as a biological property of human brains and the brains of some higher developed species of animals. Biological processes cause the emergence of consciousness, which form a part of natural biological order similarly as the other biological phenomena are, such as photosynthesis, metabolism or mitosis, and the like (cf. Edelman 1987, 1989, 1992).

---

environment, [...] it will probably leave more offspring. If, moreover, by means of directed habituation, imitation, and other forms of learning it can pass that innovation along to offspring, relatives, and other organisms with which it is socially interactive, then descendents of such individuals or groups will on the whole do better reproductively in a given environment than individuals and groups not possessing the forms of habituation and learning in question. If protracted over transgenerational time, [...] this process will shift the phenotypic trait distribution in the population toward a preferred, but from the perspective of inherited factors, only permissible plasticity of behavior in the face of environmental change".

Epistemological controversies over the object of semiotic studies

To begin, it is assumed that semiotics studies both the objects of culture and the objects of nature. As such, it has to be seen either as an interdisciplinary theory or a multidisciplinary science, composed of sub-disciplines in the form of those academically recognized disciplines that employ the concept of sign (and/or meaning) or of sign-processes as one of descriptive categories of their subject matter.

Arguments concerning the essence of semiotic objects belong to the epistemological sphere. From the perspective of their ontological modes of existence, they are specified either as a monolateral entity or a plurilateral unit comprised of interrelated constituents, or relations between those constituents. Further questions about the same refer to their material or spiritual (corporeal or intelligible, physical or mental), concrete or abstract, real or ideal forms of being, being examined subjectively or objectively in their extraorganismic or intraorganismic manifestations. In gnoseological domains, semiotic objects are approached either extra- or introspectively; as implicative, intentional, semantic, or conventional (arbitrary) phenomena; through individual tokens or general types, in the realm of man only; in the realm of all living systems, or in the universe of creatures, including the extraterrestrial and the divine.

An overview of semiotic thought reveals that concepts of the sign are expressed either in terms of (a) the unilateral sign in which sign-vehicle and referent are treated as separate entities, or (b) the bilateral sign, whose signifier and signified constitute a twofold psychical unity. Some linguists adhere to (c) the concept of the semantic triangle in which sign-vehicle, meaning (thought or notion), and referent form separate parts. Philosophers prefer to speak about the (d) trilateral sign where sign-vehicle, meaning (the *interpretant* generating one or more signs), and object of reference constitute a threefold unity. Separately noted are also the concepts of (e) the sign as a dyadic and (f) as a triadic relation. In all conceptions of signs and their objects of reference there exist four common elements, which constitute a semantic quadrangle: (I) an externalized *repraesentans*, (II) an internalized reflection of the *repraesentans*, (III) an externalized *repraesentatum*, and (IV) an internalized reflection of the *repraesentatum*.

It would be desirable for all conceptions of meaning to correspond proportionally to the particular understandings of sign. However,

some of definitions of sign result from a non-semiotic usage of the term "meaning". In the domain of signification, one may sum up the choice of answers to the questions regarding the modes of sign existence and cognition. Practitioners of semiotics usually decide whether the meaning is (a) a process or a product, a token or a type. They ask eventually whether the meaning is (b) ideal or real, abstract or concrete, concluded or intentional, objective or subjective; whether it constitutes (c) a part or a whole, forming inherent or relational properties of the sign or its object of reference. Furthermore, semioticians draw semantic inferences from (d) observations of the effects that meaning has upon the feelings or reactions of its users. Another proposal deserves mentioning in this context, namely, that meaning is to be sought in (e) the interrelationships among signs, signs and their objects of reference, signs and their users, signs and their contexts of use, or among the users of the signs, etc.

One must remark, however, that the concepts of sign and meaning developed on the grounds of language-related sciences are not necessarily parallel to the concepts of sign and meaning elaborated in semiotics concerning cultural anthropology or the philosophy of biology. Linguistically oriented semioticians of culture usually place the signs in the plane of expression as types of texts standing for types of referents in the plane of content. The latter, being called an extra-textual or extra-semiotic reality, are often identified with meanings. Regarding the signs that stand for other things, one may point out to the occurrence of meta-designation, where one type of sign refers to other types of signs. Hence, it is possible to speak in a certain language about one language in particular as well as about other languages and other semiotic systems in general.

Thus, practitioners of semiotic sciences have to be aware of the fact that, apart from the logico-philosophical and linguistic conceptions, some theories of sign and meaning originate from the theory of culture or from the semiotic approach to nature. In this context, one should mention proposals in which the sign is regarded as a type of cultural object, where the meaning tends to be specified as a relational property attached to this object by a cultural subject (cf. Eco 1979: 22–29, 177; Pietraszko 1980; 1982: 139). In such conceptions, the emphasis is on the interpretative activity of man, who apprehends the cultural objects as significant (cf. Wąsik 1987: 124–131). First, when they fulfil certain functions with respect to his aims, goals or pur-

poses, or second, because they possess certain values for satisfying his needs, desires and/or expectations.

Culture as a system of signification and communication

In the introduction to his theory of semiotics, Umberto Eco (1979) takes for granted that culture, as a whole, should be investigated as a communicational phenomenon basing on systems of signification. Eco explains how meanings and their systems develop in human culture, in terms of the creation of tools and the exchange of commodities.

Eco departs from the assumption that there was no culture during the times of the first man, even when an *Australopithecus* transformed a stone into a tool for splitting the skull of a baboon. In his opinion (Eco 1979: 22), culture was born only when a human being: (I) determined the function of the stone, (II) started to call it "a stone that serves for something", and (III) recognized it as "the stone that corresponds to the function *F* and that has the name *Y*". These three conditions result from a semiotic process, which may be illustrated as in Figure 1 (adapted from Eco 1979: 23).

One can assume, following Eco's reasoning, that our *Australopithecus* after having encountered a certain stone *S-token 1* and having used it as a means for performing a certain function *F*, comes some days later upon a second stone *S-token 2*, which he recognizes as a representation of the same type. The ability of subsuming *S-token 2* along with *S-token 1* into an abstract model *S-type* standing for the same function *F* is a semiotic activity of ascribing meanings to encountered functional forms, i.e., *sign-vehicles*. In Eco's depiction, a new semiotic dimension is added to this process of cultural meaning-creation when the possibility exists of giving a *Name* to that general type of object, i.e., the stone as a tool. The name denotes the stone-type as its meaning and connotes that function *F* which is performed by particular stone-tokens as signifiers. Communication can only occur in dyads, when there are at least two persons. Nevertheless, in the case of an individual, thanks to the exchangeability of sender-and-receiver roles, the cultural object may also become the content of potential intra-personal communication. Whoever uses the object called *S-token 1* for the first time must consider how to transfer the new acquired meaning, a new type of information that it stands for *F*, to the next day. Thus, a name given to it seems to be an appropriately elaborated mnemonic device, which mediates between

cultural objects and their possible functions. The transmission of knowledge from an individual of today to the same individual of tomorrow and to other individuals of the same human kind contributes to the fact that, within a society, every function of an object becomes transformed into the sign of its virtual use.

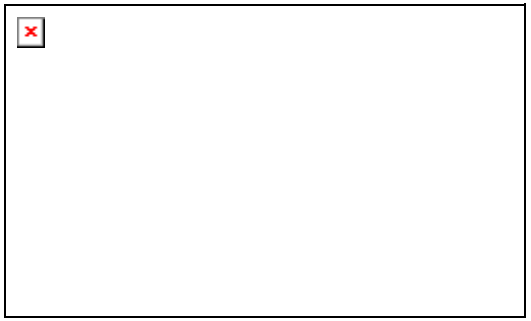

Figure 1. The stone as a tool which has a function and a name in the semiotics of culture

In a similar way, Eco (1979: 24–26) applies semiotic concepts to the analysis of the economic relationships that rule the exchange of commodities, on the assumption that the utility value of goods becomes transformed into their market value. As he assumes, the same cultural objects, which are discussed as functional types in Figure 1, may be considered as commodities *C-token 1* and *C-token 2* in accordance with their exchange value *EV* (a process shown in Figure 2, adapted from Eco 1979: 25).

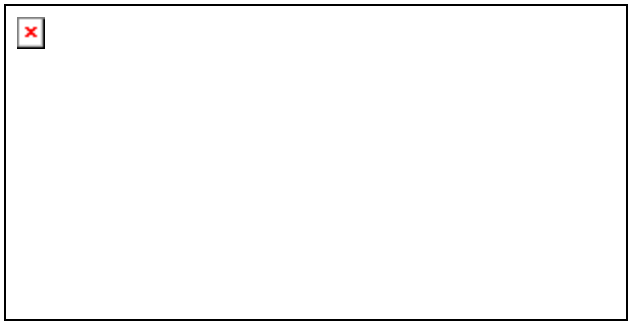

Figure 2. The signifying relationship between human labor, money and the exchage value of commodities

The economic relationship between two commodities (belonging at the same time to two different types) becomes significant in nature when their value is expressed within the same exchange parameter elaborated in a particular culture. Basing on the distinction made by Karl Marx in *Das Kapital* this parameter may refer back to human labor *HL* as being indispensable to for the production of both *C-token 1* and *C-token 2*. All commodities can be correlated by the more sophisticated cultural device of *Money*, another type of commodity, which functions as a universal sign of *EV* expressed in quantities. As Eco (1979: 25–26) states, "the only difference between a coin (as sign-vehicle) and a word is that the word can be produced without economic effort, while a coin is an irreproducible item (which shares some of the characters of its commodity object)".

The objects, stones and commodities, illustrated schematically in Figures 1 and 2 (following Eco's reasoning) were analyzed only with respect to their singular function. In fact, within the global systems of culture, i.e., the representation of culture in its totality, one should take into account every possible function of a given object, its every possible semantic content, its every meaning, thus registering every kind of functional synonymy and homonymy. According to Eco, every cultural aspect should be considered as a separate semantic entity. Thus, one could conclude that the systems of cultural signification should be analyzed in the same way as linguistic entities, units and constructions, i.e., in terms of organized structures, semantic fields. Underlying both are rules that are established for the structures of sign-vehicles in their multidimensional semantic analysis.

Eco (1979: 26–28) illustrates multidimensionality of semantic analyses of cultural objects with the example of "automobile". It is, as he points out, not only as a semantic entity, which can be examined as connected with the sign-vehicle, e.g., /automobile/ in English. "Automobile" becomes a full semantic unit having many aspects when it is placed on the axis of oppositions and relations with other units. It can be opposed to "carriage" or "bicycle" or "feet", when one distinguishes between different kinds of transportation, e.g., "by car" vs. "on foot", etc. "Automobile", as such, can be analyzed from different perspectives or considered on differed levels, physical, mechanical, economic, social or linguistic-semantic, etc. Semiotics is interested in such levels, on which the car is treated as a sign-vehicle of certain values, e.g., exchange value, utility value, symbolic value when they designate the social status, the prestige of its owner, when they co-determine the comfort, speed of ride, etc. Similarly, as in verbal com-

munication where the sign-vehicle of the type /automobile/ can become the meaning of another sign-vehicle of the type /car/, the exchange value of one cultural good can become the meaning of other goods that are also in the code of cultural semiotics.

Towards the idea of an axiosemiotic sphere of culture

In addition to the depiction of culture as a class of rules generating the sphere of so-called cultural texts with their significative and communicative functions, one can also mention distinctions that expose the importance of two orders in the system of culture, the semiotic and the axiotic. To this kind of study belongs Stanisław Pietraszko's (1982: 139) interpretation of culture as a system of axiosemiotic regularities obtaining between the values and meanings that condition and determine the modes of human life, and that become realized (materialized) in the sphere of products and the behaviours of people.

Pietraszko regards the axiosemiotic activity of man as a simultaneous ascription of new values and meanings to objects hitherto known as cultural or natural. In his view, the ascription of new values to objects by the subjects of culture is connected with the creation of new things in the epistemological sense and transferring them to another class of reality. Accordingly, in the case of an acquisition of new meanings, a new value-related situation takes place in their relation to cultural subjects. However, this "axiosemiotic nomination" of things, which results in the transfer of things, as products and behaviors of people, to the realm of cultural objects, is not necessarily connected with their usefulness. An object can possess, apart from its functionality, an axiological significance that is given to it through the ascription of a certain value. The evaluative aspect of an object can even replace its functionality, as in the case of an old wooden spoon, which formerly served village peasants as a utensil, but now hangs in a folklore museum. The same refers, e.g., to the conceptualized exposition of a simple chair in the museum of history. In both cases, the ascription of new values is accompanied by a change of meaning. That is, an axiotic act is at the same time accompanied by a semiotic act, in which a cultural object enters into a new relation with the subject of culture (cf. Wąsik 1987: 130–131).

Viewing semiotic approaches to culture from functional and axiological perspectives, one can see the necessity of finding a superior

frame of reference. It appears that the ascription of meaning to objects having certain functions or values is not only a procedure that might be regarded as characteristic of human subjects. The semiotics of culture may be also discussed using the same type of distinctions as the semiotics of nature, in accordance with the proposals of biosemioticians who turn their attention to the so-called *Umwelt-Forschung*[3] to find the biological "a priori of man" (cf. Pobojewska 1993, 1995, 1996).

Biosemiotism as an investigative perspective

Biosemiotism is an investigative attitude of those semioticians who base on the biological concept of meaning elaborated by Jakob von Uexküll (1982 [1940]; cf. Wąsik 1987: 131). This concept has been made popular by Thomas A. Sebeok (1974; cf. also 1989 [1979]), and developed by Thure von Uexküll (cf. 1970, 1979a, 1979b, 1982a 1982b, 1984, 1987, 1990, 1992, 1993). To its further extensions has contributed also Martin Krampen (1981, 1992; cf. Anderson *et al*.

[3] Jakob von Uexküll investigated how living organisms perceive their environment and how this perception determines their behaviour. He called his investigative method *Umwelt-Forschung*. In 1926, he founded the *Institut für Umweltforschung* at the University in Hamburg. The term "Umwelt", in the sense of the subjective world of an organism, was coined in his book of 1909, *Umwelt and Innenwelt der Tiere*, and the idea of functional circles (Germ. *Funktionskreise*, which lately used to be translated into English as "functional cycles") Uexküll added in the 2nd edition of it in 1921. As Kull points out (1999: 390), "in his article of 1907 he still uses the term *Milieu*, as different from *Außenwelt*". Worthy of mentioning is here the term *die Eigenwelt des Menschen* proposed by Hans Petersen (1937). Interesting is the comparison of *Umwelten* to "soap bubbles" (T. v. Uexküll 1982: 3) in the context of "environmental pipes" (*Umweltröhren*) introduced by J. v. Uexküll (cf. 1928: 70, 108). The first one refers to the environment of a living organism at a given moment as a circle (*Funktionskreis*), and the latter is meant to illustrate the sequence of all environmental circles that the individual has to pass throughout his whole life understood as a determined journey. (Research into this topic may be found in Barry Smith, "Social Objects" and Patrick Horvath, "Jakob von Uexküll: Von Mückensonnen und Umweltröhren", under the address of the Jakob von Uexküll Centre, Estonia: www.zbi.ee/~uexkull.) The investigative method of pursuing and reconstructing this journey through invisible worlds is illustrated in Uexküll & Kriszat 1970 (translation in Uexküll 1992) and Uexküll 1936. A separate source of discussions is the notion of "semiotic niche" vs. "ecological niche" in the context of the distinction between the scopes of biosemiotics and ecosemiotics (cf. Hoffmeyer 1986: 59; Kull 1998b: 350; 1998b; Brier 2000: 70). As for the notion of "ecological niche" in the works of Popper (1994) see also Mirka (2000: 100).

1984; Danesi 2000). The foundations of biosemiotics may be described as follows (for details on the roots of the whole field of study and related terms see Kull 1998a, 1999; Kawade 1991; Hoffmeyer 1997). All living systems take part in the process of creating and utilizing meanings; even the simplest forms of life, the unicellular systems, have the ability to respond to external impulses through species-specific reactions characteristic of each individual being. All living organisms, from this point of view, are to be treated as autonomous, while non-living entities, including our products, commodities and machines, must remain heteronomous (cf. T. v. Uexküll 1982b: 7).

Plants and animals share the capacity to sort stimuli, encoding them as signs. Self-regulating processes, called homeostasis, play an important role in their individual development, which ends in death. Living systems tend to maintain their internal stability through interactions with the environment, owing to the coordinated response of their parts to any situation or stimulus that might disturb their normal condition or function. Thus, from a biological perspective: "A sign is something that signifies to the activity of a living system something that has significance for the maintenance of the structure, the homeostasis of this system (its system needs)" (T. v. Uexküll 1984: 188).[4] The structure of semiotic processes looks different in the realm of plants, described by phytosemiotics, from the way it looks in the realm of animals, which belongs to the descriptive domain of zoosemiotics. In comparison to animals, plants do not have a nervous system for processing the signifiers and they have no specialized effectors for acting on something that is signified. Hence, the structure of phytosemiotic processes should be described, as T. von Uexküll (1984: 188f.) points out, in terms of cybernetic relations. In accordance with those relations, a change in the homeostasis of the system, caused by its environment or its own metabolism, which deviates from the reference value, means for the system a need for activity to restore the substances necessary to maintain its homeostasis. In the realm of zoosemiotics, living systems have specialized receptors for receiving signs, a nervous system, that processes them, and specialized effec-

[4] Cf. also the respective explanation of T. von Uexküll (1984: 188): "In order to realize my purpose of translating Peirce's formula into a concept of biological relationship, I shall have to consider two factors: (1) When a living system is the 'somebody', the subject, for whom signs and their significates have a meaning, it is materially an open system [...]. It retains its structure, its homeostasis, in open exchange with its environment. (2) Living systems are active system. They maintain their homeostasis by their own activity".

tors, which exert an influence upon something that is signified. Hence, within the functional circle of animals, "a perceptual sign (e.g., a smell of food)" can be defined as "something that signifies to the living system the need for an activity — its behavior — that has significance for its hunger-needs (e.g., obtaining a food object)" (T. v. Uexküll 1984: 189).

According to T. von Uexküll (1984), the organisms of animals possess such a level of complexity that simple phytosemiotic sign-processes are included in the zoosemiotic ones. This means that when a food object appears within subjective universes of animals, it only creates the conditions for phytosemiotic processes within their bodies. The grasping and eating of a food object create in the gastrointestinal tract the conditions for the activation of the phytosemiotic processes that signify to the intestinal cells that they must absorb the needed substances. The object "food" contains carbohydrates, fats, and proteins — the signified "something" for these phytosemiotic signs.

In discussing the biosemiotic conception of meaning in its relation to the anthroposemiotic theory of culture, we restrict our interest to the so-called *Umwelttheorie* of J. von Uexküll, in the light of which certain objects can be said to possess an "ego quality" (*Ich-Ton*). In this subject-oriented theory (being studied also by philosophers of medicine in the context of vitalism, cf., e.g., Szewczyk 1963), the understanding of what the meaning is, the role of a meaning-receiver and/or meaning-utilizer, receives primary attention. Accordingly, the sign is described as something that has a meaning for someone because of something. Certain objects in the environment of subjects become carriers of meaning when they contribute to the satisfaction of the subjects' needs, claims T. von Uexküll (1984: 188) in his analysis of *Bedeutungslehre* by J. von Uexküll. They can be meaning-carriers for the fulfillment of subject-related needs because they possess the qualities which are significant for the subjects, as, e.g., "drinking-quality" (*Trink-Ton*), "eating-quality" (*Fress-Ton*), "sitting-quality" (*Sitz-Ton*), "obstacle-quality" (*Hindernis-Ton*), "climbing quality" (*Kletter-Ton*), etc. (cf. J. v. Uexküll 1982: 28 ff.).

In order to draw together the biosemiotic concepts of sign and meaning it is worthwhile to consider some examples provided by J. von Uexküll. As the first one, consider the use of a stone in the following situation: "Let us suppose that an angry dog barks at me on a country road. In order to drive it off, I pick up a stone and frighten it off with an adept throw. Nobody who observes this process and after-

wards picks up the stone would doubt that it was the same object 'stone', which first lay on the road and then was thrown at the dog."

As J. von Uexküll (1982: 27) points out, analyzing this situation, the physical and chemical properties of the stone have remained the same but the object itself has been transformed into another kind of object, because it has changed its meaning. As long as it was part of the country road, the stone served as support for the walker's feet. Its meaning was connected with what might be called a "path-quality" (*Weg-Ton*). When the stone was picked up by someone attempting to throw it at the dog, a new meaning was imprinted upon it, namely a "throw-quality" (*Wurf-Ton*). This change of meaning became possible as soon as the stone, formerly a neutral object, entered into a relationship with a subject. Thus, the neutral object becomes transformed into a meaning-carrier when a subject imprints a meaning upon it.

J. von Uexküll (1982: 28–29) clarifies in two further examples the influence that the transformation of meaning exercises on the properties of objects appearing in the Umwelt of subjects. He notices that what happens to be neutral objects in the subjective universe of dogs can possess certain meanings for people, thanks to the properties which can be utilized as meaningful qualities under certain circumstances. For example, for the dog, as a house-occupant, many things in the kitchen have only a sitting-quality, a climbing quality, or perhaps only an obstacle-quality — especially chairs and cupboards, which may contain books or washing. All the small household effects, such as spoons, forks, matches, and the like, do not exist in the world of a dog because they are not meaning-carriers. However, a great number of things will exist for the dog as far as they have an eating-quality or a drinking quality (J. v. Uexküll 1982: 29).

Another example used by J. von Uexküll (1940) to explain his understanding of meaning is the blooming meadow (cf. J. v. Uexküll 1982: 29ff.). In his interpretation, even for different subjects who are in it, the meadow is not the same. One can take, for example, the role of the stem in a blooming meadow-flower, which functions as the meaning-carrier in four kinds of subjective universes:

(1) In the Umwelt of a girl picking flowers, who gathers herself a bunch of colorful flowers that she uses to adorn her bodice;
(2) In the Umwelt of an ant, which uses the regular design of the stem surface as the ideal path in order to reach its food-area in the flower petals;

(3) In the Umwelt of a cicada-larva, which bores into the sap-path of the stem and uses it to extract the sap in order to construct the liquid walls of its airy house;
(4) In the Umwelt of a cow, which grasps the stems and the flowers in order to push them into its wide mouth and utilizes them as fodder. (J. v. Uexküll 1982)

Each Umwelt, in J. von Uexküll's (1982: 30) interpretation, forms a closed unit in itself, which is governed by the meaning it has for a particular subject separately. Although the meaning-carriers remain identical in their structures, their contents are different for different subjects. For example:

> The color of the blossom serves as an optical perceptual cue in the girl's Umwelt, the ridged surface of the stem as a feeling perceptual cue in the Umwelt of the ant. The extraction point presumably makes itself known to the cicada as a smell perceptual cue. The effector cues are mostly imprinted upon other properties of the meaning-carrier by the subject. The thinnest point of the stem is torn apart by the girl as she picks the flower. The unevenness of the stern's surface serves the ant both as a touch perceptual cue for its feelers and as an effector cue-carrier for its feet. The suitable extraction-point that is made known by its smell is pierced by the cicada, and the sap that flows out serves as building material for its house of air. The taste perceptual cue of the stem causes the grazing cow to take more and more stems into its chewing mouth. (J. v. Uexküll 1982: 31)

To sum up, one could state that every action that consists of perception and operation imprints its meaning on the meaningless object and thereby makes it into a subject-related meaning-carrier in the respective subjective universe. That is, following Uexküll's reasoning, "the picking of the flower transforms it into an ornamental object in the girl's world. Walking along the stem changes the stem into a path in the ant's world, and when the cicada-larva pierces the stem, it is transformed into a source for building material. By grazing, the cow transforms the flower stem into wholesome fodder" (J. v. Uexküll 1982: 31).

In the analyzed Umwelten, the flower stem, acting as a meaning-carrier, was in each instance confronted with a new meaning-receiver that could also be described as a meaning-utilizer. The four meaning-utilizers — the girl, the ant, the cicada larva, and the cow — used the flower stem as decoration, as path, as supplier of material for the building of a house, and as food, respectively (cf. J. v. Uexküll 1982: 59).

To the selected subjects, for which the stem is the carrier of meaning, one should add the whole plant. The stem is part of the plant.

Thus, the whole plant should be treated as its subject. However, the whole plant cannot be considered as a meaning-utilizer when forced to receive the meaning of other subjects, which is not in its own interest. The meaning of the flower stem within the plant is its place in the homeostasis of the organism as system, but the plant as a subject finds itself in relation to other utilizers of its stem in a position of "tolerance of meaning" (*Bedeutungsverduldung*). This position can be inconvenient for the plant in different measures, e.g., when it is picked, toren to pieces, perforated or chewed by another subject. In nature, we encounter many situations of that kind, when subjects and their parts become meaningful objects for other subjects, when they find themselves within "functional circles" (*Funktionskreise*) of medium, food, enemy and sex (cf. J. v. Uexküll 1982: 59f., especially 71; see also T. v. Uexküll 1982: 83–87, Glossary).

Function-and-purpose vs. value-and-need approaches to culture

Considered against the background of anthropological and biological conceptions of meaning, the problems of function or value of significant objects, on one hand, and the problems of needs or purposes of living subjects, on the other, appear to constitute a link between the semiotics of culture and nature. In the realm of man, however, there is no contradiction between a praxeological, i.e., function-and-purpose-oriented approach to language and culture and an axiological, value-and-need-oriented approach to the same. They represent complementary perspectives on the same objects of culture treated either as instruments or as goods in relation to functions or values (modified after Wąsik 1997: 348, and 1998: 58).

As illustrated in Figure 3, specific terms have been defined as follows: *O* = object of culture, a perceivable thing or event in a 'praxeosemiotic' or an 'axiosemiotic' sphere of culture; *U* = user (meaning-creator, meaning-receiver & meaning-utilizer), a subject of culture, i.e., a living system with an ego-quality who subsumes and utilizes objects of culture as *PS* or *AS*; *PS* = 'praxeosignificate', a functional and meaningful object of culture treated both as a tool and as a sign; *AS* = 'axiosignificate', a valuable and meaningful object of culture, treated both as a good and as a sign; *Tool* = an object of culture performing a function for the fulfillment of a subjective purpose of *U*;

Good = an object of culture possessing a value for the satisfaction of a subjective need of *U*; *Sign* = an object of culture having meaning for the subject of culture because of something; *Meaning* = significance of *O* for *U*; *Function* = a role played by a tool while serving a purpose intended by *U*; *Value* = a relational property of a cultural object that satisfies a subjective need; *Purpose* = a goal intended to be attained (to be fulfilled) which means, for the activity of a cultural object, an impulse to utilize a tool to perform a serviceable function; *Need* = a systemic lack which means, for the activity of a cultural subject, an impulse to satisfy a disturbed equilibrium in his or her biological urges and/or socio-psychological wants; *Utilization* = fulfilment of a subjective purpose by serving as a tool or the satisfaction of a subjective need by acquiring a value of cultural good; *Subsumption* = the identification of token 1 with token 2 as belonging to a general type.

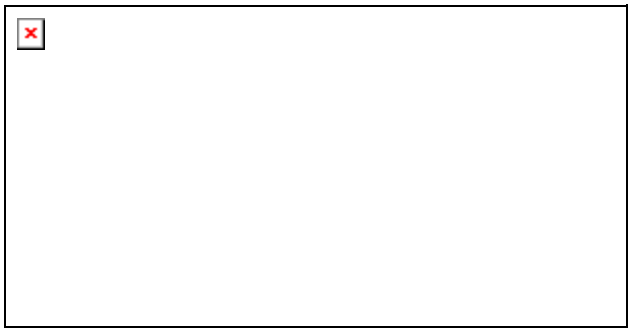

Figure 3. The sign as a tool or a good in a 'praxeosemiotic' and/or 'axiosemiotic' sphere of culture

Both the instrumental and the axiological formulations of sign and meaning, relevant for the explanation of the semiotic character of culture, reveal only an aspectual difference as concerns functions and values of cultural objects in the context of needs and purposes of cultural subjects. From the viewpoint of function, one may investigate all semiotic systems of culture according to the serviceable role they play in satisfying the communicational needs of the subjects of culture. In the value-oriented approach, however, one aims at classifying of all the subjective needs of human beings, in trying to discover how they

are satisfied by means of selected semiotic systems, or what kind of respective needs may be satisfied by what kind of semiotics.

Verbal means as signs of human needs

As an analytic example, in which an axiosemiotc view of cultural objects is discussed against the background of praxeosemiotic concepts of sign and meaning, we take language utterances studied in the context of communicative events (cf. Wąsik 1997). The acceptance of the concept of culture as a system of significative tools fulfilling certain functions in the realm of human communication presupposes in language sciences the analysis of verbal means according to their respective functions or respective purposes (communicative goals) achieved by interlocutors. Apart from the semantic function, which is explainable through the direct reference of textual elements to their extratextual reality in terms of "locutionary meaning", the practitioners of language sciences also study pragmatic functions of utterances that occur in indirect speech acts. Studying language utterances from the viewpoint of their "illocutionary forces", one may consider, among others, Geoffrey Leech's (1990: 104–105) classifications, which concentrate on the strategy of means-ends analyses "according to how they relate to the social goal of establishing and maintaining comity":

(A) Competitive functions: ordering, asking, demanding, begging;
(B) Convivial functions: offering, inviting, greeting, thanking, congratulating;
(C) Collaborative functions: asserting, reporting, announcing, instructing;
(D) Conflictive functions: threatening, accusing, cursing, reprimanding, etc.

Another view of linguistic pragmatics results from the proposal, e.g., of Wiesław Awdiejew (1987: *passim*), who has distinguished three types of illocutionary functions of language utterances:

(E) Modal functions: certainty assumptions, modal vagueness, doubt;
(F) Emotive functions: dissatisfaction, satisfaction, disappointment, appreciation, condemnation, self praise, praise, boasting, criticism, compliment, flattering, sympathy, admonition, reprimand, excuse, envy, accusation, jealousy, dispraise;

(G) Active functions: proposal, obligation, advice, warning, request, invitation, rejection, hesitation, command, threat, recommendation, suggestion, etc.

In an instrumentalist approach to verbal means of communication, the practitioner of semiotics may apply, among others, the methodological apparatus of pragmatic linguistics and sociological pragmatics. Appropriately, one may search for the functions of utterances and/or the purpose and communicative strategies that interlocutors choose for a given speech act or communicative event, e.g., to inform, to ask, to flatter, to insult, or to mock the other person.

However, as concerns the inclusion of language utterances in the axiosemiotic sphere of culture, representatives of semiotic disciplines may treat them as tokens of cultural goods. Their studies may aim at distinguishing those needs of people that are satisfied by verbal means and exchanged in the interpersonal communication (cf. Parsons and Shils 1967; see also Ross 1985). Semioticians may also be interested in searching for values that the verbal means in question express as against the nonverbal means of human communication. For example, linguistically inclined semioticians may pose questions as to the dispositional values of language utterances expressed through different channels of communication.

Asking what kind of needs can be satisfied by verbal means that the communicating individuals use in indirect speech acts, the practitioner of semiotic sciences may distinguish among the objects of investigation, for example:

(1) Boasting — where the linguistic expressions of individuals are evaluated as realizations of their needs for dominance, for exhibition, or for sharing things with others; e.g., senders' utterances can be treated as signs of needs for esteem, the need to be noticed, recognized, etc.

(2) Offering, inviting — as exponents of the need for deference, to conform to customs, the need for abasement, the desire to admit blame in order not to be rejected, etc.

(3) Apologizing — as expressions of the need for deference, to conform to customs, for abasement, the desire to admit blame in order not to be rejected, etc.

(4) Praising and complementing — as signals appealing to the needs of others, the need for affection and approval, expressing the need for deference, or the indiscriminate need to please others, etc.

(5) Criticizing, blaming — in short, the need for aggression, for power, for dominance, the need to have control over others, the need for intraception, i.e., to understand and analyze others, their behavior, the object they possessed, etc.

(6) Joking — the need for inclusion in a social group, the need for exhibition, e.g., to show off one's wit, etc.

(7) Greeting — the need to nurture, to be sympathetic to others, to show affection, the need for affiliation, the desire to belong to a chosen group of people. By greeting others individuals usually express their need to be accepted by them and/or to feel strong attachment with them, and sometimes the need for exhibition, the desire to be noticed and recognized, etc.

Our sample analyses have shown that the meaning of verbal means may be investigated not only from the perspective of their functions but also their values. And since the semiotics of communication investigates not only monosemous signs in use, but also analyzes the contexts in which they appear as polysemous entities, one should bear in mind that verbal means can not only have many functions but also many values, both as instruments of communication and as cultural goods. In order to study verbal means within the framework of axiosemiotics, one has to extend the interest sphere of linguistics proper into the realm of the sciences of language that border on sociology, psychology, and the theory of culture.

Concluding remarks

To sum up, one could state that in the world surrounding people and in the subjective universe surrounding other living organisms, objects can occur as neutral or as potential carriers of meaning. As such, they have to be subsumed under categories of semiotic objects with respect to the possession of properties that enable them to substitute (stand for) other objects, to be utilized for performing certain tasks or to satisfy certain needs of given subjects. Hence, the meaning of signifying objects can be derived either from the relation between the expression of a signifier and (1) a signified content, or (2) a signified function, or (3) a signified value of the cultural and natural objects subsumed by the interpreting subjects under the semiotic ones.

References

Anderson, Myrdene; Deely, John; Krampen, Martin; Ransdell, Joseph; Sebeok, Thomas A.; Uexküll, Thure von 1984. A semiotic perspective on the science: Steps toward a new paradigm. *Semiotica* 52(1/2): 7–47.

Andrade, Luis Eugenio 1999. Natural selection and Maxwell's demons: A semiotic approach to evolutionary biology. *Semiotica* 127(1/4): 133–149.

Awdiejew, Wiesław 1987. *Pragmatyczne podstawy interpretacji wypowiedzeń* [*Pragmatic Foundations of the Interpretation of Utterances*]. Kraków: Nakładem Uniwersytetu Jagiellońskiego.

Baldwin, James Mark 1896. A new factor in evolution. *American Anthropologist* 30: 441–451, 536–553.

Biltz, Rudolf 1981. *Psychotische Umwelt: Versuch einer biologisch orientierten Psychopathologie*. Stuttgart: F. Enke.

Brier, Søren 1999. Biosemiotics and the foundation of cybersemiotics: Reconceptalizing the insights of ethology, second-order cybernetics, and Peirce's semiotics in biosemiotics to create a non-Cartesian information science. *Semiotica* 127(1/4): 169–198.

— 2000. Biosemiotics as a possible bridge between embodiment in cognitive semantics and the motivation concept of animal cognition in ethology. *Cybernetics and Human Knowing* 7(1): 57–75.

Chebanov, Sergej V. 1994. Man as participant in natural creation: Enlogue and ideas of hermeneutics in biology. *Rivista di Biologia* 87(1): 39–55.

Coletta, W. John 1999. Literary biosemiotics and the postmodern ecology of John Clare. *Semiotica* 127(1/4): 239–271.

Danesi, Marcel 2000. The biosemiotic paradigm of Thomas A. Sebeok. In: Tarasti, Eero (ed.), *Commentationes in Honorem Thomas A. Sebeok Octogenarii A.D. MM Editae*. Imatra: The International Semiotics Institute, 5–29.

Dawkins, Richard 1982. *The Extended Phenotype*. Oxford: Oxford University Press.

Depew, David 2000. The Baldwin effect: An archeology. *Cybernetics and Human Knowing* 7(1): 7–20.

Eco, Umberto 1979. *A Theory of Semiotics*. Bloomington: Indiana University Press.

Edelman, Gerald M. 1987. *Neural Darwinism: The Theory of Neuronal Group Selection*. New York: Basic Books.

— 1989. *The Remembered Past: A Biological Theory of Consciousness*. New York: Basic Books.

— 1992. *Bright Air, Brilliant Fire: On the Matter of the Mind*. New York: Basic Books.

Emmeche, Claus 1991. A semiotical reflection on biology: Living signs and artificial life. *Biology and Philosophy* 6: 325–340.

— 1992. Modeling life: A note on the semiotics of emergence and computation in artificial and natural living systems. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *Biosemiotics: The Semiotic Web 1991*. Berlin: Mouton de Gruyter, 77–99.

— 1999. The Sarkar challenge to biosemiotics: Is there any information in a cell? *Semiotica* 127(1/4): 273–293.
Emmeche, Claus; Hoffmeyer, Jesper 1991. From language to nature: The semiotic metaphor in biology. *Semiotica* 84(1/2): 1–42.
Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Trans. Barbara J. Haveland. Bloomington: Indiana University Press.
— 1997. Biosemiotics: Towards a new synthesis in biology. *Europan Journal for Semiotic Studies* 9: 355–376.
Hoffmeyer, Jesper; Emmeche, Claus 1991. Code-duality and the semiotics of nature. In: Anderson, Myrdene; Merrell, Floyd (eds.), *On Semiotic Modeling*. Berlin: Mouton de Gruyter, 117–166.
Ingold, Tim 1989. The social and environmental relations of human beings and other animals. In: Standen, Valerie; Foley, Robert A. (eds.), *Comparative Socioecology: The Behavioral Ecology of Humans and Other Mammals*. Oxford: Blackwell Scientific, 495–512.
— 1992. Culture and the perception of the environment. In: Croll, Elisabeth J.; Parkin, David J. (eds.), *Bush Base*: *Forest Farm*. London: Routledge, 39–56.
— 1999. Social relations, human ecology, and the evolution of culture: an exploration of concepts and definitions In: Andrew Lock, Charles R. Peters (eds.), *Handbook of Human Symbolic Evolution*. Oxford: Blackwell Publishers 178–203.
Kawade, Yoshimi 1991. The two foci of biology: Matter and sign. *Semiotica* 127(1/4): 369–384.
Krampen, Martin 1981. Phytosemiotics. *Semiotica* 36(3/4): 187–209.
— 1992. Phytosemiotics revisited. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *Biosemiotics: The Semiotic Web 1991*. Berlin: Mouton de Gruyter, 213–220.
Kull, Kalevi 1998a. On semiosis, Umwelt, and semiosphere. *Semiotica* 120(3/4): 299–310.
— 1998b. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–371.
— 1999. Biosemiotics in the twentieth century: A view from biology. *Semiotica* 127(1/4): 385–414.
— 2000. Organism can be proud to have been their own designers. *Cybernetics and Human Knowing* 7(1): 44–55.
Leech, Geoffrey 1990 [1983]. *Principles of Pragmatics*. 7th edition. London: Longmann.
Mirka, Danka 2000. Species, theories, styles. In: Tarasti, Eero (ed.), *Commentationes in Honorem Thomas A. Sebeok Octogenarii A.D. MM Editae.* Imatra: The International Semiotics Institute, 92–104.
Nöth, Winfried 1996. Ökosemiotik. *Zeitschrift für Semiotik* 18(1): 7–18.
— 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–343.
Parsons, Talcott 1949. *The Structure of Social Action*. New York: Free Press.
— 1951. *The Social System*. New York: Free Press.
Parsons, Talcott; Shils, Edward A. (eds.) 1967 [1951]. *Towards a General Theory of Action.* 6th edition. Cambridge: Harvard University Press.

Petersen, Hans 1937. *Die Eigenwelt des Menschen*. (Bios, Abhandlungen zur theoretischen Biologie und ihrer Geschichte sowie zur Philosophie der organischen Naturwissenschaften 8.) Leipzig: J. A. Barth.

Pietraszko, Stanisław 1980. O sferze aksjosemiotycznej [On the axiosemiotic sphere]. In: Siciński, Andrzej (ed.), *Problemy teoretyczne i metodologiczne badań stylu życia* [*Theoretical and Methodological Problems of the Studies on Life Style*]. Warszawa: Polska Akademia Nauk. Instytut Filozofii i Socjologii, 55–75.

— 1982. O przedmiocie teorii kultury [On the subject matter of the theory of culture]. In: Pietraszko, Stanisław (ed.), *Przedmiot i funkcje teorii kultury* [*Subject and Functions of the Theory of Culture*]. Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego, 117–140.

Pobojewska, Aldona 1993. Die Subjektlehre Jacob von Uexkülls. *Sudhoffs Archiv* 77: 54–71.

— 1995. Die Umweltkonzeption Jacob von Uexkülls: eine neue Idee des Untersuchungsgegenstandes von der Wissenschaft. In:. Lenk, H; Poser, H. (eds.), *Neue Realitäten: Herausforderung der Philosophie*. *XVI. Deutscher Kongress für Philosophie, 20.–24. September 1993, TU Berlin, Sektionsbeiträge*, 94–101. Berlin: Technische Universität Berlin, Universitätsbibliothek.

— 1996. *Biologia i poznanie: biologiczne "à priori" człowieka a realizm teoriopoznawczy* [*Biology and Cogniton: Biological "à priori" of Man and the Gnoseological Realism*]. Łódź: Wydawnictwo Uniwersytetu Łódzkiego.

Popper, Karl Raimund 1994. *Knowledge and the Body-Mind Problem*: *In Defence of Interaction*. London: Routledge.

Ross, Raymond Samuel 1985 [1974]. *Speech Communication*: *Fundamental and Practice*. Englewood Cliffs: Prentice-Hall.

Searle, John R. 1983. *Intentionality: An Essay in the Philosophy of Mind*. Cambridge: Cambridge University Press.

— 1992. *The Rediscovery of the Mind*. Cambridge: MIT Press.

Sebeok, Thomas A. 1974. Semiotics: A survey of the state of the art. In: Sebeok, Thomas A. (ed.), *Current Trends in Linguistics* vol. 12. The Hague: Mouton, 211–264.

— 1989 [1979]. Neglected figures in the history of semiotic inquiry: Jakob von Uexküll. In: Sebeok, Thomas A., *The Sign and Its Masters*, 2nd ed. Lanham: University Press of America, 187–207.

Sebeok, Thomas A.; Danesi, Marcel 2000. *The Forms of Meaning: Modeling Systems Theory and Semiotics*. Berlin: Mouton de Gruyter.

Stjernfeld, Frederik 1999. Biosemiotics and formal ontology. *Semiotica* 127(1/4): 537–565.

Szewczyk, Kazimierz 1963. *Biologia i sens: studium witalizmu Jacoba von Uexkülla* [*Biology and Sense*: *A Study of Jakob von Uexküll's Vitalism*]. Łódź: Akademia Medyczna [A habilitationsschrift carried out in the Department of Ethics and Philosophy of the Medical Academy in Łódź].

Teherani-Krönner, Parto 1996. Die Uexküllsche Umweltlehre als Ausgangspunkt für die Human- und Kulturökologie. *Zeitschrift für Semiotik* 18(1): 41–53.

Uexküll, Jakob von 1907. Die Umrisse einer kommenden Weltanschauung. *Die neue Rundschau* 18: 641–661.

— 1921 [1909]. *Umwelt und Innenwelt der Tiere*. 2. verm. u. verb. Aufl. Berlin: J. Springer.
— 1936. *Niegeschaute Welten: Die Umwelten meiner Freunde. Ein Erinnerungsbuch*. Berlin: S. Fischer.
— 1973 [1928, 1920]. *Theoretische Biologie*. Frankfurt/Main: Suhrkamp.
— 1982 [1940]. The theory of meaning. *Semiotica* 42(1): 25–82.
— 1992 [1957, 1934]. A stroll through the world of animals and men: A picture book of invisible worlds. *Semiotica* 89(4): 319–391. [Also in: Schiller, Claire H. (ed.), *Instinctive Behavior*. *The Development of a Modern Concept*. New York: International Universities Press, 5–80.]
Uexküll, Jakob von; Kriszat, Georg 1970 [1962, 1934]. *Streifzüge durch die Umwelten von Tieren und Menschen: Ein Bilderbuch unsichtbarer Welten. Bedeutungslehre*. Frankfurt a. M.: S. Fischer.
Uexküll, Thure von 1970. Die Umweltforschung als subjekt- und objektumgreifende Naturforschung. In: Uexküll and Kriszat 1970: xxiii–xlviii.
— 1979a. Die Zeichenlehre Jakob von Uexkülls. *Zeitschrift für Semiotik* 1: 37–47.
— 1979b. Die Umweltlehre Jakob von Uexkülls und die Wissenschaften vom Menschen. *Merkur* 33(7): 621–635.
— 1982a. Semiotics and medicine. *Semiotica* 38(3/4): 205–215.
— 1982b. Introduction: Meaning and science in Jakob von Uexküll's concept of biology. *Semiotica* 42(1): 1–24.
— 1984. Semiotics and the problem of the observer. *Semiotica* 48(3/4): 187–195.
— 1987 [1981]. The sign theory of Jakob von Uexküll. In: Krampen, Martin; Oehler, Klaus; Posner, Roland; Sebeok, Thomas A.; Uexküll, Thure v. (eds.), *Classics of Semiotics*. New York: Plenum Press, 147–179.
— 1990. Medizin und semiotik. In: Koch, Walter A. (ed.), *Semiotik in den Einzelwissenschaften*, Bd. 1. Bochum: Brockmeyer, 307–342.
— 1992. Introduction: The sign theory of Jakob von Uexküll. *Semiotica* 89(4): 279–315.
— 1993. Ökologie im Licht der Lehre Jakob von Uexküll's. In: Kull, Kalevi; Tiivel, Toomas (eds.), *Lectures in Theoretical Biology*: *The Second Stage*. Tallinn: Estonian Academy of Sciences, 149–152.
Wąsik, Zdzisław 1987. *Semiotyczny paradygmat językoznawstwa. Z zagadnień metodologicznego statusu lingwistycznych teorii znaku i znaczenia* [*A Semiotic Paradigm of Linguistics. From Questions about the Methodological Status of Linguistic Theories of Sign and Meaning*] (= Acta Universitatis Wratislaviensis No 939, Studia Linguistica XI). Wrocław: Wydawnictwo Uniwersytetu Wrocławskiego.
— 1997. Verbal means as signs of human needs. In: Rauch, Irmengard; Carr, Gerald F. (eds.), *Semiotics Around the World: Synthesis in Diversity*. Proceedings of the Fifth Congress of the International for Association Semiotic Studies, Berkeley 1994. Berlin: Mouton de Gruyter, 347–350.
— 1998. *An Outline for Lectures on the Epistemology of Semiotics*. Opole: Wydawnictwo Uniwersytetu Opolskiego.
— 2000. Jakob von Uexküll's 'Umwelt-theory': A link between the semiotics of nature and the semiotics of culture. In: Tarasti, Eero (ed.), *Commentationes in*

Honorem Thomas A. Sebeok Octogenarii A.D. MM Editae. Imatra: The International Semiotics Institute, 142–163.

О биологическом понятии субъективной значимости: связь между семиотикой природы и семиотикой культуры

В рамках данной работы логико-философский подход к носителям или процессам значений соположен с антрополого-биологическими понятиями субъективной значимости, общими для семиотики культуры и семиотики природы. Предполагается, что определенные объекты, идентифицируемые в человеческом универсуме и в мире, окружающем все живые организмы, как значимые для получателей, создателей и пользователей значений, могут определяться как знаки, когда они репрезентируют другие объекты, выполняют определенные задачи или удовлетворяют определенные нужды субъектов. Следовательно значение обозначающих объектов может быть найдено в отношении выражения означающего или 1) к означенному содержанию, или 2) к означенной функции, или 3) к означенной ценности культурных и естественных объектов, которые интерпретирующий субъект определяет как семиотические.

Subjektiivse tähenduslikkuse bioloogilisest mõistest: seos looduse- ja kultuurisemiootika vahel

Antud töö raames on loogilis-filosoofiline lähenemine tähendusekandjatele või tähendusprotsessidele suhestatud subjektiivse tähenduslikkuse antropobioloogiliste mõistetega, mis on ühised nii kultuuri- kui ka loodusesemiootika jaoks. Eeldatakse, et teatud inimilmas ja kõiki elusolendeid ümbritsevas maailmas tähenduste saajate, loojate ja kasutajate poolt tähenduslikena tuvastatavaid objekte võib määratleda märkidena, kui nad representeerivad teisi objekte, täidavad teatud ülesandeid või rahuldavad subjektide teatud vajadusi. Seega võib tähendustatud objektide tähendust leida tähistaja väljenduse suhte kaudu interpreteeriva subjekti poolt semiootilisena määratletud kultuuri- ja looduslike objektide 1) tähistatud sisusse, või 2) tähistatud funktsiooni, või 3) tähistatud väärtusesse.

Ecosemiotics and cybersemiotics

Søren Brier
Royal Veterinary and Agricultural University
Rolighedsvej 23, DK-1958 Frederiksberg C, Denmark
e-mail: sbr@kvl.dk

Abstract. The article develops a suggestion of how cybersemiotics is pertinent to ecosemiotics. Cybersemiotics uses Luhmann's triadic view of autopoietic systems (biological, psychological, and socio-communicative autopoiesis) and adopts his approach to communication within a biosemiotic framework. The following levels of exosemiosis and signification can be identified under the consideration of nonintentional signs, cybernetics, and information theory: (1) the socio-communicative level of self-conscious signification and language games, (2) the instinctual and species specific level of sign stimuli signifying through innate release response mechanism and sign games, and (3) the level of structural coupling, signal recognition, and languaging, where cybernetic feedback loops evince differences. Signification and communication levels arise whenever autopoietic systems interpenetrate (1) with the language system's semiotic and the psyche's phenosemiotic processes based on imaging, emotion, and volition and (2) between the psyche's phenosemiotic and the body's endosemiotic processes. It is at these two levels that we have the ecosemiotic signification processes of nonintentional signs in nature. Humans are linguistic cyborgs as animals are sign cyborgs because signs at different levels interpenetrate and form our embodied processes. Sign producing and interpreting capability has had selective influence on both animals and humans in evolution.

Nöth (2001) specifies the scope of ecosemiotics as having the semiotics of signification of nonintentional signs as crucial in this field since a big part of ecosemiosis is about perception of non-human signs and as such of non-intentional semiosis. A theory of semiotics, which not only deals with intentional signs of communication but also encompasses non-intentional signs, such as symptoms of the body and pat-

terns of inanimate nature, is Peirce's semiotics. It breaks with the traditional dualistic epistemological problem of first order science by framing its basic concept of cognition as *signification* in a triadic semiotic philosophy.

Peirce's triadic semiotics is integrated in the framework of his evolutionary cosmology, consisting of the three sub-theories of *tychism,* the theory of chance as an influence in the universe, *agapism*, the thesis that sympathy (or "evolutionary love") is "the great evolutionary agency of the universe", and *synechism*, which states that there is continuity from mind to matter (cf. Peirce 1992: xxii). According to Peirce, the three universal categories of *Firstness, Secondness,* and *Thirdness* are not only to be found within the perceiver's mind, but also in the nature perceived. The theory of *tychism* states that chance events, which belong to the category of Firstness, evince an evolutionary tendency to take habits and thus to evolve to Thirdness. The chaos of mere chance events, which characterizes Firstness is not seen as the lack of law, as in mechanicism and rationalism, but as something full of potential qualities to be manifested individually in Secondness and as general habits in semiosis in Thirdness.

It is interesting to note that Peirce, Bertalanffy, and Luhmann, in spite of much criticism of Hegel, are nevertheless influenced by this German philosopher. They are all concerned with the problem of how new hierarchical levels of natural existence can arise in an evolutionary process that should be describable as a regular interaction of some basic dynamic categories. The genius of Peirce found a way to describe such processes in perception, thought, and communication by means of his three universal categories, which are so fundamental that it is evident that these also function in nature independently of the human mind. A fundamental connection between mind and nature beyond mechanicism is then established.

A similarly fundamental model (but of a very different foundation) has been proposed within the cybernetics pan-information paradigm based on an objectivistic concept of information. For instance, Stonier (1997) sees the *infon* as a kind of fundamental *particle*, i.e., the dynamic organizational force in nature and evolution. However, Stonier has no explicit general framework like Peirce's metaphysical conception of Firstness, Secondness, and Thirdness with semiotic qualities even at the level of evolution guiding the evolutionary development of natural laws in a teleonomic process working over space-time magnitudes so powerful that it is beyond human perception. Peirce's semiotics is a radical turnaround both from the Kantian tradition, from ra-

tionalism and from dualistic mechanicism as originally laid down by Descartes.

In times of search for new foundations of sustainability and understanding of the place of humans and their role and possibilities in nature, it is worthwhile exploring the foundations, possibilities, and limits of *ecosemiotics*. In this context, I would like to discuss the relevance of the concept of organizational closure and embodiment, which has been developed in the theory of autopoiesis and in second order cybernetics, and has become an integral part of Niklas Luhmann's general systems theory. The present article is based on results reported in Brier (1999, 2001).

Luhmann's triadic autopoietic systems

Luhmann has generalized the concept of autopoiesis to comprise both the psychic and biological systems of an individual and the socio-communicative systems of a group. He views the psyche as a silent inner system, a closed system of perception, emotions, and volitions. The psychic system of the individual is characterized by autopoiesis and organizational closure. A socio-linguistic system has to be created for communication to happen. Socio-communication between individuals is an organizationally closed system, which evinces autopoiesis. Only communication communicates. Social systems are communicative systems with human bodies and minds as their environments. There are hence three organizationally closed systems, the biological, the psychical and the socio-communicational one, to make communication possible.

To Luhmann (1995), communication is a sequence of three selections, of information, of utterance, and of meaning. The selections of information and of utterance have to be made by what we traditionally call "the senders". The selection of meaning has to be made by the receivers, who choose their understanding of the signs produced. In addition, there is a fourth selection when the message is connected to present practice. A message is produced successfully when the receiver says something that the sender chooses to understand as a confirmation of understanding of the sender's first message.

Luhmann's view of information is partly based on Shannon and Weaver, but Luhmann does not believe in the possibility of applying this model outside the sphere of human socio-communication. Infor-

mation comprises the quantitative aspect of a meaningful human context and it is combined with utterance and meaning. Luhmann stresses that both the sender and the receiver have to make their choices to produce a meaningful message. Information is a choice related to subject matter, utterance is a choice pertaining to the way of saying something, and meaning is a choice of the hearer's interpretation and it depends on the hearer's evaluation of the human context. It is especially in the social communicative construction of meaning that Luhmann's theory is relevant to semiotics.

The cybersemiotic view

Our inner mental world is a way of representing our bodily interactions with the environment and the construction of a sphere of signification by means of our body. What Spinoza calls *conatus*, i.e., self-value and self-interest in preserving the individual's and species' self-organizing structure, is fundamental to the living systems' ability to signify. But this individual sphere of signification is again perturbed by the interactions starting with mating, rearing of the young, and competition for hunting territory, group hierarchy, or co-operation in food gathering and hunting. These activities first generate sign games and later, in humans, language games. Prerequisites of constructing meaningful and informative messages are autopoiesis, signification, and conatus with motivation and intentionality. It is only within this triad that the selections of information, utterance and meaning are possible. My theory is then that sign and language games are based on the interpenetration of autopoietic systems. Luhmann, in my view, had still problems to produce a concept of meaning that relates deeply to the flesh, blood, and life (conditions) of biological systems and the existential conditions of human consciousness. Phenomenology and hermeneutics have more to offer at this point when seen as part of a pragmatic language philosophy, like Wittgenstein's language game theory and Lakoff and Johnson's embodied cognitive semantics combined with ethology within biosemiotic framework (further argued below).

Extended in this way, Luhmann's three autopoietic systems are indeed necessary for the creation of a message, but Luhmann's functionalism does not adequately take into consideration the role of the body and the mind in the production and meaning of social communication. A way of escaping from this theoretical impasse is to view the

interpenetration between the three organizationally closed systems in a semiotic framework. Signs acquire meaning where the systems *interpenetrate*, which has been Luhmann's term for the interplay between biological autopoiesis, psychic closure and the socio-communicative system with its own closure at the social level.

Meaning is then seen as being generated by the interpenetration of the biological, psychical, and socio-linguistic systems. For example, language is a part of the socio-communicative system, but it does not really get a meaning before it interpenetrates with the psychic system, indicating differences of emotion, volition and perception, and 'putting words' into our silent inner being. However, our cognitive, emotional, and volitional qualities would only have a weak connection to reality if they were not connected to the survival of the living systems' organization in its interacting with the environment's differences in the development of a signification sphere in the evolution of the species. Biosemiotics and the theory of metaphor have given evidence of the importance of embodiment in semiosis (further argued in Brier 2001). For the connection between the biosemiotic (ethologically based) concept of motivation and the motivational concept of embodied cognitive semantics and the details of a comprehensive cybersemiotic model of the relevant determinants see Brier (2000). As argued in this context, a phenomenological-emotional approach is necessary to understand how meaning is produced, which is consistent with Peirce's theory of feeling as an attribute of Firstness.

Cognitive phenomena have either been explained by functionalist cybernetic or by meaning based semiotic approaches. None of them give a complete explanation. Peirce has pointed out the continuity between human reasoning and machine operations. Solving logical problems and algorithms is equal to a mechanical process that obeys predetermined rules. This is what human nature has in common with mere machines, according to Peirce, who wrote:

> All that I insist upon is, that, in like manner, a man may be regarded as a machine which turns out, let us say, a written sentence expressing a conclusion, the man-machine having been fed with a written statement of fact, as premiss. Since this performance is no more than a machine might go through, it has no essential relation to the circumstance that the machine happens to work by geared wheels, while a man happens to work by an ill-understood arrangement of brain-cells. (Peirce CP 2.59)

Creative work is needed to construct logical systems, but this does not mean that logical reasoning is more fundamental than life and con-

sciousness. For Peirce, semiosis is universal. It is the prerequisite of science and philosophy, of knowledge as such. Knowledge systems unfold from our bio-psycho-socio-linguistic conscious being. Their function is to help us orient (ourselves) in the world and help us act together in the most fruitful way, but they do not explain us to ourselves.

Prigogine's views of complexity (cf. Prigogine & Stengers 1984) and Peirce's view of chaos and chance are compatible, but Peirce's view that we cannot draw a fundamental distinction between mind and matter is still more fundamental. There are no good reasons why the inner world of cognition, emotion, and volition should not be accepted as being as real as the physical world and our cultural world of signs and meaning (including Popper's world 3 of objective knowledge). Embodied life has to be an essential part of reality. We are thinking in, or maybe even with, the body.

Cybersemiotics deals with the metaphysical background of both cybernetics and semiotics. It brings cybernetics and semiotics in relation to each other, especially in their modern versions of second order cybernetics and the theory of autopoiesis on the one hand and Peircian biosemiotics on the other. Furthermore, cybersemiotics considers motivation and embodiment as important parts of biosemiotic communication. Embodiment and motivation are important common denominators of animal sign games and of human language games, thus integrating biosemiotics with the cognitive-semantic embodied metaphor theory of Lakoff and Johnson and with Wittgenstein's later language philosophy.

One of the foundations of cybersemiotics is Luhmann's conception of a message consisting of information, utterance, and meaning. However, Luhmann did not elaborate the semiotic process of signification in order to understand the production of meaning. His theory of the socio-communicative human being consisting of three autopoietic systems has been used in cybersemiotics to distinguish between (1) the languaging (Maturana) of the biological system (coordinations of coordinations of behaviour), (2) the sign games (Brier) of the bio-psychological system, and finally (3) the language games (Wittgenstein) of the self-conscious linguistic human (Cyborg) through generalized media in the socio-communicative systems (Luhmann). Luhmann's systems theoretical conception has thus been extended by a semiotic dimension, and his theory is being placed in the Peircean triadic metaphysics.

It is obvious that language games arise in social contexts where humans use their minds to coordinate their actions with other humans. Filtered through culture and language, some of these language games are about nature. Humans also participate in emotional and instinctual

biological sign game (further argued in Brier 1995) of paralinguistic signs, whose origin is in the evolution of signification processes in living systems. Furthermore, mind and body are in internal communication. Kull (1998) discusses *psychosomatics* as a form of communication between culture and internal nature, and similarly, Luhmann focuses on communicative interaction between the body and human culture.

It was Sebeok (1976: 3) who introduced the term *endosemiosis* to designate semiotic processes taking place within organisms, in contrast to *exosemiosis*, which refers to sign process that occur between organisms. Uexküll *et al*. (1993) define endosemiosis as any semiotic interaction at a biological level. If *ecosemiotics* designates signification processes in which non-intentional signs are involved, the term *exosemiosis* that refers to communication by means of intentional signs should be considered in opposition to it.

How should then the semiotic interaction between the biological and the psychological systems then be called? Luhmann postulates that body and psyche are autopoietic systems which are closed to each other, but which interact by *interpenetration*. The semiotic aspect of this interpenetration of body and psyche can be called for *intrasemiosis*.

Finally I will suggest that we call the wordless inner semiotic processes of the mind or psyche for *phenosemiosis*, as there are the perceptual, emotional, volitional signs often in the form of images and patterns, which the phenomenologists takes as the basic elements of our inner world.

Today we know that there are semiotic interactions between the hormone systems, the transmitters in the brain, and the immune system, and it is known that these interactions are very important for the establishment of the second order autopoietic system, which a multicellular organism constructs. Parts of this system are the cells that are themselves autopoietic systems. However, we do not know very well what the relations between our lived inner world of feeling, volitions, and intentions and this system are. It seems that certain kinds of attention on bodily functions, such as imaging, can create physiological effects. As mentioned above, this is partly due to substances that have an endosemiotic sign effect on organs and specific cell types within the body. Such processes are very significant to the embodiment of the human mind and somehow they are released by intrasemiotic sign games. For example, our state of mind is determined by our body posture through the tightness of our postural muscles. We also know that our hormonal level influences our sexual and maternal responses. Fear, for example, causes a series of chemical processes that change

the state and reaction time of several body functions. There is still a lot we do not yet know about the interaction between these systems.

The nervous system, the hormonal system, and the immune system are incorporated within an enormous self-organized sign web. Sign production in autopoietically closed living systems does not allow for any real opening of the system for the reception of signs as such, and semiotics in itself has hardly considered evolutionary the role of embodiment in the creation of signification. According to the cybersemiotic approach, signs are produced when the systems interpenetrate, and the closed biological, psychic, and socio-linguistic systems produce different kinds of semiosis through different types of interpenetration with structural couplings and cybernetic "languaging", as Maturana and Varela (1980) call it.

The theory of autopoiesis describes the two interpenetrating systems as black boxes which are closed to each other, but Maturana points out that interpenetration develops as a coordination of coordinations of behaviour, which he calls languaging. In the process of languaging, reciprocally structural couplings take place between he the two systems, which allow for sign production and exchange. Maturana's concept of languaging through reciprocal structural couplings thus describes the bio-psychological interaction between two individuals in a social group. The relation to the environment is directed through unilateral structural couplings. However, it is not the sign or the language game as such that is central to languaging but the cognitive coupling, which constitutes the necessary connective coordination for communication to develop as a signification system with its own organizational closure. It is therefore necessary to distinguish between languaging and sign games at the level of reflexes and instinctual movements. Perception, which elicits reflexes, is independent of motivation, whereas perception of sign stimuli depends on motivation, which has to do with instinctual sign games. Ethologists have shown how certain instinctual movements become ritualized and get a signal release value for instinctive behaviour as "sign-stimuli". Lorenz (1973), in particular, realized that emotions have to be connected with the production of instinctual movements. These insights give evidence of how the connection between signs and internal or phenomenological understanding is constructed. Lakoff (1987) and Lakoff & Johnson (1999) have further shown how metaphorical processes can explain this mechanism of bodily meaning and how it encompasses socially and culturally produced signs.

Based on ethology and biosemiotics I have shown that cognition manifests as embodied semiosis, which is motivated in our biological social interest as a powerful creator of structure and meaning in our sphere of signification. Most animal behavior is as unconscious as most of our linguistic categorization and use of metaphors. Ethologists had to realize that motivation is not a physiological process (see also Ellis *et al*. 1998). As we are born, we grow into social communication; our psyche is perfused with signs. Sign games develop into language games. Our mind is "infected" with language, and we become semiotic cyborgs or what we call humans. We are born as animals with the capacity of constructing interpenetrations between psychic and socio-communicative systems. We create internal interpretants that are meaningful to us because of the mutual structural couplings of languaging established in evolution.

Along these lines, my preliminary model combines semiotics with systems theory in its advanced second order version, integrating in complementary ways pragmaticist semiotics, cognitive semantics, and language game theory. I am aware that my integration of semiotics, cognitive semantics, and Luhmann's three organizationally closed systems goes beyond Luhmann, but I think this extended theory is necessary for obtaining a more comprehensive perspective of the relation between ethology and cognitive embodied semantics in a biosemiotics framework (Brier 2000).

Lakoff & Johnson's research can be seen as a bridge between the biological and the cultural levels in cognition and communication. Their concept of embodiment can be expanded beyond such schemes as up-down, in-out, front-back, container-path to embrace further signification spheres of living systems. The cybernetic view of embodiment should be developed further on the basis of Lorenz's (1970–71) and Tinbergen's (1973) ethological research paradigm, Uexküll's presemiotic phenomenological biology, and Maturana & Varela's theory of autopoiesis.

We have become self-conscious human beings in and through language. Pre-linguistic infants are only animals with a human potential. Only the social web of languaging between members of the same species and the sign games of emotional awareness form the self-conscious linguistic human being. Loosely inspired by Donna Haraway and Lucia Santaella, I accept the human being as a linguistic Cyborg. It is a biopsychological being "infected" by language, with the consequence that its nervous system and awareness have been affected by irreversible changes. The advantage that the socio-communicative hominids gained

from the structural coupling of language games and generalized media is so enormous (cf. Deacon 1997) that language and linguistic activities became an important selection pressure in early human evolution. This pressure left its influence on the bodily development of humans towards better anatomical structures to support language production. As the human brain and skull grew in size, children were born with increasingly neotenic features to make them more susceptible to cultural linguistic programming. The instinctual system becomes more and more open to programming through personal experience. Thus, the advantage of learning processes is that they pertain better to the actual environmental and social situation and not only to those situations of the past that were instrumental in selecting our genes.

This system of adaptation in early life, combined with the mental tool of conceptual communication and later with inner thought, was so advantageous for the survival and proliferation of the species that we developed into those linguistically-culturally programmed cyborgs that we call today human beings. It is important to keep Heidegger's and Wittgenstein's insight in mind that we are not only linguistic beings who think, learn, communicate, and co-ordinate through language, but also that it is as much language that thinks in us. As much as we speak a language, we are also spoken by language, which makes it difficult for us to think beyond language. We have to begin our search for knowledge realizing that our mind is semiotic. It is built on, or from, semiotic processes, already at the animal stage. Being in permanent semiosis with other social beings, with nature, and with ourselves, we can hardly expect to gain knowledge beyond our own sphere of signification. We can slowly increase our cultural sphere of signification through science and philosophy, but it is doubtful whether we can ever explain it in a way that we can predict or even reconstruct it from scratch.

Cybersemiotics accepts the epistemological premises of internal realism created by Putnam and used by Lakoff (1987), which work well with Peirce, Prigogine, and Luhmann: we observe the universe from our world — or rather signification spheres. What we can do is to examine ourselves as bodies and to develop inner awareness of our language, society, and through ecosemiotics reflect on our understanding of our natural environment. Then we can gradually try to discover the necessary prerequisite for our world to function the way it does. There is no unique and safe way of doing this. As Peirce and Popper have recognized, it must be done by bold hypotheses (abduction), by logical thinking to determine internal consistencies and concise con-

sequences (deduction), and by testing both the empirical (induction) and the theoretical coherence of what we at present believe to be solid knowledge. Cybersemiotics is the proposal of a model to understand ourselves, our society and our environment (through ecosemiotics) until something better comes by.

Conclusion

The cybersemiotic framework combines Peirce's non-reductionistic, non-mechanical, evolutionary, and triadic semiotic framework, second order cybernetics, the theory of autopoiesis, Luhmann's theory of socio-communication, cognitive semantics in Lakoff & Johnson's embodied version, and Wittgenstein's theory of meaning construction in language games. In its framework, semiosis is the key to the understanding of cognitive and communicative processes. Evolution is defined as the creation of material, psychological, and cultural habits. Meaning is seen as being embodied in biosemiosis and investigated from the points of view of cognitive semantics, autopoiesis theory, and ethology. However, with the new cybernetics and Uexküll, the embodiment of meaning must be considered as having a much broader scope than its embodiment in the nervous system, in neurotransmitters, and hormone, or immune systems, where it is appears in the form of reactions to the sign substances that they secrete. As Fogh Kirkeby (1997) suggests, we should look at the human body-mind or body-thought as a complex phenomenological dynamical system, including the construction of the environment and the other (body-mind) systems that make it possible for signification to appear.

Since signification does not only pertain to the environment, but also to the perception of other members of the species in cultural and proto-cultural behavior as well as to self-perceptions, I use "eco-" as a prefix to the signification sphere when it pertains to nature outside the species in question.

Language is about nature, culture, and our inner world of emotions, volitions, and rationality. Ecosemiotics investigates language insofar as it shows how living systems represent nature in spheres of signification that extend to language games in culture. Cybersemiotics shows that the bases of such eco-language games are the eco-sign-games of animals, combined with a sphere of signification, originally called "Umwelt" by Uexküll, and created through evolution. Their

basis is further an intricate interplay between the living system and its environment, establishing what Maturana and Varela call structural couplings. The sphere of signification is a useful model of nature showing how living systems have existed and evolved through millions of years. This is also true of the human species whose language is inherently connected with the ecology of human culture. Cultures are collective ways of securing the ecological survival of a social system. Cultures also have a sphere of signification, which is in mutual determination with ecosemiosis. This sphere of signification is largely created by the life forms and language games of that culture, be they animistic, as in a hunter-gather society, or materialistic, energetic, and informational, as in a post-industrial knowledge society.

In sum, the present analysis proposes to distinguish between the following three spheres of eco-signification and one domain of eco-structural couplings:

(1) There is first the cultural sphere of eco-signification.
(2) There is then a species-specific sphere of eco-signification.
(3) Every individual has his/her own eco-signification sphere.
(4) There is the structural domain of eco-coupling, as described in theory of autopoiesis and second order cybernetics, which can be found at the core of Uexküll's Umwelt theory.

These four levels depend on one another. Although they do not necessarily dovetail perfectly into one another, they are all essential constituents of our eco-semiotic system.

References

Brier, Søren 1995. Cyber-semiotics: On autopoiesis, code-duality and sign games in bio-semiotics. *Cybernetics & Human Knowing* 3(1): 3–25.

— 1999. Biosemiotics and the foundation of cybersemiotics: Reconceptualizing the insights of ethology, second order cybernetics, and Peirce's semiotics in biosemiotics to create a non-Cartesian information science. *Semiotica* 127(1/4): 169–198.

— 2000. On the connection between cognitive semantics and ethological concepts of motivation: A possible bridge between embodiment in cognitive semantics and the motivation concept in ethology. *Cybernetics and Human Knowledge* 7(1): 57–75.

— 2001. Cybersemiotics and Umweltlehre. *Semiotica* 134(1/4).

Deacon, Terrence W. 1997. *The Symbolic Species: The Co-Evolution of Language and the Brain.* New York: Norton.

Ellis, Ralph D.; Newton, Nakita 1998. Three paradoxes of phenomenal consciousness: Bridging the explanatory gap. *Journal of Consciousness Studies* 5(4): 419–42.
Kirkeby, O. Fogh 1997. Event and body-mind: An outline of a post-postmodern approach to phenomenology. *Cybernetics & Human Knowing* 4(2/3): 3–34.
Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–364.
Lakoff, George 1987. *Women, Fire and Dangerous Things: What Categories Reveal about the Mind*. Chicago: Chicago University Press.
Lakoff, George; Johnson, Mark 1999. *Philosophy in the Flesh: The Embodied Mind and its Challenge to Western Thought*. New York: Basic Books.
Lorenz, Konrad 1970–1971. *Studies in Animal and Human Behaviour,* 2 vols. Cambridge (Mass.): Harvard University Press.
— 1973. *Die Rückseite des Spiegels: Versuch einer Naturgeschichte menschlichen Erkennens*. Piper: München.
Luhmann, Niklas 1990. *Essays on Self-Reference*. New York: Colombia University Press.
— 1995. *Social Systems.* Stanford: Stanford University Press.
Maturana, Humberto R.; Varela, Francisco J. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Dordrecht: Reidel.
Nöth, Winfried 2001. Ecosemiotics and the semiotics of nature. *Sign Systems Studies* 29(1) (this vol.).
Peirce, Charles S. 1931–1958. *Collected Papers*. Vols. 1–6, eds. C. Hartshorne & P. Weiss, vols. 7–8, ed. A.W. Burks. Cambridge (Mass.): Harvard University Press. [Quoted as: CP.]
— 1992. *The Essential Peirce: Selected Philosophical*, vol. 1 (1867–1893), eds. N. Houser & C. Kloesel. Bloomington: Indiana University Press.
Prigogine, Ilya; Stengers, Isabelle 1984. *Order Out of Chaos: Man's New Dialogue with Nature*. New York: Bantam.
Sebeok, Thomas A. 1976. *Contributions to the Doctrine of Signs*. Bloomington: Indiana University Press.
Stonier, Thomas A. 1997. *Information and Meaning: An Evolutionary Perspective*. Berlin: Springer.
Tinbergen, Niko 1973. *The Animal in Its World*. London: George Allan & Unwin.
Uexküll, Jakob von 1957. A stroll through the worlds of animals and men: A picture book of invisible worlds. In: Schiller, Claire H. (ed.), *Instinctive Behavior: The Development of a Modern Concept*. New York: International University Press, 5–80.
Uexküll, Thure von; Geigges, Werner; Herrmann, Jörg M. 1993. Endosemiosis. *Semiotica* 96(1/2): 5–51.
Wittgenstein, Ludwig 1958. *Philosophical Investigation*, 3rd ed., transl. by G. E. M. Anscombe. New York: MacMillian.

Экосемиотика и киберсемиотика

В статье сделана попытка связать киберсемиотику с экосемиотикой. Киберсемиотика опирается на троичное деление *автопойэтических* систем (биологический, психологический и социокоммуникативный автопойэзис) Луманна и применяет его взгляд на коммуникацию в контексте биосемиотики. Учитывая неинтенциональные знаки, кибернетику и теорию информации, можно выделить следующие уровни экосемиозиса и означивания: 1) социокоммуникативный уровень сознательного означивания и языковых игр, 2) инстинктивный и видоспецифический уровень знаковых стимулов, означивающих посредством врожденного механизма реакции и "знаковых игр", 3) уровень структурного соединения, узнавания сигнала и "оязычивания", где циклы кибернетической обратной связи указывают на различия. Уровни означивания и коммуникации проявляются везде, где автопойэтические системы 1) перемешиваются с семиотическими процессами языковой системы и феносемиотическими процессами психики, опирающимися на представления, эмоции и волю, или 2) вторгаются между феносемиотическими процессами психики и эндосемиотическими процессами тела. На этих двух уровнях происходят экосемиотические неинтенциональные процессы означивания в природе. Люди являются лингвистическими киборгами точно так же, как животные являются знаковыми киборгами, так как знаки на разных уровнях перемешиваются и оформляют процессы воплощения. Способность производить и интерпретировать знаки оказывала в ходе эволюции селектирующее влияние как на животных, так и на людей.

Ökosemiootika ja kübersemiootika

Artiklis pakutakse välja ja arendatakse üht võimalust, kuidas seostada kübersemiootikat ökosemiootikaga. Kübersemiootika tugineb Luhmanni kolmetisele käsitlusele autopoieetilistest süsteemidest (bioloogiline, psühholoogiline ja sotsiokommunikatiivne autopoieesis) ja rakendab tema vaadet kommunikatsioonile biosemiootika kontekstis. Mitteintentsionaalseid märke, küberneetikat ja informatsiooniteooriat arvestades on tuvastatavad järgmised eksosemioosise ja tähistamise tasandid: (1) eneseteadvusliku tähistamise ja keelemängude sotsiokommunikatiivne tasand, (2) kaasasündinud reaktsioonimehhanismi ja "märgimängude" kaudu tähistavate märgistiimulite instinktiivne ja liigispetsiifiline tasand, (3) struktuurse sidustumise, signaali (ära)tundmise ja "keelestamise" tasand, kus küberneetilise tagasiside tsüklid osutavad erinevustele. Tähistamise ja kommunikatsiooni tasemed ilmnevad, kus iganes autopoieetilised süsteemid (1) segunevad keelesüsteemi semiootiliste ja psüühika fenosemiootiliste kujutlustel, emotsioonidel ja tahtel põhinevate protsessidega, või (2) tungivad psüühika fenosemiootilise ja keha endo-

semiootiliste protsesside vahele. Neil kahel tasandil toimuvad ökosemiootilised mitteintentsionaalsed tähistamisprotsessid looduses. Inimesed on lingvistilised küborgid nii nagu loomad on märgiküborgid, kuna märgid erinevatel tasanditel segunevad ja kujundavad kehastuvaid protsesse. Võime märke toota ja tõlgendada on evolutsiooni käigus avaldanud selektiivset mõju nii inimestele kui loomadele.

Vital signs: An ecosemiotic perspective on the human ecology of Amazonia

Alf Hornborg
Human Ecology Division, Lund University
Finngatan 16, 223 62 Lund, Sweden
e-mail: alf.hornborg@humecol.lu.se

Abstract. Ecosemiotics represents a theoretical approach to human ecology that can be applied across several disciplines. Its primary justification lies in the ambition to transcend "Cartesian", conceptual dichotomies such as culture/nature, society/nature, mental/material, etc. It argues that ecosystems are constituted no less by flows of signs than by flows of matter and energy. This paper discusses the roles of different kinds of human sign systems in the ecology of Amazonia, ranging from the phenomenology of unconscious sensations, through linguistic signs such as metaphors and ethnobiological taxonomies, to money and the political economy of environmental destruction. Human-environmental relations mediated by direct, sensory and (oral) linguistic communication have tended to enhance biological diversity, suggesting modes of calibrating the long-term co-evolution of human and non-human populations. Economic sign systems, on the other hand, have rapidly and drastically transformed human-environmental relations in Amazonia to the point where the entire rainforest ecosystem is under threat. In detaching themselves from the direct, "face-to-face" communication between humans and their natural environments, flows of money and commodities — and the decontextualized knowledge systems that they engender — have no means of staying geared to the long-term negotiation of local, ecological co-existence. It is argued that the ongoing deterioration of the biosphere can be viewed as a problem of communication, deserving semiotic analysis.

1. Ecosemiotics: a brief theoretical background

Human-environmental relations are being studied from a variety of perspectives in a number of disciplines. The human sciences have thus seen the emergence of new subfields such as environmental history,

environmental anthropology, environmental sociology, environmental philosophy, and environmental economics. Ecosemiotics, on the other hand, should be seen as a new theoretical approach to human ecology that can be applied across several disciplines (cf. Hornborg 1996, 1999a; Nöth 1998; Kull 1998). Its basic assumptions are of a highly abstract and formal nature, but can be used as a framework for organizing very specific, empirical material. Its primary justification lies in its ambition to transcend "Cartesian", conceptual dichotomies such as culture/nature, society/nature, mental/material, etc. To the extent that such binary oppositions continue to obstruct holistic understandings of human agency in the biosphere, the various environmental subfields of the human sciences may have something to gain from an elementary familiarity with the ecosemiotic paradigm.

Briefly, we might characterize this paradigm as founded on the contention that ecosystems are constituted no less by flows of signs than by flows of matter and energy. It rejects the conventional notion of nature as a primarily material phenomenon, opposed to a notion of society as primarily communicative. Rather, it views nature and society as interconnected systems, both of which are simultaneously material and communicative.

When I write that ecosemiotics is a "new" theoretical approach, this needs to be qualified. Early in the twentieth century, the zoologist Jakob von Uexküll (1864–1944) had realized how constrained our view of ecosystems had become by the obsession with quantification and materiality that dominated the natural sciences. His concern was to visualize the interaction of organisms in nature as premissed on their subjective, species-specific perception of each other and of their worlds. He called such subjective worlds Umwelten (Uexküll 1982 [1940]). This subjectivistic brand of biology laid the foundation for the modern science of ethology, but its philosophical implications for general biology and ecology should have been far-reaching. The continued hegemony of materialism in natural science can be understood as an accommodation to the demands of an economic and technological establishment concerned with the management and control of natural systems. Uexküll's *Umweltlehre* raised more profound questions about nature than the exact measurement of its material metabolism. In echoing the animistic cosmologies of many pre-modern cultures, it has appeared romantic and of little use for the modern science of ecology. Possibly, the recent concern with biological communication (e.g., pheromones) could lead to a general reassessment of Uexküll's position. Nevertheless, this concern remains pragmatic rather than phi-

losophical and continues to be geared to measurement and control. Whereas Uexküll and the pre-modern animists were both concerned with perceiving the natural environment as composed of sentient subjects, mainstream biology continues to convey the image of nature as an assemblage of objects.

The significance of an ecosemiotic approach becomes clearer when we consider the role of humans in ecosystems. The anthropologist, psychiatrist, and biologist Gregory Bateson (1904–1980) similarly visualized a science of living systems that focused on communication. He applied a remarkably consistent, theoretical framework to his various studies of animal behaviour (dolphins, octopuses, otters), play, alcoholism, schizophrenia, art, ritual, war, and environmental crisis. Whatever the material substrate and the particular outcome, Bateson argued that the patterns and forms of living things are generated in communicative relations between recursively engaged subjects or "minds" (Bateson 1972, 1979). He was thus able to see cultural phenomena such as language or ritual as subsets of a much wider and more general category of communicative phenomena, which defined and coincided with life itself. This largely intuitive vision surfaced in a number of startling analogies between cultural and biological phenomena that mainstream anthropology found little use for. In later years he explicitly tried to apply these insights to environmental concerns by approaching ecological crisis as a "pathology" of epistemology and communication. Such normative and functionalist arguments made him and his followers (e.g. Rappaport 1968, 1979) easy targets for criticism within anthropology (e.g. Friedman 1979), but I believe that this has been an unfortunate case of throwing the baby out with the bathwater (cf. Hornborg 1996, 1998a). As Bateson and Rappaport envisaged, we have many insights to gain from viewing ecological crisis as a problem of communication.

2. Questions and applications

In what follows I shall try to address three questions that I believe to be of fundamental importance to ecosemiotics:

(1) To what extent can ecosystems be seen as semiotic (sign-mediated) phenomena?

(2) To what extent can those semiotic flows and processes that are organized by humans be seen as constitutive of ecosystems?

(3) What are the different kinds of human sign systems that take part in the constitution of ecological processes, and which generalizations can we make about their respective roles in transforming ecosystems?

The first of these questions challenges the conventional dichotomy of the communicative (or "mental"; cf. Bateson's notion of "mind") and the material. The second challenges the dichotomy of culture and nature. The third, finally, mobilizes ecosemiotic perspectives in an attempt to provide a general account of ecological crisis. It suggests, in fact, that such perspectives should be crucial ingredients in the currently ongoing, global deliberations on sustainability.

Although the issues raised are of general and global importance, I have chosen to ground this discussion in the ethnography and historical ecology of Amazonia. Amazonia not only happens to be the region of the world the ethnography of which I am most familiar with (Hornborg 1988, 1993, 1998b), it is also a bioregion conventionally perceived as pristine wilderness yet inhabited for millennia by human populations that have actively transformed it.

Add to this the increasing volume of ethnography documenting in subtle detail the indigenous cosmology and practice of human-environmental relations in the region (e.g. Århem 1996; Brown 1986; Crocker 1985; Descola 1994; Kensinger & Kracke 1981; Moran 1993; Posey & Balée 1989; Reichel-Dolmatoff 1971, 1996; Rival 1996; Roosevelt 1994a; Seeger 1981; Sponsel 1995; Viveiros de Castro 1992, 1998, 1999), and it will be apparent that Amazonia can be approached as something of an ecosemiotic laboratory. Needless to say, the format of this article permits me only to sketch the barest outline of such a comparative study, the main purpose of which is to convey the wide spectrum of possible applications of an ecosemiotic perspective. Due to the wealth of relevant material, only a minute sample of what the ethnographers of Amazonia have reported on human-environmental relations in the area can be mentioned in this context. The list of references is nevertheless oversized in proportion to the text, suggesting that this should be classified as a review article and a proposal for future work.

In posing and addressing questions such as those above, I hope that we shall be able to organize our thinking about human-environmental relations in new ways. In particular, an ecosemiotic approach may provide a conceptual framework for transcending "Cartesian" dichotomies such as mental/material or culture/nature without abandoning the analytical rigour that remains Descartes' more essential legacy.

2.1. To what extent can ecosystems be seen as semiotic (sign-mediated) phenomena?

As Uexküll and Bateson have both in different ways shown, the material interactions of organisms in ecosystems presuppose their exchange and interpretation of signs. This point requires no elaborate argument, but a single example may be appropriate. The harpy eagle (*Harpia harpyja*) of the Amazon rainforest is equipped not only with a very keen sense of sight but also with a propensity to respond to those particular kinds of movement in the foliage that result from the activities of monkeys. Were it not for the eagle's capacity to interpret such very specific sense data, it would not maintain its position at the apex of the Amazonian food chain. Conversely, monkeys have responded phylogenetically by becoming increasingly attentive to signs of eagles. This can be generalized for the entire rainforest ecosystem. In a myriad similar ways, each organism and species exists by virtue of its capacity to perceive and interpret the world around it. An ecosystem is not a machine, where the various components mindlessly fulfil their functions as a reflection of the external mind of the engineer. Ecosystems are incredibly complex articulations of innumerable, sentient subjects, engaging each other through the lenses of their own subjective worlds. Intriguingly, as we shall see, such an interpretation of ecology, here offered in an academic context, harmonizes exceedingly well with traditional, indigenous "ecocosmologies" (Croll & Parkin 1992; Århem 1996, n.d.) in Amazonia. Ecosemiotics thus does not merely provide a vantage-point for understanding these cosmologies in theoretical terms, but actually also for *validating* them (cf. Hornborg 1996, 1999b).

2.2. To what extent can those semiotic flows and processes that are organized by humans be seen as constitutive of ecosystems?

There is a tradition in European thought of maintaining a conceptual boundary between "nature" and "culture". To be sure, the impact of human activity on the natural environment has been all too apparent throughout Western history (cf. Thomas 1956; Turner *et al.* 1990; Worster 1988; Ponting 1991; Simmons 1993b; Hughes 1994). However, rather than acknowledging the pervasive interfusion of humanity and non-human nature, European cosmology has responded either by

ignoring the anthropogenic aspects of landscapes or by reserving its notion of "nature" for distinct but dwindling, geographical areas perceived as uncontaminated by human activity (cf. Ellen 1996). This is well exemplified by a quote from Marston Bates' *Where Winter Never Comes* that introduces a popular volume on *The Amazon* published by Time-Life Books as part of its series on *The World's Wild Places*: "It is a humbling experience, and surely a healthy one, to enter a landscape that man has not been able to alter, to dominate, to twist to his own purposes" (Sterling 1973: 18).

In recent years, there has been a growing recognition of the need to transcend such rigid nature/culture dichotomies in our approach, for instance, to landscapes or human bodies. Both human organisms and their environments are partly biophysical and partly symbolic in derivation. Nature and culture are not mutually exclusive domains or essences, but sedimentations of semiotic processes at different levels of integration. Even biochemical processes have a semiotic dimension (Hoffmeyer 1996), not to mention the various visual, auditory, olfactory, and tactile communication systems of human and non-human organisms. It nevertheless remains justified to analytically distinguish "cultural" phenomena as those which rely on that specific category of signs that we call *symbols*, defined by Peirce as signs that relate only by convention to the objects to which they refer. Cultural or symbolic phenomena may thus qualify as more or less uniquely human, yet in this context should be recognized as recent additions to the more general semiotics of ecosystems.

We may note in passing how difficult it is to extricate ourselves from dichotomous patterns of thinking that are evoked by polarizing vocabularies such as nature/culture, material/communicative, or biophysical/symbolic. Such distinctions need not be abandoned, however, as long as we acknowledge them as referring merely to "aspects" or "dimensions" of living systems rather than to partitioned "segments" of reality. Seen as aspects of integrated wholes rather than entities in their own right, the opposite poles of such analytical dichotomies should not be treated as standing in some kind of causal relationship to each other. An analytical dualism, in other words, need not imply an ontological dualism.

Amazonia provides us with remarkable evidence for the extent to which human, cultural behaviour can be constitutive of ecosystems. I am not referring here to the widely publicized deforestation of significant parts of the region in recent decades, but to the discovery that the composition of the presumably pristine rainforests themselves has

been influenced by human activity over the centuries. It has been suggested that at least 12% of the *terra firme* forests of Brazilian Amazonia may be anthropogenic, i.e. "of a biocultural origin that would not have existed without past human interference" (Balée 1989, 1993: 231). Detailed, ethnobotanical studies of the agroforestry practices of e.g. the Kayapó (Posey 1983, 1985) and the Ka'apor (Balée 1993) of Brazil reveal that human activity has had a tendency to enhance rather than diminish biodiversity. In stark contrast to modern monocultures of, e.g., *Eucalyptus* or soybeans, indigenous agroforestry complexes tend to increase the number of species per hectare. Whether or not this is the result of conscious intention is a matter of contention (Balée 1993), with obvious implications for discussions of the nature of "traditional ecological knowledge". yet does not really affect the general conclusion here, viz. that the cultural predilections of human beings leave their marks even in the most "natural" of environments (for a similar assessment on a global scale, cf. Simmons 1993b).

A fundamental challenge for ecosemiotics is to develop a framework for accounting for the interpenetration of "culture" and "nature". Although there seems to be a widespread consensus that the dichotomy needs to be transcended, most contributions that make this claim can be more or less readily assigned to either of C. P. Snow's "two cultures" (humanities versus natural science; cf. Ingerson 1994). I should add that I am here only considering those studies that engage both theory and tangible, empirical material on human-environmental relations in different cultural contexts. This generally restricts our discussion to studies from anthropology, while excluding, for instance, most work in environmental history (which tends to lack theory) or environmental philosophy (which tends to lack empirical material). On one hand, there are studies that in various ways are concerned with the human experience and perception of the environment (e.g., Croll & Parkin 1992; Simmons 1993a; Hirsch & O'Hanlon 1995; Descola & Pálsson 1996; Ellen & Fukui 1996; Ingold 2000). On the other hand, there are studies which tend to privilege quantitative data on the measurable, biophysical parameters of human-environmental relations (e.g. Moran 1990, 1993; Bates & Lees 1996 Kormondy & Brown 1998; and to some extent also Simmons 1993b; Crumley 1994; Sponsel 1995; Wilson 1999). Over the years, although several scholars have demonstrated eminent proficiency in both discourses (e.g., Rappaport 1968; Ellen 1982; Ingold 1986; Descola 1994), very rarely has there been a successful, theoretical integration of humanistic and biophysical dimensions in the study of human ecology. In the present

discussion I can only in a very rudimentary manner suggest some theoretical avenues for striking such a balance between constructivism and scientific realism. Let us begin by asking the kinds of questions that an ecosemiotic perspective would have to raise.

2.3. What are the different kinds of human sign systems that take part in the constitution of ecological processes, and which generalizations can we make about their respective roles in transforming ecosystems?

I shall distinguish between three kinds of sign systems: *sensory*, *linguistic*, and *economic*. Each of these semiotic levels is a prerequisite for the next, since linguistic signs must be mediated by sense organs and economic signs by cultural categories pertaining to exchange (e.g., "money", "price", "commodity", "wage"). On the other hand, each level has had a tendency to progressively detach itself from the logically and phylogenetically prior one, disembedding discourse from experience and economy from culture.

2.3.1. Sensory signs

To begin with, of course, humans are equipped to transmit and receive sensory (visual, auditory, tactile, olfactory, taste) signals like other animals. Such pre- or extra-linguistic sign systems are intrinsically difficult to theorize about, primarily because theory itself is founded in language. Theory can here rarely do more than *evoke* what remains an infinitely subtle, elusive, and largely unconscious level of human experience. Yet the approach of phenomenology, with its notions of "dwelling" and "being-in-the-world", has been quite successful in helping us acknowledge its importance. This in itself has amounted to a powerful counterpoint to materialist science and "Cartesian" objectification. Significantly, phenomenological approaches in environmental philosophy (Evernden 1985) and anthropology (Ingold 2000) tend to emphasize the fundamental, human inclination to experience the natural environment as composed of subjects (cf. also Bird-David 1993, 1999).

Throughout the millennia of foraging and subsistence horticulture in Amazonia, a major part of the interaction between human and non-human organisms has been mediated by a myriad sensations of the eye, ear, nose, tongue, and skin, only a fraction of which have been reflected upon and assigned linguistic categories. Such sensory sign

flows are what constitute the human embedment in the world evoked by phenomenologists and "practice theorists". To the extent that people mimetically reproduce and share conventional patterns of emitting and responding to such sensory signals, these patterns are cultural. To the extent that they represent embodied, practical skills of coping in the rainforest environment, they can be classified as a non-linguistic component of "traditional ecological knowledge". This sensory level of human-environmental relations includes modes of interpreting non-human life forms as well as modes of communicating with them. Amahuaca hunters in Peru know not only how to glean information from sounds, movements, scents, excrements, tooth marks, tracks, bits of fruit, displaced leaves, broken twigs, etc., but also how to disguise their own colour and scent and to imitate animal cries and try to get the animals to respond (Carneiro 1974: 126–127). Hunters among the Achuar of Ecuador similarly use all their senses in interpreting the characteristic signs of different species and are able to "do a perfect imitation of the distress calls of young or of a female in heat of any species to draw the parents or males within range of the blowgun" (Descola 1994: 237).

Though seemingly ephemeral and largely uncodified in language, sensory sign systems are nonetheless potent ingredients in human-environmental relations, capable of inscribing themselves in the landscape. The relation between such local, cultural experience and natural surroundings is clearly co-evolutionary, or recursive, much as any other relation in an ecosystem. Whether deliberately or not, the dietary and other cultural preferences of past generations of Amazonian Indians such as the Ka'apor have left a tangible record in the form of, e.g., old fallows, with a much higher incidence of food species (Balée 1993: 245; 1995: 106). Referring to Carole Crumley's definition of "landscape" as "the material manifestation of the relation between humans and the environment", Balée (1995: 106) concludes that "old fallows constitute landscapes per excellence". The Huaorani of the Upper Marañon similarly tend to encourage the occurrence of the *ungurahua* palm (*Jessenia bataua*) and other useful species, while more consciously cultivating the peach palm (*Bactris gasipaes*) and sweet manioc (Rival 1996: 238–241). Rival shows that these species are assigned different symbolic values and associated with different kinds of social relations. The peach palms and their fruit are perceived as gifts from deceased relatives and appropriate food for celebrating within the endogamous group, while manioc is used to entertain visitors and potential allies. It is not difficult to imagine the role of such senti-

ments in generating specific patterns of distribution for different plant species. Although much of this crop symbolism is evidently codified in explicit preferences (cf. next section), it is apparent that the sentiments thus expressed represent a more elusive, sensory level of experience that is transmitted largely through mimetic practice rather than words. No less than language, social practice is a cultural process that conditions human beings to respond in specific ways to particular signs. Suffice to say that sensory, non-linguistic signs do play an important role in traditional, human-environmental relations, and that, for millennia, they have been active ingredients in the human transformation of ecosystems.

2.3.2. Linguistic signs

A second kind of human sign system is, of course, language. Linguistic sign systems are generally regarded as the central medium of culture, and it is no coincidence that anthropological theories of culture to such a large extent have been inspired by linguistics.

Whether analyzing systems of ethnobiological classification (Fowler 1977; Berlin 1992) or metaphorizations of human-environmental relations (Lévi-Strauss 1969b, 1973, 1978; Gudeman 1986; Bird-David 1993; Descola 1994; Århem 1996; Viveiros de Castro 1999), anthropologists have focused on linguistic data. It would seem obvious that cultural categories and metaphors are likely to influence the way humans engage their natural surroundings, but for anthropologists of a phenomenological persuasion, such linguistic codifications are secondary to practical knowledge, or skill (cf. Ingold 1992, 2000). The relative significance of the two levels probably varies between different cultural contexts, with social complexification and modernization generally entailing increasing emphasis on language. In any case, linguistic signs have always been the main source of cultural information for anthropologists, and it is difficult to envisage a systematic research methodology for eliciting cultural information that would not have to use language as a medium.

Human language has most certainly become an active ingredient in ecosystems (cf. Rappaport 1993: 156). Balée (1995: 100–101) suggests that one of the effects of post-conquest depopulation on the Guajá Indians of Brazil was a significant reduction of plant vocabulary, and that this was associated with their abandonment of a sedentary and agricultural existence. (He nevertheless finds in the modern, impoverished Guajá language compelling evidence for prior horticul-

ture.) The number of generic plant names among the linguistically related and still agricultural Ka'apor is about 479, while in Guajá (for the same flora) "only" 353. It is evident that language may serve as a repository of ecological knowledge, if only as a mnemonic device providing cues for the activation of a much larger body of practical knowledge acquired through practice. Language can thus be seen as a codification of human practice, including practical engagement with non-human organisms. In serving as a kind of systemic memory that is indeterminately yet significantly related to systemic performance, linguistic codes are in certain respects analogous to genetic codes (Hornborg 1988). This applies not only to ethnobiological taxonomies such as those investigated by Balée, but also to the various metaphorizations of human-environmental relations that have been reported from indigenous peoples throughout Amazonia.

The social life of nature

Metaphorical representations of this kind often invoke familiar aspects of social life to serve as models for human interaction with non-human nature. Descola (1992) refers to such projections of meaning from society to nature as "animism", as opposed to the inverse projection from nature to society that we know as "totemism" (cf. Lévi-Strauss 1966). Common to both is the interpenetration or perhaps amalgamation of categories and sentiments pertaining to social and human-environmental relations, respectively. Ingold (1996) argues that these two kinds of relations are not distinguishable from each other in hunting-and-gathering societies. From the perspective of an outside observer, however, it is striking how widespread is the drift of attitudes and sentiments from social to human-environmental relations in traditional societies (cf. Gudeman 1986; Bird-David 1993; Descola 1994). No doubt there is also a widespread transfer of meanings in the opposite direction, suggesting a dialectic between "animism" and "totemism".[1]

Among the Achuar, Descola (1994: 327) discovers that "the distinction between hunting and gardening is nurtured by an opposition

[1] Such a dialectic between images of society and images of nature can also be identified in the history of Western civilization, as is obvious, for instance, in the affinities between the ideology of capitalism and Darwinism. Other examples might include the recursive mirroring of a clock-like, rationally constructed society, on one hand, and a mechanistic view of the cosmos, on the other. Of much greater antiquity is the dialectic between kin-based or political authority and images of a patriarchal divinity.

between two types of sociability: the women's consanguine mothering of cultivated plants and the affinal charming of game practiced by the men". Skills in these activities hinge on the capacity to communicate with other life forms through magical songs called *anent*, and Descola (1994: 262) notes that hunting *anent* "have a cajoling, wheedling tone that is not found in gardening *anent*, the garden being a world of kindred beings devoid of the touchy feelings that the man must take care not to ruffle in dealing with allies". In line with what has been previously said, it is obvious that the linguistic form of these songs is merely the skeleton of a profoundly embodied mode of communication. The word *anent* literally designates "words that come from the heart" (Descola 1994: 198). "The 'sung' mode", says Descola (1994: 200), is used "to overdetermine normal language in those circumstances where the latter is not an adequate vehicle, that is when the words must reach the heart of a spatially or ontologically remote target". In the Achuar universe, humans, plants, animals, and even meteors can be seen as persons with individual souls (Descola 1994: 93), and Descola asks why, given such a universe, the Achuar should forego the normal means of acting upon it. "When one postulates that cultivated plants are beings with souls, it is obviously normal to attempt to keep up harmonious relations with them, using for this magical songs (*anent*) which are employed to the same end in human relations" (Descola 1994: 214).

It is evident that the essence of those practices that modern people refer to as "magic" or "ritual" is the imperative to communicate with non-human nature that stems logically from viewing the world as composed of sentient subjects. This attitude may be extended beyond the domain of living things on our planet, as when the Eastern Timbira of Brazil ceremonially induce the Moon (*Puduvri*) to keep the maize plants free of animal parasites (Nimuendajú 1974: 117). If astronomical bodies are capable of signalling to humans — as indeed the Pleiades (*krot*) to the Eastern Timbira signal the rainy season and the need to start clearing for a garden (*ibid*., 116) — it is only logical that they should be involved in the total, communicative community of which the Amazonian Indian perceives himself to be a part. It should nevertheless be justified to distinguish between those human signs that actually do have a sentient, non-human receiver (e.g.; in the form of a game animal) and those that only ostensibly do so (e.g.; exhortations to astronomical bodies). This is not to say that "ostensible" communication is necessarily less efficient in producing the desired result than "actual" communication, as it may serve the important purpose of

calibrating an uncertain subject to its task. Tambiah (1968: 202) writes that it is possible to argue that "all ritual, whatever the idiom, is addressed to the human participants and uses a technique which attempts to re-structure and integrate the minds and emotions of the actors". From the perspective of an observer, however, there is clearly a difference between actually communicating with non-human subjects, on the one hand, and individually or collectively summoning one's own powers of concentration, on the other.

In the eye of the beholder

Every Amazonian people has developed its own cultural lens for interpreting its natural environment, but there are some fundamental themes that seem to be pervasive throughout most of this vast region. Significantly for our purposes, one such theme is a keen awareness of the notion of perspective, i.e. the recognition that any particular perception of the world is contingent on the vantage-point of the beholder. In acknowledging that the relation between sign and object hinges on the interpretant, this basic wisdom reveals an indigenous, Amazonian concern with semiotics. An early observation along these lines is Weiss' remark about the cosmology of the Campa:

> It is a world of relative semblances, where different kinds of beings see the same things differently; thus human eyes can normally see good spirits only in the form of lightning flashes or birds whereas they see themselves in their true human form, and similarly in the eyes of jaguars human beings look like peccaries to be hunted. (Weiss 1974: 264)

A number of Amazonian ethnographies confirm this pervasive link between what Århem (1991) and Viveiros de Castro (1998) call "perspectivism" and an understanding of the world as a continuous food chain. To the Makuna of southeastern Colombia, for instance, any class of beings will classify all others as either "predators" or "prey", in shamanic language referred to respectively as *yai* (jaguar) and *wai* (fish) (Århem 1996). As among traditional hunting peoples in many parts of the world, the relation between the Makuna hunter and his prey is construed as a reciprocal exchange between human and animal communities, modelled on the relation between affines. Through a continuous recycling of souls or "generic vitality", predation — whether in the form of humans consuming animals or spirits consuming humans — is thus also procreation. This is linked to a widespread, cosmological theme that represents affinal relations and predation as cognate forms of symbolic exchange (cf. Descola 1992; Overing

1993). This theme has inspired a number of anthropological studies of what Viveiros de Castro (1996: 190) calls the "symbolic economy of alterity", linking native Amazonian sociologies and ecologies into a common, interpretative framework for understanding as seemingly disparate, cultural phenomena as war, cannibalism, hunting, shamanism, and funerary rites (cf. Viveiros de Castro's own 1992 study of the Brazilian Araweté).

A crucial element of such animistic cosmologies of Amazonia is the conviction that all beings are fundamentally "humans" or "persons", as expressed, for instance, in the Makuna notion of *masa* (Århem 1996: 200). Viveiros de Castro (1999: 4) writes: "To say […] that animals and spirits are people, is to say that they are persons, and to personify them is to attribute to non-humans the capacities of conscious intentionality and social agency which define the position of the subject". Whereas Europeans have had a tendency to think of humans as composed of a cultural surface that disguises their animal essence, Amazonians see it the other way around: the surface appearance of animals disguises their human aspect (Viveiros de Castro 1999: 3). For Amazonian Indians, to know is to personify rather than to objectify, and an object is merely "an incompletely interpreted subject" (Viveiros de Castro 1999: 6, 8). Against this background, shamanism can be understood as the highly valued capacity of certain humans to adopt the perspective of non-human subjects (cf. Århem 1991).

Viveiros de Castro intriguingly argues that Amazonian "perspectivism" is not tantamount to relativism: all beings see the world in the same way (in terms of a single set of fundamental categories), what changes is the world that they see (Viveiros de Castro 1999: 10). Drawing on an observation by Renard-Casevitz on the Matsiguenga of Peru, he suggests that words that to us denote objective, self-contained entities (such as "fish", "snake", "hammock", or "beer") tend to be used by Amazonians as "relational pointers" in the same way as kinship terms. Thus, "what to us is blood, is maize beer to the jaguar; what to us is soaking manioc, the souls of the dead see as rotting corpse; what we see as a muddy waterhole, the tapirs see as a great ceremonial house …" (Viveiros de Castro 1999: 10; cf. Århem 1991: 119–120). In these cosmologies, it seems, to be a fish is not an intrinsic property but a condition established "only by virtue of someone else whose fish it is" (Viveiros de Castro 1999: 11). I interpret this to mean that the category "fish" should not be confused with the actual species to which humans feel that it refers, but should rather be under-

stood as an inter-specific, abstract sign for food, of which these species, from the point of view of humans, are merely an instantiation. There is an underlying unity of soul in all beings which causes them to see the same things everywhere; the difference in how they perceive other beings (as belonging to one or the other among their common set of categories) is given in the specificity of their bodies (Viveiros de Castro 1999: 13). What is remarkable about these cosmologies, from a modern vantage-point, is the extent to which Amazonians have acknowledged the limitations of their own, human powers of perception, and the empathy with which they have imagined other species' ways of viewing the world. Yet, all through this radical decentering of human experience, their basic code of linguistic categories appears never to be cast in doubt.

Food taboos and the attempted mechanization of culture

In considering various, linguistically mediated aspects of human-environmental relations in Amazonia, we should finally say something about dietary prohibitions or "food taboos". Twenty years ago, this topic became the focus of a more general debate which opposed "materialist" and "mentalist" interpretations of human-environmental relations in Amazonia and elsewhere. On the one hand, the approach of "cultural ecology" characteristically viewed dietary prohibitions as functional adaptations to the constraints of the natural environment, e.g. as pragmatic responses to the imperatives of resource management (Ross 1978). On the other hand, several anthropologists instead argued that the rationale for such prohibitions should be sought not in nature but in culture itself, whether approached from a symbolic, structural, or psychological perspective (Kensinger & Kracke 1981). Some of the latter emphasized, however, that there need be no real contradiction between the two approaches (e.g., Menget 1981: 6). Even the semiotician Urban (1981), who initially declares himself to be a "mentalist", concedes that "food taboos have ecological consequences, and so can be profitably analyzed within the framework of an ecosystem perspective" (Urban 1981: note 1). Tuzin (1981: 190) concluded that the issue "is not whether we see the boundary between mentalism and materialism to be friendly or hostile, but that we see the boundary at all". As long as we do, he continues, "there will be no unified theory of food taboos […] or culture in general".

The main point of these studies seems rather to have been to show that the semiotics of food taboos are more than automatic reflections of the exigencies of the environment, and that the logic of cultural

meanings has an autonomy and a specificity that accords with a view of human populations as active and idiosyncratic subjects. Seen in this light, it is obvious that these anthropologists were provoked by the ecologists to do for human populations precisely what Uexküll and his followers have sought to do for non-human species: to grant them the status of subjects. The paradigm of "cultural ecology", not to mention the "cultural materialism" of Harris (1979), tends to extend the denial of subjective agency from mainstream biology's mechanistic view of ecosystems into human society and culture. An ecosemiotic perspective, on the contrary, would grant human meaning systems the same measure of idiosyncrasy as the Umwelt of any other species, and perceive ecosystems as the stochastic outcome of the coexistence of a multitude of such subjectivities. "Co-evolution" is clearly a better word for these processes than the cultural ecologists' notion of "adaptation", which conjures the image of a one-way learning process, geared to a static "environment" and leaving no room for creative, idiosyncratic innovation. Rather than amount to a distinction between the autonomous subjectivity of culture and the mechanical pragmatics of nature, humanist arguments can be accommodated within a more sensitive, communicative theory of life. As we have seen in previous sections, such a theory might well have much in common with those to which many Amazonian Indians have traditionally subscribed.

The evidence for cultural idiosyncrasy is quite obvious as far as the semiotic logic of food avoidances is concerned (cf. Leach 1964; Tambiah 1969; Sahlins 1976). Among the Shokleng of Brazil, food taboos "far transcend their purely ecological functions" by signalling social status and thus mediating social relations, a phenomenon which can be recognized as belonging to the widespread phenomenon of "totemism" (Urban 1981). From a psychoanalytic perspective, Kracke (1981) argues that food avoidances among the Kagwahiv can be understood as a symbolic language for articulating and resolving repressed, personal conflicts. The Kagwahiv "use nature as a rich source of metaphor for depicting emotional states and intimate relationships". Kracke shows how the domestication of non-human nature with human qualities rebounds into society by offering a code with which to express social relations: "the plaintive call of the jacamin, the wail of the jogo-jogo, and the more raucous cry of the toucan are identified with a baby's crying, while the tapir is a sexual competitor, the paca self-indulgent, and the agouti and tinamou lazy […]". Human qualities are thus projected onto animals prior to their serving as ordering prin-

ciples for society, much as was observed above about the dialectic between "animism" and "totemism".

Such recursive processes of meaning transfer are, of course, eminently suitable for semiotic analysis. Urban (1981: 86) observes that the purported consequences of transgressing a dietary restriction reveal "ethnotheoretic notions that can be conveyed only through language", and that "turn out to involve an function 'iconic' (or what used to be called function 'sympathetic') connection between the species and supposed consequence". For instance, the Shokleng claim that eating paca or agouti meat would cause the teeth of a child to grow too rapidly, causing toothache. Similarly, the Sanumá on the border between Brazil and Venezuela say that parents eating snake meat may cause their children to have diarrhea, since snakes have liquid excrement, and that eating sloth meat may cause them to develop a twisted wrist (Taylor 1981: 43–44). Kagwahiv maintain that the infant child of a man who kills a curassow (a red-beaked bird) may develop inflammations of the mouth and lips (Kracke 1981: 114). Referring to Leach (1964) and Tambiah (1969), Kracke (1981: 110) suggests that food prohibitions can be accounted for in terms of the different species' metonymical or metaphorical proximity to humans (e.g., pets are metonymically close, while monkeys are metaphorically so). Following Lévi-Strauss (1966), Descola (1994: 211; 1992: 114) observes that some animal or plant species are particularly well suited to the role of symbolic signifier because of distinctive, visible features that suggest invisible properties. Thus, dietary prohibitions recognized by the Achuar at the time of planting their gardens function "as a sign pointing to one of the three categories of attributes detrimental to plants' harmonious growth: things that rot, signified by the *kanka* fish, the *muntish* grub, and by digestion in general; things that burn, signified by peppers and meat exposed to direct contact with fire; things that are slender, signified by monkeys swinging on flexible branches". (Descola 1994: 211).

Such semiotic transformations are evident not only in food prohibitions, but throughout all the various aspects of indigenous cosmology. For the Campa, whatever is "excessively thin", has the "drab colour of decay", or "presents a false appearance" is a demon; thus, *shiénti* (adult ant lions), *tsiisanti* (drab-coloured hummingbirds), and *shiinti* and *tsináro* (leaf-like katydids) are all demons (Weiss 1974: 262). With regard to the last of these categories, we can observe in passing that the indigenous concern with deception — as in the widespread, mythological theme of the Trickster — is a matter deserving rigorous

semiotic analysis. Deliberate deception is obviously not the same thing as when the human essence of an animal is not apparent to the human observer, due to his or her limited powers of perception (see above), but both are profoundly semiotic concerns.

Suffice to say, at this point, that the semiotic logic underlying indigenous Amazonian sentiments regarding plant and animal species cannot be reduced to objective, utilitarian principles that somehow transcend the vagaries of sensory experience and symbolic classification. In fact, the claim of some Western observers to have access to these transcendental principles — whether "adaptation", "optimization", or even "sustainability" — can in itself be taken as an expression of a particular symbolic scheme (cf. Sahlins 1976; Gudeman 1986). However, to say that indigenous cosmologies are not immediately "adaptive" in a mechanical sense is not to deny that their fundamental, relational modality of human-environmental calibration, in all its attentiveness to the ecological Other, seems singularly attuned to the vital task of communication. This mode of ecological calibration, as we have seen, is founded on the continuous interweaving of direct, sensory experience and local, oral communication.

Linguistic signs, however, may also be subjected to different degrees of social reification and decontextualization. The invention of writing facilitated the detachment of words from local, socio-ecological negotiations and their use as top-down signalling systems in expansive, hierarchical social systems. Textualized knowledge systems with universalist aspirations are crucial vehicles for implementing "rational", modernist monocultures in Amazonia as elsewhere. The fetishized vocabularies of e.g. economics and agricultural science are not designed to stay attentive to the integrity of specific, local ecosystems, but to pursue their own, abstract designs on an increasingly standardized, global landscape. This transformation in the socio-ecological use of language has been intimately geared to the logic of economic signs.

2.3.3. Economic signs

A third kind of ecosemiotic flows are the movements of artefacts, people, resources, and exchange values that comprise the subject matter of economics, economic history, and economic anthropology. As we have already noted, such flows presuppose specific, cultural/linguistic understandings of exchange, including notions about reciprocity and about its appropriate, institutional frameworks. How-

ever, as investments of human labour and natural resources congeal into material exchange values, the circulation of such artefacts acquires a logic of its own that transcends the face-to-face reciprocities of oral communication and local value systems (cf. Munn 1986). Such flows have long been an influential factor in shaping human-environmental relations in Amazonia, but their ecological repercussions have recently seen a drastic increase in magnitude.

As we concluded the previous section by discussing the semiotics of food, it may be appropriate to begin by recalling, with Kelekna (1981: 178), that Lévi-Strauss (1969a) juxtaposed the exchange of "words, objects, and women" as constitutive of traditional societies, and that "food occupies an unusually prominent place in the category of 'objects' exchanged between individuals and groups". Classical monographs discussing the social significance of food exchange among Amazonians include Chagnon (1968) on the Yanomamö, Rivière (1969) on the Trio, and Siskind (1973) on the Sharanahua. A corollary of what was previously said about food avoidances is that foods that are positively enjoined (and enjoyed) will also be so largely by virtue of some symbolic scheme of classification. Kelekna (1981: 184) observes that a person through the ritual consumption of a prescribed item may attempt to "appropriate the power manifested by a plant, a fish, a bird, an animal", a phenomenon that extends even to cannibalism (Kracke 1981: 104; Viveiros de Castro 1992). Certain crops and their derivatives may also be assigned special, ritual significance, as has been the case with maize and maize beer in many areas of South America (Morris 1979).

Foodstuffs not only serve as lubricants for local, social relations, but frequently also become important items of trade. Distantly imported foodstuffs and other consumption goods have always been an important source of elite identity in stratified societies. Various geographical constellations of local, cultural demand and sources/producers/suppliers of the coveted products have generated regional systems of exchange linking various parts of Amazonia with each other and with adjoining regions such as the Andean highlands (Roth 1974 [1924/1929]; Oberem 1974 [1967]; Gade 1972; Lathrap 1973, 1974; Camino 1977; Myers 1983; Raymond 1988; Whitehead 1993, 1994; Arvelo-Jiménez & Biord 1994; Hornborg 2000). The widespread distribution of prehistoric art styles may also be indicative of long-distance exchange, e.g. of ritual paraphernalia (Lathrap 1974; Roosevelt 1994b: 6). Drawing on archaeological evidence from pre-conquest Amazonian chiefdoms, Roosevelt (1993: 260) writes that "[s]trings of

disc beads, usually of shell, were widely used as a medium of exchange, and semi-precious stone ornaments, such as greenstones [jade], were part of a system of elite gift-giving". Trade goods mentioned by Whitehead (1994: 38; 1993: 295) include worked jade from the lower Amazon exchanged for goldwork from the lower Orinoco and circum-Roraima region, poisons, metals, and jewels from the Guayana highlands, and gold objects "traded out of the Vaupés-Rio Negro region by the Manoas and circulated eastwards, as far north as the Caribbean". Even if much of the evidence for indigenous, long-distance trade derives from post-conquest historical sources, such extensive systems of exchange — and thus ultimately the global, cultural logic of consumption — have undoubtedly been important factors in determining patterns of land use in Amazonia since prehistoric times. As the archaeological evidence is generally restricted to durable trade goods such as stone, metal, and shell, it is important to remember that the greatest volumes of trade may have been in perishable, organic materials such as herbs, feathers, and animals.

Long-distance exchange in valuables may significantly affect local land use both at their source and their point of consumption by encouraging intensified production and providing catalysts for stratification (cf. Hornborg 2000). In pre-modern Amazonian societies, long assumed to have been intrinsically egalitarian (cf. Clastres 1977), it may have provided one of few possibilities for gaining political power through the control of scarce resources (alongside e.g. control of fertile river bottom lands, or of women, or sons-in-law, or ceremonial knowledge; cf. Kracke 1993). Archaeological evidence for prehistoric stratification and agricultural intensification is accumulating throughout Amazonia, with particularly striking settlement sizes and earthworks reported from Marajo Island at the mouth of the Amazon, the Santarém area on the lower Amazon, and lowland areas of Bolivia and Ecuador (Roosevelt 1993; 1994b: 8). The ridged fields and causeways of the Mojos area of Bolivia cover thousands of hectares and are clearly visible from the air. The earliest historical sources confirm high population densities, stratification, and a lively trade along the major rivers prior to European conquest (Porro 1994). Early documents emphasize the intense exploitation of floral and faunal resources and the high levels of agricultural productivity of these societies (Whitehead 1994: 36). Whitehead (*ibid*.) notes that the "fact that some Amerindian economies were geared to producing such food surpluses in antiquity is also demonstrated by the existence of indigenous markets and exchange systems in fish meal and manioc flour, as well

as the large-scale 'ranching' of turtles and iguanas". He suggests, furthermore, that stratified trading polities (exemplified by the Lokono of Guayana) would have thrived as much in the interfluvial areas as in the floodplains, as such locations would have afforded control over important trade routes (Whitehead 1993: 296; 1994: 36).

In the sixteenth century, at least the main rivers of Amazonia were evidently dominated by complex, densely populated societies practicing intensive cultivation of seed crops such as maize (Roosevelt 1993). Some archaeological sites suggest populations "in the tens of thousands at least" (*ibid*.: 274). In line with a general argument that goes back to Lathrap (1968), Roosevelt (1993) suggests that the subsistence practices of most contemporary Amazonians (swidden manioc horticulture, fishing, and hunting) over much of the area represents a post-conquest regression to patterns that prevailed before the emergence of these complex polities, beginning in the first millennium B.C. This process of devolution was precipitated by the traumatic, demographic collapse that occurred some time between the mid-sixteenth and mid-seventeenth centuries as a result of the introduction of European microbes, yet largely prior to actual, European settlement (Porro 1994; Whitehead 1993: 289). These microbes rapidly diffused along the vital arteries of indigenous exchange, devastating the social fabric of Amazonia. The very existence of an established, economic communication network integrating the region was thus conducive to biological contamination, depopulation, and social crisis. There were nevertheless also indigenous groups who were able, at least temporarily, to take advantage of new opportunities for trade following the arrival of the Europeans (Whitehead 1993: 287, 297; 1994: 41).

Roosevelt's hypothesis of a "rise and fall" of social complexity, we might add, seems compatible with the present distribution and possible, historical transformations of Amazonian kinship systems. Analyses of kin terminologies and other aspects of social cosmology suggest a certain capacity to oscillate between locally endogamous, "two-line" systems and more extrovert systems emphasizing exogamy and the distinctness — or "otherness" — of affines (Hornborg 1998b). The extent to which such a cycle may also have involved significant permutations of *eco*cosmology, and whether these are legible in the ethnoarchaeological record, is a matter about which we can only speculate (cf. Roosevelt 1994b: 16). If, as we have mentioned, notions about relations between humans and other species have been connected to notions about the relations between kin and affines, it seems probable that social transformations leading simultaneously to increas-

ing stratification and to more intensive exploitation of natural resources would have been negotiated through the medium of such a common, symbolic configuration. The key to this configuration may well be found in the pervasive, Amazonian inclination to view predatory relations as reciprocal. It would seem reasonable, given this cultural background, that increasingly exploitative relations to other species would have been legitimised through a similar imagery as was used to justify increasingly exploitative relations between affines, and that the common idiom through which these changes were enacted would have been concerned with maintaining the image of reciprocity. In pursuing this hypothesis ethnoarchaeologically, it would no doubt be useful to compare the ancient, Amazonian imagery with that of stratified, Andean polities like the Inca state (cf. Murra 1980[1956]; Godelier 1986: 160).

Largely depopulated, Amazonia in the eighteenth and nineteenth centuries reverted to the semblance of a pristine wilderness, but the growing colonial population engaged in various kinds of natural resource extraction initiated new processes of very tangible changes in land use. Whitehead (1993: 293) writes that the colonial process "has not been limited to the social sphere but also extended to the biological, directly resulting in the degradation or destruction of aboriginal flora and fauna". Echoing Crosby's (1986) observations on "ecological imperialism", he mentions "the rapid way in which wild cattle, pigs, and goats may have directly degraded the grassland-savannas making them less favorable to the indigenous species" (Whitehead 1994: 37). The more recent and ongoing incorporation of Amazonia in a global market economy has accelerated environmental destruction. The local linkages between political economy and environmental destruction (such as deforestation) have been phrased in terms of "political ecology" (Painter & Durham 1995), and perspectives from "dependency theory" and "world system theory" have been applied to illuminate the global logic of unequal exchange which continues to impoverish the "extractive economies" of Amazonia (Bunker 1985; cf. Hornborg 1998c, 2001b). The rainforest ecosystem is today threatened not only by commercial forestry, ranching, and agriculture, but also by the extraction of subterranean resources such as oil (cf. Rival 1997).

From an ecosemiotic perspective, it is obvious that modern money and commodities are signs capable of radically transforming, if not dismantling, Amazonian ecosystems. I have elsewhere argued at some length that the capacity for destruction that seems to be inherent in modern, general-purpose currency is an effect of the peculiarly vacu-

ous, semiotic properties of money (Hornborg 1999a). Briefly, this semiotic vacuity consists in the undifferentiated nature of the modern, economic sign system: in contrast to genes, language, and even traditional, "multi-centric" economies, modern money represents a code "with only one sign". It signifies everything and nothing, lacking even a conventional relation (as in Peirce's definition of symbol) to any specific referent. I have argued (*ibid*.) that a sign system with these properties is fundamentally at odds with the principles of organization in living systems, i.e. with life itself. The reification and autonomization of exchange value has also been well accounted for in the Marxian theory of "fetishism" (Taussig 1980), which is essentially a semiotic approach to political economy (Hornborg 2001a, 2001b).

3. Conclusions

I have suggested that an ecosemiotic approach should lead us to ask questions about the roles of different kinds of human sign systems in transforming ecosystems. Semiotics, like any other useful methodology (e.g., logic, mathematics, neoclassical economics), always runs the risk of turning inward on itself so as to become its own, tautological obsession. When applied to the comprehension of empirical, cultural and ecological processes, however, it may help us reorganize our thinking in ways that permit new perspectives on old problems. The ongoing deterioration of the biosphere (somewhat anthropocentrically referred to as our "life support systems" or even "natural capital") can thus be viewed as a problem of communication, deserving semiotic analysis. A semiotic approach appears to be the only conceivable framework for simultaneously considering the very diverse kinds of data on human-environmental relations that have been presented in this article, ranging from the phenomenology of unconscious sensations through structural analysis of elaborate linguistic constructions, to political economy. All these kinds of data are amenable to analysis founded on a general understanding of signs.

From this sketchy review of the human ecology of Amazonia we may draw some general conclusions about the kinds of ecological transformations that can be attributed to different kinds of human sign systems. We have seen that human-environmental relations that are primarily mediated by direct, sensory and (oral) linguistic communication, e.g., subsistence horticulture and foraging, have tended to en-

hance biological diversity. We have reason to believe that ethnobiological vocabularies and metaphorical representations of human-environmental relations that are founded on intimate, practical experience of local ecosystems represent (not simple "adaptations" but) *modes of calibration* eminently suitable for negotiating the long-term co-evolution of human and non-human populations. An important ingredient in these modes of calibration is the inclination towards genuine communication with non-human interlocutors, which presupposes a dialogic stance founded on the conviction that these non-human Others are indeed sentient subjects. The effects of such communicative processes on ecosystems may indeed be transformative in the long run, but there is no evidence that they have ever threatened the integrity of Amazonian ecosystems as wholes.

Economic sign systems, on the other hand, have rapidly and drastically transformed human-environmental relations in Amazonia to the point where the entire rainforest ecosystem is under threat. Flows of reified exchange values had fundamentally transformed large areas of Amazonia already during the two millennia preceding European conquest. The devastating demographic impact of the arrival of Europeans to South America initially alleviated human designs on Amazonian ecosystems, so much so that the whole region was perceived to be virtually unaffected by human occupation. However, with the accelerating encroachment of colonialism, resource extraction and the global market economy, ecological transformations were resumed at an unprecedented rate. In detaching themselves from the direct, "face-to-face" communication between humans and their natural environments, flows of money and commodities — and the textualized knowledge systems that they engender — have no means of staying geared to the long-term negotiation of local, ecological co-existence. On the contrary, their effect seems generally — in Amazonia as elsewhere — to have been to transform human perceptions of the environment from a community of sentient subjects to a mechanical assemblage of objects, thus truncating an ancient and literally vital dialogue. This objectivist stance has also been globally codified in the form of mainstream biological and ecological science. An ecosemiotic perspective, on the contrary, would rather stay attuned to the "animistic" cosmologies of native Amazonia, for perfectly rational reasons. It seems doubtful, however, that such local sensitivity to context can be

significantly revitalized on a global scale without major transformations of the very idea of money.[2]

References

Århem, Kaj 1991. Ecosofía Makuna. In: Correa, Francois (ed.), *La selva humanizada: Ecología alternativa en el trópico húmedo colombiano*. Bogotá: ICAN/FEN/CEREC, 105–122.

— 1996. The cosmic food web: Human-nature relatedness in the Northwest Amazon. In: Descola & Pálsson (eds.) 1996, 185–204.

— (n.d.). Ecocosmology: Indigenous conceptions of human-nature relatedness. Book proposal by Kaj Århem, Göteborg university. MS, 9 pp.

Arvelo-Jiménez, Nelly; Biord, Horacio 1994. The impact of conquest on contemporary indigenous peoples of the Guiana Shield: The System of Orinoco Regional Interdependence. In: Roosevelt (ed.) 1994a, 55–78.

Balée, William 1989. Managed forest succession in Amazonia: The Ka'apor case. In: Posey & Balée (eds.) 1989, 129–158.

— 1993. Indigenous transformation of Amazonian forests: An example from Maranhão, Brazil. *L'Homme* 126/128: 231–254.

— 1995. Historical ecology of Amazonia. In: Sponsel (ed.) 1995, 97–110.

Bates, Daniel G.; Lees, Susan H. (eds.) 1996. *Case Studies in Human Ecology*. New York: Plenum.

Bateson, Gregory 1972. *Steps to an Ecology of Mind*. Frogmore: Paladin.

— 1979. *Mind and Nature: A Necessary Unity*. New York: Dutton.

Berlin, Brent 1992. *Ethnobiological Classification: Principles of Categorization of Plants and Animals in Traditional Societies*. Princeton: Princeton University Press.

Bird-David, Nurit 1993. Tribal metaphorization of human-nature relatedness. In: Milton, Kay (ed.), *Environmentalism: The View from Anthropology*. London: Routledge, 112–125.

— 1999. 'Animism' revisited: Personhood, environment, and relational epistemology. *Current Anthropology* 40(1): 67–91.

Brown, Michael F. 1986. *Tsewa's Gift: Magic and Meaning in an Amazonian Society*. Washington: Smithsonian Institution Press.

Bunker, Stephen G. 1985. *Underdeveloping the Amazon: Extraction, Unequal Exchange, and the Failure of the Modern State*. Chicago: University of Chicago Press.

[2] I would like to thank the Bank of Sweden Tercentenary Foundation for supporting the project "Native American Ecocosmologies and Environmental Ethics: Animism, Modernity, and the Cultural Phenomenology of Human-Environmental Relations", conducted in collaboration with Mikael Kurkiala.

Camino, Alejandro 1977. Trueque, correrías e intercambios entre los Quechuas andinos y los Piro y Machiguenga de la montaña peruana. *Amazonía Peruana* 1(2): 123–140.
Carneiro, Robert L. 1974 [1970]. Hunting and hunting magic among the Amahuaca of the Peruvian montaña. In: Lyon (ed.) 1974, 122–132.
Chagnon, Napoleon A. 1968. *Yanomamö: The Fierce People*. New York: Holt, Rinehart & Winston.
Clastres, Pierre 1977. *Society Against the State*. Oxford: Basil Blackwell.
Crocker, J. Christopher 1985. *Vital Souls: Bororo Cosmology, Natural Symbolism, and Shamanism*. Tucson: University of Arizona Press.
Croll, Elisabeth; Parkin, David (eds.) 1992. *Bush Base: Forest Farm. Culture, Environment and Development*. London: Routledge.
Crosby, Alfred W. 1986. *Ecological Imperialism: The Biological Expansion of Europe, 900–1900*. Cambridge: Cambridge University Press.
Crumley, Carole L. (ed.) 1994. *Historical Ecology: Cultural Knowledge and Changing Landscapes*. Santa Fe: School of American Research Press.
Descola, Philippe 1992. Societies of nature and the nature of society. In: Kuper, Adam (ed.), *Conceptualizing Society*. London: Routledge, 107–126.
— 1994. *In the Society of Nature: A Native Ecology in Amazonia*. Cambridge: Cambridge University Press.
Descola, Philippe; Pálsson, Gísli (eds.) 1996. *Nature and Society: Anthropological Perspectives*. London: Routledge.
Ellen, Roy F. 1982. *Environment, Subsistence and System: The Ecology of Small-Scale Social Formations*. Cambridge: Cambridge University Press.
— 1996. The cognitive geometry of nature: A contextual approach. In: Descola & Pálsson (eds.) 1996, 103–123.
Ellen, Roy F.; Fukui, Katsuyoshi (eds.) 1996. *Redefining Nature: Ecology, Culture and Domestication*. Oxford: Berg.
Evernden, Neil 1985. *The Natural Alien: Humankind and Environment*. Toronto: University of Toronto Press.
Fowler, Catherine S. 1977. Ethnoecology. In: Hardesty, Donald L. (ed.), *Ecological Anthropology*. New York: John Wiley & Sons, 215–243.
Friedman, Jonathan 1979. Hegelian ecology: Between Rousseau and the World Spirit. In: Burnham, Philip C.; Ellen, Roy F. (eds.), *Social and Ecological Systems*. London: Academic Press, 253–270.
Gade, Daniel W. 1972. Comercio y colonización en la zona de contacto entre la sierra y las tierras bajas del valle del Urubamba en el Perú. *XXXIX Congreso Internacional de Americanistas*, vol. 4. Lima, 207–221.
Godelier, Maurice 1986. *The Mental and the Material*. London: Verso.
Gudeman, Stephen 1986. *Economics as Culture: Models and Metaphors of Livelihood*. London: Routledge & Kegan Paul.
Harris, Marvin 1979. *Cultural Materialism: The Struggle for a Science of Culture*. New York: Vintage.
Hirsch, Eric & O'Hanlon, Michael (eds.) 1995. *The Anthropology of Landscape: Perspectives on Place and Space*. Oxford: Oxford University Press.
Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press.

Hornborg, Alf 1988. *Dualism and Hierarchy in Lowland South America: Trajectories of Indigenous Social Organization*. Uppsala Studies in Cultural Anthropology 9. Stockholm: Almqvist & Wiksell.
— 1993. Panoan marriage sections: A comparative perspective. *Ethnology* 32: 101–108.
— 1996. Ecology as semiotics: Outlines of a contextualist paradigm for human ecology. In: Descola & Pálsson (eds.) 1996, 45–62.
— 1998a. Ecological embeddedness and personhood: Have we always been capitalists? *Anthropology Today* 14(2): 3–5. [Reprinted in Michael Lambek & Ellen Messer (eds.) 2001. *Ecology and the Sacred: Engaging the Anthropology of Roy A. Rappaport*. Ann Arbor: University of Michigan Press.]
— 1998b. Serial redundancy in Amazonian social structure: Is there a method for poststructuralist comparison? In: Godelier, Maurice; Trautmann, Thomas R.; Tjon Sie Fat, Franklin E. (eds.), *Transformations of Kinship*. Washington: Smithsonian Institution Press, 168–186.
— 1998c. Towards an ecological theory of unequal exchange: Articulating world system theory and ecological economics. *Ecological Economics* 25(1): 127–136.
— 1999a. Money and the semiotics of ecosystem dissolution. *Journal of Material Culture* 4(2): 143–162.
— 1999b. Comment on Nurit Bird-David, 'Animism' revisited: Personhood, environment, and relational epistemology. *Current Anthropology* 40(1): 80–81.
— 2000. Accumulation based on symbolic versus intrinsic 'productivity': Conceptualizing unequal exchange from *Spondylus* shells to fossil fuels. In: Denemark, Robert; Friedman, Jonathan; Gills, Barry; Modelski, George (eds.), *World System History: The Social Science of Long-Term Change*. London: Routledge, 235–252.
— 2001a. Symbolic technologies: Machines and the Marxian notion of fetishism. *Anthropological Theory* 1(4).
— 2001b. *The Power of the Machine: Global Inequalities of Economy, Technology, and Environment.* Walnut Creek: Altamira/Rowman & Littlefield.
Hughes, J. Donald 1994. *Pan's Travail: Environmental Problems of the Ancient Greeks and Romans*. Baltimore: John Hopkins University Press.
Ingerson, Alice E. 1994. Tracking and testing the Nature-Culture dichotomy. In: Crumley (ed.) 1994, 43–66.
Ingold, Tim 1986. *The Appropriation of Nature: Essays on Human Ecology and Social Relations*. Manchester: Manchester University Press.
— 1992. Culture and the perception of the environment. In: Croll & Parkin (eds.) 1992, 39–56.
— 1996. Hunting and gathering as ways of perceiving the environment. In: Ellen & Fukui (eds.) 1996, 117–155.
— 2000. *The Perception of the Environment: Essays in Livelihood, Dwelling and Skill*. London: Routledge.
Kelekna, Pita 1981. Achuara food taboos. In: Kensinger & Kracke (eds.) 1981, 177–185.

Kensinger, Kenneth M.; Kracke, Waud H. (eds.) 1981. *Food Taboos in Lowland South America*. Working Papers on South American Indians 3. Bennington: Bennington College.
Kormondy, Edward J.; Brown, Daniel E. 1998. *Fundamentals of Human Ecology*. Upper Saddle River: Prentice Hall.
Kracke, Waud H. 1981. Don't let the piranha bite your liver: A psychoanalytic approach to Kagwahiv (Tupí) food taboos. In: Kensinger & Kracke (eds.) 1981, 91–142.
— (ed.) 1993. *Leadership in Lowland South America*. South American Indian Studies 1. Bennington: Bennington College.
Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–371.
Lathrap, Donald W. 1968. The 'hunting' economies of the Tropical Forest Zone of South America: An attempt at historical perspective. In: Lee, Richard B.; DeVore, Irven (eds.), *Man the Hunter*. Chicago: Aldine, 23–29.
— 1973. The antiquity and importance of long-distance trade relationships in the moist tropics of Pre-Columbian South America. *World Archaeology* 5: 170–186.
— 1974. The moist tropics, the arid lands, and the appearance of great art styles in the New World. *Special Publications of the Museum of the Texas Technological University* 7: 115–158.
Leach, Edmund 1964. Anthropological aspects of language: Verbal categories and animal abuse. In: Lenneberg, Eric (ed.), *New Directions in the Study of Language*. Cambridge: MIT Press, 25–63.
Lévi-Strauss, Claude 1966. *The Savage Mind*. Chicago: University of Chicago Press.
— 1969a. *The Elementary Structures of Kinship*. London: Eyre & Spottiswoode.
— 1969b. *The Raw and the Cooked*. New York: Harper & Row.
— 1973. *From Honey to Ashes*. New York: Harper & Row.
— 1978. *The Origin of Table Manners*. London: Jonathan Cape.
Lyon, Patricia (ed.) 1974. *Native South Americans: Ethnology of the Least Known Continent*. Boston: Little, Brown.
Menget, Patrick 1981. From forest to mouth: Reflections on the Txicáo theory of substance. In: Kensinger & Kracke (eds.) 1981, 1–17.
Moran, Emilio F. (ed.) 1990. *The Ecosystem Approach in Anthropology: From Concept to Practice*. Ann Arbor: University of Michigan Press.
— 1993. *Through Amazonian Eyes: The Human Ecology of Amazonian Populations*. Iowa City: University of Iowa Press.
Morris, Craig 1979. Maize beer in the economics, politics and religion of the Inca Empire. In: Gastineau, Clifford F.; Darby, William J.; Turner, Thomas B. (eds.), *Fermented Food Beverages in Nutrition*. New York: Academic Press, 21–34.
Munn, Nancy 1986. *The Fame of Gawa*. Cambridge: Cambridge University Press.
Murra, John V. 1980 [1956]. The Economic Organization of the Inca State. Supplement 1 to *Research in Economic Anthropology*. Greenwich: JAI Press.
Myers, Thomas 1983. Redes de intercambio tempranas en la hoya Amazónica. *Amazonía Peruana* 4(8): 61–75.

Nimuendajú, Curt 1974 [1946]. Farming among the Eastern Timbira. In: Lyon (ed.) 1974, 111–119.
Nöth, Winfried 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–343.
Oberem, Udo 1974 [1967]. Trade and trade goods in the Ecuadorian montaña. In: Lyon (ed.) 1974, 346–357.
Overing, Joanna 1993. Death and the loss of civilized predation among the Piaroa of the Orinoco Basin. *L'Homme* 126/128: 191–211.
Painter, Michael; Durham, William H. (eds.) 1995. *The Social Causes of Environmental Destruction in Latin America*. Ann Arbor: University of Michigan Press.
Ponting, Clive 1991. *A Green History of the World: The Environment and the Collapse of Great Civilizations*. Harmondsworth: Penguin.
Porro, Antonio 1994. Social organization and political power in the Amazon floodplain: The ethnohistorical sources. In: Roosevelt (ed.) 1994a, 79–94.
Posey, Darrell Addison 1983. Indigenous ecological knowledge and development of the Amazon. In: Moran, Emilio F. (ed.), *The Dilemma of Amazonian Development*. Boulder: Westview, 135–144.
— 1985. Indigenous management of tropical forest ecosystems: The case of the Kayapó Indians of the Brazilian Amazon. *Agroforestry Systems* 3(2): 139–158.
Posey, Darrell Addison; Balée, William (eds.) 1989. *Resource Management in Amazonia: Indigenous and Folk Strategies*. (=Advances in Economic Botany 7). Bronx: New York Botanical Garden.
Rappaport, Roy A. 1968. *Pigs for the Ancestors: Ritual in the Ecology of a New Guinea People*. New Haven: Yale University Press.
— 1979. *Ecology, Meaning, and Religion*. Berkeley: North Atlantic Books.
— 1993. Humanity's evolution and anthropology's future. In: Borofsky, Robert (ed.), *Assessing Cultural Anthropology*. New York: McGraw-Hill, 153–166.
Raymond, J. Scott 1988. A view from the tropical forest. In: Keatinge, Richard W. (ed.), *Peruvian Prehistory: An Overview of Pre-Inca and Inca Society*. Cambridge University Press, 279–300.
Reichel-Dolmatoff, Gerardo 1971. *Amazonian Cosmos: The Sexual and Religious Symbolism of the Tukano Indians*. Chicago: University of Chicago Press.
— 1996. *The Forest Within: The World-View of the Tukano Amazonian Indians*. London: Themis.
Rival, Laura 1996. Domestication as a historical and symbolic process: Wild gardens and cultivated forests in the Ecuadorian Amazon. In: Balée, William (ed.), *Advances in Historical Ecology*. New York: Columbia University Press, 232–250.
— 1997. Oil and sustainable development in the Latin American humid tropics. *Anthropology Today* 13(6): 1–3.
Rivière, Peter G. 1969. *Marriage Among the Trio: A Principle of Social Organization*. Oxford: Oxford University Press.
Roosevelt, Anna Curtenius 1993. The rise and fall of the Amazon chiefdoms. *L'Homme* 126/128: 255–282.
— (ed.) 1994a. *Amazonian Indians from Prehistory to the Present: Anthropological Perspectives*. Tucson: University of Arizona Press.

— 1994b. Amazonian anthropology: Strategy for a new synthesis. In: Roosevelt (ed.) 1994a, 1–29.
Ross, Eric B. 1978. Food taboos, diet and hunting strategy: The adaptation to animals in Amazon cultural ecology. *Current Anthropology* 19(1): 1–36.
Roth, Walter Edmund 1974 [1924/1929]. Trade and barter among the Guiana Indians. In: Lyon 1974, 159–165.
Sahlins, Marshall 1976. *Culture and Practical Reason*. Chicago: University of Chicago Press.
Seeger, Anthony 1981. *Nature and Society in Central Brazil*. Cambridge: Harvard University Press.
Simmons, Ian G. 1993a. *Interpreting Nature: Cultural Constructions of the Environment*. London: Routledge.
— 1993b. *Environmental History: A Concise Introduction*. Oxford: Blackwell.
Siskind, Janet 1973. *To Hunt in the Morning*. Oxford: Oxford University Press.
Sponsel, Leslie E. (ed.) 1995. *Indigenous Peoples and the Future of Amazonia: An Ecological Anthropology of an Endangered World*. Tucson: University of Arizona Press.
Sterling, Tom 1973. *The Amazon*. Amsterdam: Time-Life International.
Tambiah, Stanley 1968. The magical power of the word. *Man* (n.s.) 3: 175–208.
— 1969. Animals are good to think and good to prohibit. *Ethnology* 8: 423–459.
Taussig, Michael T. 1980. *The Devil and Commodity Fetishism in South America*. Chapel Hill: University of North Carolina Press.
Taylor, Kenneth I. 1981. Knowledge and praxis in Sanumá food prohibitions. In: Kensinger & Kracke (eds.) 1981, 24–54.
Thomas, William L., Jr. (ed.) 1956. *Man's Role in Changing the Face of the Earth*. Chicago: University of Chicago Press.
Turner II, B. L., *et al*. (eds.) 1990. *The Earth as Transformed by Human Action: Global and Regional Changes in the Biosphere over the Past 300 Years*. Cambridge: Cambridge University Press.
Tuzin, Donald F. 1981. Food taboos in lowland South America: A discussion. In: Kensinger & Kracke (eds.) 1981, 186–191.
Uexküll, Jakob von 1982 [1940]. The theory of meaning. *Semiotica* 42: 25–82.
Urban, Greg 1981. The semiotics of tabooed food: Shokleng (Gé). In: Kensinger & Kracke (eds.) 1981, 76–90.
Viveiros de Castro, Eduardo 1992. *From the Enemy's Point of View: Humanity and Divinity in an Amazonian Society*. Chicago: University of Chicago Press.
— 1996. Images of nature and society in Amazonian ethnology. *Annual Review of Anthropology* 25: 179–200.
— 1998. Cosmological deixis and Amerindian perspectivism. *The Journal of the Royal Anthropological Institute* (n.s.) 4(3): 469–488.
— 1999. The transformation of objects into subjects in Amerindian ontologies. Paper presented at the 98th annual meeting of the American Anthropological Association, Chicago.
Weiss, Gerald 1974 [1972]. Campa cosmology. In: Lyon (ed.) 1974, 251–266.
Whitehead, Neil Lancelot 1993. Ethnic transformation and historical discontinuity in native Amazonia and Guayana, 1500–1900. *L'Homme* 126/128: 285–304.

— 1994. The ancient Amerindian polities of the Amazon, the Orinoco, and the Atlantic coast: A preliminary analysis of their passage from antiquity to extinction. In: Roosevelt (ed.) 1994a, 33–53.
Wilson, David J. 1999. *Indigenous South Americans of the Past and Present: An Ecological Perspective*. Boulder: Westview.
Worster, Donald (ed.) 1988. *The Ends of the Earth: Perspectives on Modern Environmental History*. Cambridge: Cambridge University Press.

Знаки жизни: экология человека Амазонки в экосемиотической перспективе

Экосемиотика представляет собой теоретический подход к экологии человека, применяемый во многих дисциплинах. Ее главное оправдание заключается в стремлении преодолеть картезианские концептуальные дихотомии типа культура/природа, общество/природа, духовное/материальное и т.п. Экосемиотика утверждает, что экосистемы состоят из знаковых потоков не менее, чем из потоков материи и энергии. В статье рассматривается роль различных человеческих знаковых систем в экологии Амазонки, начиная с феноменологии подсознательных ощущений, лингвистических знаков типа метафор и этнобиологических таксономий и кончая деньгами и политэкономией разрушения окружающей среды. Отношения человека с окружающей средой, проявляющиеся в прямой, сенсорной и (устной) языковой коммуникации, приводят к увеличению биологического разнообразия, предлагая способы проверки долгосрочной коэволюции человека с остальной природой. С другой стороны, экономические знаковые системы стремительно и весьма существенно трансформировали отношения между человеком и окружающей средой в районе Амазонки, приведя их к тому, что под угрозой уничтожения оказалась вся экосистема дождевых лесов. Будучи отстраненными от прямого общения “лицом к лицу” между людьми и их средой, потоки денег и товаров — и созданные ими деконтекстуализированные системы знания — неспособны удержаться в состоянии долгосрочного посредничества в локальном экологическом сосуществовании. В статье утверждается, что продолжающуюся порчу биосферы можно рассматривать как проблему коммуникации, достойную семиотического анализа.

Elu märgid:
Amasoonia inimökoloogia ökosemiootilises perspektiivis

Ökosemiootika kujutab endast teoreetilist lähenemist inimökoloogiale, mida võib rakendada mitmetes distsipliinides. Selle peamine õigustus peitub soovis ületada kartesiaanlikud kontseptuaalsed dihhotoomiad nagu kultuur/loodus, ühiskond/loodus, vaimne/materiaalne jne. Ökosemiootika väidab, et ökosüsteemid ei koosne mitte vähem märgi- kui mateeria- ja energiavoogudest. Artiklis käsitletakse eri liiki inimmärgisüsteemide rolli Amasoonia ökoloogias, alates alateadlike tajude fenomenoloogiast, lingvistilistest märkidest nagu metafoorid ja etnobioloogilised taksonoomiad, ning lõpetades raha ja keskkonna hävitamise poliitökonoomiaga. Inimese–keskkonna suhtlemine otse, sensoorselt ja lingvistiliselt (suuliselt) on kaldunud suurendama bioloogilist mitmekesisust, soodustades arvestamist pikaajalise inimese ja ülejäänud looduse koevolutsiooniga. Teisest küljest on majanduslikud märgisüsteemid kiiresti ja drastiliselt viinud inimese–keskkonna suhted Amasoonias punktini, kus hävimisohus on kogu vihmametsa ökosüsteem. Distantseerudes otsesest "näost-näkku" suhtlusest inimeste ja nende keskkonna vahel, ei oma kaupade ja raha vood — ning nende tekitatud dekontekstualiseeritud teadmissüsteemid — vahendeid püsimaks pikaajaliste "läbirääkimistega" saavutatavas kohalikus, ökoloogilises koosluses. Artiklis väidetakse, et biosfääri jätkuvat rikkumist võib vaadelda kui kommunikatsiooniprobleemi, mis väärib semiootilist analüüsi.

Cognition as expression: On the autopoietic foundations of an aesthetic theory of nature

Andreas Weber

Institute for Cultural Studies, Humboldt-Universität zu Berlin
Sophienstraße 22a, D–10178 Berlin, Germany[1]
e-mail: andreas.weber@rz.hu-berlin.de

In memoriam Francisco J. Varela

Abstract. This paper attempts to put forward an aesthetic theory of nature based on a biosemiotic description of the living, which in turn is derived from an autopoietic theory of organism (F. Varela). An autopoietic system's reaction to material constraints is the unfolding of a dimension of meaning. In the outward *Gestalt* of autopoietic systems, meaning appears as form, and as such it reveals itself in a sensually graspable manner. The mode of being of organisms has an irreducible aesthetic side in which this mode of being becomes visible. Nature thus displays a kind of transparency of its own functioning: in a nondiscursive way organisms show traces of their *conditio vitae* through their material self-presentation. Living beings hence always show a basic level of expressiveness as a necessary component of their organic mode of being. This is called the *ecstatic* dimension of nature (G. Böhme, R. Corrington). Autopoiesis in its full consequence then amounts to a view reminding of Paracelsus' idea of the *signatura rerum* (C. Glacken, H. Böhme): nature is transparent, not because it is organized *digitally* as a linguistic text or code, but rather because it displays *analogically* the kind of intentionality engendered by autopoiesis. Nature as a whole, as "living form" (S. Langer), is a symbol for organic intentionality. The most fundamental meaning of nature protection thus is to guarantee the "real presence" of our soul.

[1] Private Address: D-21720 Guderhandviertel 90, Germany.

A summer, with its harvest sown, reaped and stored, is an epic song ...
R. W. Emerson

1. Introduction

We live in a time that is witnessing great progress in the field of biology. Yet, in spite of being able to engineer new qualities in living beings, biology remains unable to define its object of study: life (Kull 1999). Theoretical advances in this area have not gone much further than when Schrödinger (1944) published his landmark paper on the subject. Biologists can enumerate certain qualities of the living — motility, irritability, perception and so forth — but cannot define what life really is.

At the same time, it is no longer clear what we mean by nature, nor if nature as an independent domain exists at all. Many believe that what we conceive of as "nature" is a human invention that can only be understood from a specific cultural background. This view is called the "cultural a priori" (Böhme *et al*. 2000). Culture, on the other hand, is thought to obey only the laws of the free, arbitrary, and glottomorphic human mind. But as observers such as George Steiner (1991) note, products that emerge from such a conception of culture are suffering from an acute breakdown of sense.

This situation coincides with the global destruction of biodiversity, the pace of which is still increasing, if slower than before (Wilson 1995). This coincidence is not without reason. It is the outcome of the current presupposition of "what life really is", which acts as a kind of hidden center of gravity at the core of our culture: it is the metaphor of the organic machine, or as Hans Jonas (1973) puts it, the overwhelming dominance of an ontology of death.

In the following, I first sketch an alternative approach to defining life, drawn mainly from the theory of autopoiesis. On this basis, I try to demonstrate that the realization of life always includes an expressive aspect. I argue that, from an autopoietic point of view, the organism is embodied cognition; hence, its outward shape is a sign of its inner perspective. Because nature in this view is symbolic and expressive also of human feeling, its destruction amounts to a reduction of human inner experience.

2. Life as embodied identity

To overcome the threefold dilemma described above requires a new understanding of life. One stream of thought that can lead to such an understanding is the theory of autopoiesis, and particularly its development by Francisco Varela. He provides a basic, but non-substantive definition of life. “An organism”, he says, “is fundamentally a process of constitution of an identity” (Varela 1997). A living entity produces itself and all its components independently. It is distinguished by the ability to retain its integrity in the face of its environment. It produces the structure as well as the border of its milieu. Thus, the organism produces exactly the components that have produced it. It is important to see that the living entity exists as a certain self-identical structure in space and time, although it is at no moment materially identical with itself. Only the fact of being alive keeps this circuit closed. When an organism dies, the process comes to an end, and the components behave as normal chemical compounds — they decay:

> An autopoietic system — the minimal living organization — is one that continuously produces the components that specify it, while at the same time realizing it (the system) as a concrete unity in space and time, which makes the network of production of components possible. More precisely defined: An autopoietic system is organized (defined as unity) as a network of processes of production (synthesis and destruction) of components such that these components (i) continuously regenerate the network that is producing them, and (ii) constitute the system as a distinguishable unity in the domain in which they exist. (Varela 1997: 75)

The organization of the living is characterized by the conjunction of two, seemingly different ontological realms. Unshaped matter and the process of regulation together make up the proper reality of the organism. This process-related circularity is a fact that biology must take into account. The process of the living takes place in normal matter, only that the latter is organized in such a way that it shows autopoietic behaviour. The autonomous encounter with reality — an encounter that is not completely causally determined — is called “cog nition” by Varela. He does not use the term in the classical sense of the cognitive sciences (which understand by “cognition” the logical operation of symbols) but rather emphasizes the living’s creativity of opening up a world in interactions relative to the living system. By cognition in an autopoietic sense, organisms create relevance by separating the outside from themselves, while at the same time being dependent on it:

> In brief, the term cognitive has two constitutive dimensions: first its coupling dimension, that is, a link with its environment allowing for its continuity as individual entity; second its interpretative dimension, that is, the surplus of significance a physical interaction acquires due to the perspective provided by the global action of the organism. (Varela 1997: 81)

The transition of the physical level of energy to the level of significance happens when the organism manifests as a "whole". By this the relation of energetic exchange becomes a relation of signification on the existential background of the organism. Because the living system has an interest in keeping itself closed, it becomes dependent on the surroundings. Outward stimuli thus gain meaning in respect to the organism's needs.

The making of the self actually creates an ontological triangle: by self-confirmation, the non-self is separated off as Umwelt; and this separation opens the possibility of interaction with the Umwelt, for better or worse. The world thus gains, in the same movement by which Self and Other are divided, existential significance for the emerging self. This triadic relation can be understood as the archetype of the sign-process as construed by Peirce. In this view, the self-constitution of the subject is *always* the constitution of a semiosphere.[2]

For an organism the world has a meaning in an existential sense, because the interactions with this world determine the fate of the living unit. This interaction is marked by a twofold difficulty, a seemingly paradoxical situation: First, the organism has to keep in the field of physico-chemical law to maintain a "coupling" with the underlying energetical structures. Second, the organism is not causally determined by the outside. It creates its behaviour by its own regulation. So the "real background" gives sense to the organism's behaviour precisely in establishing a continuous threat to it:

> The difference between environment and world is the surplus of *signification* which haunts the understanding of living and of cognition, and which is at the root of how the self becomes one... There is no food significance in sucrose except when a bacterium swims upgradient and its metabolism uses the mole-

[2] An interesting point is that Peirce's triadic sign has a strong similarity to Kant's *Ding an sich*: the object (the signification) does not 'really' exist as such, but only arises by our encounter with the *Ding an sich*, that, in turn, will never show its real nature because we are slaves to our conditions of perception. Only the sign exists really (in an energetic sense) but is perceived only in that form which our body makes of the perturbation it causes.

> cule in a way that allows its identity to continue. This surplus is obviously not indifferent to the regularities and texture (i.e. the 'laws') that operate in the environment, that sucrose can create a gradient and traverse a cell membrane, and so on. On the contrary, the system's world is build *on* these regularities, which is what assures that it can maintain its coupling at all times. (Varela 1991: 86)

A "perturbation", in autopoietic terms, is a stimulus that interferes with the organism from the outside. It is causing the organism to react, but in a way that is determined by its inner processes and states. Hence, a stimulus is *interpreted*. Perturbation *sensu* Maturana & Varela (1980) and sign *sensu* Hoffmeyer (1996) are thus identical: they are both existential interferences. Autopoiesis also provides an empirical explication of the proto-biosemiotic theory of Jakob von Uexküll (1980). When organisms are conceived of as autopoietic systems, *meaning* is their fundamental dimension of existence. This is the true boundary that separates the organic realm from pure matter. It is the organism's paradoxical dependence on its surroundings that lends to those surroundings an irrevocably existential value. A semiotics of the living world must be constructed on this foundation. It must be a biological theory of meaningful, natural signs *qua* the organisation of life that realizes its existence.

3. Ecstasitics of cognition

We have said that the reaction of living systems to material constraints is the unfolding of a dimension of meaning. For a living system, continued existence toward processual closure is intrinsically the *subjectively absolute goal* of the system. But this absoluteness is also manifested externally. A subjective *impression* of a perturbation, as the term was explained above, must always be connected with an *expression*. This observation calls for the logic of autopoiesis: Because biological self-production occurs as a material process, every signification is primarily a material one, simply because the breakdown of the process closure puts an end to life. Only by this material process the subjective perspective is obtained. Therefore, in the outer shape of autopoietic systems, meaning appears as form. As such it reveals itself in a sensually graspable manner. This means that the mode of being of

organisms has an irreducibly aesthetic side by which precisely this mode of being becomes visible.[3]

The relation between inside and outside was prefigured in our definition of cognition. In cognition, meaning becomes manifest for an organism in the perspective of concern. This is always a bodily, material process in space, because the living system really exists in space and time and because the process of living is about maintaining an identity *as matter*. For example, an animal will react to a shock by flight, to a wound by hiding and later by bearing a scar. A tree on a steep slope will visibly force its roots into the soil. There is a general exterior aspect to autopoiesis because organic systems are embodied, because they are reacting as bodies in space to their worlds.

A system's inward reaction to a perturbation, and thus its necessary generation of meanings, shines through bodily as the system's mode of reaction to stimuli. Because we defined cognition as a system's inner-directed reaction to a perturbation and thus as the necessary generation of meanings, the system's history is a display of these meanings. The outside is the first place where meaning appears visibly. The difference between "inside" in our subjective sense and "outside" in the sense of a morphology then is only a distinction between modes of expression. "Subjectivity" in this sense is primarily meant as "concerning the perspective of cognition", and this perspective can be manifest in an inside or an outside. Or rather, it will show up both inside *and* outside, because neither is possible without the other.

Cognition, as the complete self-realization of a living organism, is visibly embodied. It is the transparency of an invisible inside in the outside, a level of expression within the bodily reality of coping with the world. Form is thus necessarily related to what an organism experiences from its inner perspective. The Aristotelian "soul", as the paradigm of the specific "being as such" of a phenotype and its levels of development, remains open at every moment. The cramped fists of a hungry baby, or his sleepy uncertain movements, say *something* about his inner perspective without being entirely capable of saying

[3] For Aristotle, the morphological form of an animal was indeed the expression of its *anima*, its "soul". It is a principle of motion inseparable from the body of plants, animals and humans, organizing matter into the form of a living being. Since the quintessence of organism lies in its form. The living aspires to it according to its own entelechy. Cf. Aristotle, *De anima* II, 1, 412a; Aristotle, *Physik* 254b.

how he is feeling "in reality"; for this "reality" simply does not exist in a discursive way because the baby's perspective is a private one.[4]

This brings us to the issue of animals that have no highly centralized nervous system — a point of critique frequently raised against Jonas's claim that life is generally subjective. For subjectivity to arise, however, a central nervous system is not necessary. In understanding the interplay between autonomy and necessity, form and matter, as organic cognition on the most basic bodily level, it becomes clear that the nervous system is embedded in the physiological context as a specialized part of it, but not as something entirely different. Here the still-dominant, consciousness-centered view misses the point.[5] The *whole* reacts to a stimulus, and its *expression* can perhaps be all the stronger, the less important the role of a nervous system is: think of the immense aesthetic dimension of flowers and anthozoans, the weightlessness of floating jellyfish, like the drifting of life itself — all that is an inside turned to the exterior, feeling voiced to the world.

In this view, the perennial question of how mind can *causally* determine the body becomes obsolete. For even a simple organism does not react causally to its environment, but rather according to its inner states, hence, according to meaning. When a protist flees chemical stimulation, there is no reason, from the protist's point of view, to admit two different processes, one intentional and one physical. We rather have to deal with a uniform biological process, in which flight behaviour is the manifestation of the meaning that the chemical substance has for the organism. This meaning is to decipher from a host of signs already on a basic biological level. Think, for example, of the speaking expression of a drying plant, or even of a *Paramecium* that cramps together its unicellular "body" before it dies from the picrinous acid dripped on the slide. The hermeneutics of the living that Helmuth Plessner (1975) speaks of begin already here.[6]

---

[4] Here we are augmenting Wittgenstein notion of "private language" with a biological dimension (already implied in Maturana & Varela 1980). But note that a "biological privateness" is far more accessible than a purely linguistic one.

[5] See, e.g., Wetz (1994: 89, 194); also Schäfer (1993) and Krebs (1997). These critics seem not to be aware of the final depth of Jonas' ideas, which logically do not admit an ontological separation within the realm of the living. This also shows that it is urgently necessary to support Jonas's ontology with the more empirical and more widely-accepted findings of Varela.

[6] I am aware that this can be only a preliminary discussion of the subject. *Prima facie* intuition shows a correlation between my feelings as a sentient being and the symptoms observed in the other. My reasoning here also does not mean that I deny the reality or the communicability of human consciousness. I simply believe that meaning

Let us now return to the "expressive" dimension as seen in the pure fact of the morphological presence of living things. This sensual presence may well be the "surplus of meaning" that Varela talks about. Contrary to Heraclitus's view, nature apparently delights in *showing* itself. This ubiquitous sensual presence is what Gernot Böhme calls the "ecstatic character" of nature.[7] It protrudes ("ex-stare") from itself and affects the senses of every being:

> That nature has such an ecstatic dimension is easily proven with scientific facts... Concrete nature is full of colours, smells, full of signs and contours, there is no thing that does not show its presence and that does not contribute with its voice to the great concerto. (G. Böhme 1992: 131, transl. by A. W.)

Cognition thus becomes an aesthetic phenomenon of the first order. I define aesthetics here primarily as a theory of sensual perception relating to the concrete, sensual, and therefore subjective presence of things. Aesthetics defined in this manner is founded on an autopoietic theory of organic perception. This is in line with the original sense of the term coined by Baumgarten in the eighteenth century. Now we can enlarge upon this: In sensually perceiving natural things we can see their cognitive histories. If the ecstatic dimension says something about an organism's underlying cognition, then it speaks also about the inner dimension of life thus made visible. Such a semiotic aesthetics is therefore the key to understanding nature, to deciphering living subjective meaning, and to understanding the world thus created. *Outside myself meaning becomes visible first and immediately in the aesthetic dimension, as an embodied sign of cognitive history*. It is thus the most direct access to "knowledge" about the world. But this knowledge is not discursive. It is rather the "archetype of the concrete", as Jonas says (1973: 39). Sensually experienced expression is not information. It is meaning.

This brings me to another consequence of the logic of the autopoietic system. Successful autopoiesis is the achievement of life's self-approval; it is thus the materially successful gesture of the organism's saying "yes!" to itself. The motive that is expressed in the ecstatic aspect of the living therefore must be continued existence under the aspect of its success. That means flourishing, flowering. Even the simplest form of life in its visibility shows an ecstatic moment in the most

---

is transparent already in many ways before — and beyond — consciousness. For us the phenomenon of life is the only immediately accessible domain, the only "knowledge" that we have directly, unaltered by the sense organs.

[7] Cf. Corrington (1995).

emphatic sense of the word, as evidenced by its overflowing and transgressing its own limits.

And life as self-approval may be automatically life as beauty. In living, life celebrates itself. Only as an emphatic gesture of self-approval can it be life, since it always has to confirm its existence in order to assure its continuation.[8] Can we postulate that the beautiful has its logical place as the necessary formal counterpart of achieved autopoiesis? Can we say that the realization of the living not only has a beautiful component, or can be treated under an aesthetic aspect, but that it rather is beauty *in its essence*?[9]

4. Nature as embodied feeling

In ascribing a decipherable meaning to the exterior aspect of natural things, we methodologically approach the classical semiotic practices of antique medicine and medieval theology. In a way our semiotic proposal is an organic hypothesis concerning what Hans Blumenberg (1981) calls the "legibility of the world", referring e.g. to the symbolic universe in Renaissance alchemy or in medieval belief. Nonetheless, our approach does not derive from any culturally established cosmos of signs, but rather from an empirical look at cognition.

Living nature can act as a reservoir of symbols, because it implies continuously its organic background. By this, it shows a transparency of its functioning conditions. In living form the laws of a general *conditio vitae* thus appear in a nondiscursive manner, as expression: as expression of the tendency to variety, manifoldness, plenitude — to precarious, utopic plenitude. The autopoietic theory of the organism engenders a theory of organic expression as a necessary consequence. This reminds of the medieval way to speak of macro- and microcosm (Böhme 1988): From an autopoietic viewpoint the understanding of

[8] See also Jonas in Wetz (1994: 141): "In its desire for more life, life is more than life because it contains a 'yes to life' concerning itself. The more complex an organism is, the more intensively it experiences its inner dimension, and the more 'emphatically' it approves itself " (transl. A.W.).

[9] This comes close to the kind of "unlocated sense organ" Bateson (1988) saw in the flowering meadow. The meadow for him danced an endless dance: the history of embodiment of meanings in the interplay between the self-realizing individuals and their Umwelten, an ecstatic dimension of feeling transposed on the outside. This embodied cognition is what Bateson called mind: the unfolding of a dimension of meaning by the history of auto-regulation of a living system.

living form is possible because the receiver is himself nothing different than the universe sending out signs; because organic nature is a symbolic expression of the symbolically operating organic subject.

Nature as a whole is symbolically pregnant, in the sense of Ernst Cassirer. The sensual effect of natural forms is corporeally the same as their symbolic understanding. This equates with the Goethean idea of the "Urphänomen" which is something that acts as a symbol because it empirically has the symbolized qualities (as e.g. the magnet for attraction and rejection).[10]

This leads to a radical consequence in which the mind-body problem seems to be overcome semiotically. The correspondence between mind — the interior subjective perspective — and body is itself already a symbolic relationship. Meaning and value as correlates of the interior perspective become visible in the body. This biosemiotic interpretation joins how Cassirer argues:

> The relation between body and soul represents the archetype and first model for a genuinely symbolical relation ... Here neither an inside nor an outside is at the origin, neither a before nor an afterwards, a causing force or a caused effect. (Cassirer 1977–1982, vol. 3: 117; translation A.W.)

Mind is a symbol for the body because mind — the subjective experience — is the meaning of the experience mediated by the body. This relation mirrors the way the interior perspective is the meaning of the body's encounter with situations.

If we take nature as an assembly of bodies and the body as a part of nature, then we can extend this finding; then "soul" in Cassirer's sense stretches out as the whole of animate nature lying before us. Nature thus *is* the outside of an organic inside, hence it is also our inside turned out; its expression *is* our intentionality. At the same time, from the expressiveness lying before me, another inside can be experienced as an outside. A subjective experience with an Other, who is not different from me in its basic situation, becomes aesthetically transparent. And only thus does it becomes real: the inside, or feeling, is

[10] The concept of a natural symbolization process presented here is far more precise than the American Transcendentalists' view, e.g. in Emerson's dictum, "Things admit of being used as symbols, because nature is a symbol, in the whole and in every part" (1951: 269). Transcendentalism started from the romantic supposition that spirit manifests in nature and is symbolized through it. The present approach contents itself with biological observation. Nature is not a transcendental symbol of the spirit beyond by downward causation. Rather spirit — organic cognition — works by upward causation, creating signs and symbolic pregnancy through the realization of the living (Weber and Varela, in preparation).

only possible as the cognitive or behavioural dimension of an outside, of an embodied form. Both are fundamentally the same, in the sense that they form the matrix of one biological individuality.

In this view nature is legible as an ecstatic emanation, as an exteriorization of inner experience. The organic world around us is thus identical with the emotional world inside us. Nature reflects the latter in a kind of familiar, but nondiscursive mirror and thus expresses before me what is inside of me, but what can gain reality only by being expressed (Weber 1998). In this respect, biodiversity is not only the illustration of an endless variation on functionality, but is also an expressive phenomenon of the first order. It is the presence of manifold ways of organic experience. And only by means of this existential subjectivity does the semiosphere come into being.

5. Ecosemiotics: Nature as a necessary symbol for human experience

The semiotic threshold is transgressed by the generation of value due to the self-maintenance of an autopoietic system. Therefore in its foundations semiotics is always biosemiotics. Cultural semiotics is working as an extension of the same principles which biosemiotics basically generates in organism, thus creating a semiosphere that is partly, but not totally independent from bodily foundations. The prefix "bio-" viz. "cultural" designates the respective system engendering semiosis: this can be a biological or a cultural structure (which would be called a "discourse" or "dispositif", cf. Foucault 1990).

We have to speak of "ecosemiotics" in any case the relation to the external environment is concerned. First this is just biology: What in classical terms is described by the biological subdiscipline of ecology would be ecosemiotics in a biosemiotic approach — as physiology in a biosemiotic view has become endosemiotics (Uexküll *et al*. 1993), zoology zoosemiotics (Sebeok 1963) and botany phytosemiotics (Krampen 1992). Therefore, some biological relations of the human species to the environment may be called ecosemiotic because in principle they are biosemiotic.

We can also speak of ecosemiotics as a subgroup of cultural semiotics, e.g. when the sign system concerns man's relationship towards nature (as e.g. in the "natural semiotics" of Paracelsus, see Blumenberg (1981), Böhme (1988), or, for another example, Bateson's

"Ecology of Mind" (1988), a work, which is by the way groundbreaking semiotics). This is the far more interesting point: Maybe the truly ecosemiotic part of cultural semiotics is where the junction lies between biological and cultural generation of signs, and where hence the access to the mind-body problem can be found.

Cultural ecosemiotics then is the expression of man's organic nature in cultural terms. In this respect, the cultural universe of archaic people like the Australian aborigines rests nearly completely ecosemiotic — cosmological, territorial, social and historical structures being expressed via paintings or songs "representing" animals, plants, and landscapes (Lévi-Strauss 1968, Morphy 1991). I therefore claim that ecosemiotic thinking reveals the fact that in the symbolic cosmos of culture organic nature is the strongest symbol to represent the human organic *conditio vitae* (Weber, in preparation).

Culture in its deep roots is always ecosemiotic. Culture is an intensification of the basic paradoxical situation of the closed organic system that despite its closure has to allow a flux of the world through its confines. We have seen with Cassirer that "interiority", hence mind, can be considered as the meaning of the existential embodied realities. In a parallel movement, the embodied organic realities outside, are symbolic for the human interior perspective. This may account for the obsession with nature in early culture.

The first stage of this archaic functioning of natural symbols is a kind of metonymic effect, that has been emphasized by various authors working about primitive stages of symbolism. Especially Cassirer has seen the important role of ritual involving the body's senses in the symbolic cosmic religions of primitive people; a finding that has been confirmed empirically by the fieldwork of various authors (Morphy 1995, Layton 1995).

In a concrete manner then the inner space of experience finds its synechdochetic extension in the real spaces of nature. Only by the experience of the living depth of nature the own inner universe the poet Rilke is speaking of as "intensified sky" becomes accessible. Another prime metaphor for this inner space is the sea, as have shown authors like Melville, Conrad, and, recently, Hamilton-Paterson. For there is an inner relationship of space that stands apriori to the real spaces of the world. This is the space of the inner experience, a value- or meaning-space that measures and expresses real outside spaces in its terms, and that lays a metaphorical and synaesthetic basic grid on the world, with its meshes determined by the existential values of organic meaning. This primordial space is *not* the body. It is the space of

organic existence, the absolute space of existential meaning. This space is real not as the Euclidean topography we conceive the world of, but as the synaesthetic and ecstatic space of the whole nature.

If nature acts as the main reservoir of organic symbols, and if these symbols are essential for grasping our own interior in a concrete, embodied form, then the presence of natural forms is an inevitable condition for us to fully understand ourselves. The hypothesis that there is a deep meaning in the experience of natural beauty is echoed by many recent works in cultural studies that show man's obsession with forests, trees, lakes, animals, and so on throughout history (e.g., Schama 1996; Böhme & Böhme 1996). Oelschlaeger (1991) has observed that people who dedicate themselves to preserving wilderness are trying to protect this symbolic cosmos, and not a particular landscape.

The ecosemiotic lesson that we can draw from this might be that living nature really is a symbol for something most important in us. By being transparent in itself, living nature reveals the functioning of the cosmos that has brought forth life as the paradigm of the self-bearing, self-producing, flowering plenitude of a fragile and precarious equilibrium that is always doomed to fail, but that at the same time will always be replaced by new growth. This is the only adequate model of the soul. The destruction of nature thus has a symbolic counter effect on that which have prospering organic beings. In destroying other creatures as the resources of self-growing life, we say goodbye symbolically to the principle of plenitude.[11]

References

Aristotle. *De anima* II, 1, 412a.
— *Physik* 254b.
Bateson, Gregory 1988. *Ökologie des Geistes*. Frankfurt am Main: Suhrkamp.
Blumenberg, Hans 1981. *Die Lesbarkeit der Welt*. Frankfurt am Main: Suhrkamp.
Böhme, Gernot 1992. *Natürlich Natur*. Frankfurt am Main: Suhrkamp.
Böhme, Gernot; Böhme, Hartmut 1996. *Feuer, Wasser, Erde, Luft: Eine Kulturgeschichte der Elemente*. München: C. H. Beck.
Böhme, Hartmut 1988. *Natur und Subjekt*. Frankfurt am Main: Suhrkamp.
Böhme, Hartmut; Müller, Lothar; Matussek, Peter 2000. *Orientierung Kulturwissenschaft: Was sie kann, was sie will*. Reinbek bei Hamburg: Rowohlt.

[11] This work has been funded by scholarships from the Deutsche Bundesstiftung Umwelt (DBU) and the French Government.

Cassirer, Ernst 1977–1982. *Philosophie der symbolischen Formen*. Darmstadt: Wissenschaftliche Buchgesellschaft.
Conrad, John 2000. *Lord Jim: Eine Geschichte*, München: Piper.
Corrington, Robert S. 1995. *Ecstatic Naturalism: Signs of the World*. Bloomington: Indiana University Press.
Emerson, Ralph W. 1951. The Poet. In: *Emerson's Essays*. New York: Harper and Row, 261–291.
Foucault, Michel 1990. Einleitung zu *Der Gebrauch der Lüste*. In: Engelmann, Peter (ed.), *Postmoderne und Dekonstruktion: Texte französischer Philosophen zur Gegenwart*). Stuttgart: Philipp Reclam jun., 84–107.
Glacken, Clarence J. 1967. *Traces on the Rhodian Shore: Nature and Culture in Western Thought from Ancient Times to the End of the Eighteenth Century*. Berkeley: California University Press.
Goethe, Johann Wolfgang von 1998. *Gesammelte Werke*. Hamburger Ausgabe. München: dTV.
Hamilton-Paterson, J. 1995. *Seestücke*. Stuttgart: Klett-Cotta.
Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press.
Jonas, Hans 1973. *Organismus und Freiheit: Ansätze zu einer philosophischen Biologie*. Göttingen: Vandenhoeck und Ruprecht.
Krebs, Angelika (ed.) 1997. *Naturethik: Grundtexte der gegenwärtigen tier- und ökoethischen Diskussion*. Frankfurt am Main: Suhrkamp.
Krampen, Martin 1992. Phytosemiotics revisited. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *Biosemiotics: The Semiotic Web 1991*. Berlin: Mouton de Gruyter, 213–219.
Kull, Kalevi 1999. Biosemiotics in the twentieth century: A view from biology. *Semiotica* 127(1/4): 385–414.
Lévi-Strauss, Claude 1968. *Das wilde Denken*. Frankfurt am Main: Suhrkamp.
Langer, Susanne K. 1953. *Feeling and Form*. New York: Scribner's.
Layton, Robert 1995. Relating to the country in the Western Desert. In: Hirsch, Eric; O'Hanlon, Michael (eds.), *The Anthropology of Landscape*. Oxford: Clarendon Press, 210–231.
Maturana, Humberto R.; Varela, Francisco J. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Boston: Reidel.
Melville, Herman 1977. *Moby Dick*. Zürich: Diogenes.
Morphy, Howard 1991. *Ancestral Connections: Art and an Aboriginal System of Knowledge*. Chicago: University of Chicago Press.
— 1995. Landscape and the reproduction of the ancestral past. In: Hirsch, Eric; O'Hanlon, Michael (eds.), *The Anthropology of Landscape.* Oxford: Clarendon Press, 184–209.
Oelschlaeger, Max 1991. *The Idea of Wilderness: From Prehistory to the Age of Ecology.* New Haven, CT: Yale University Press.
Peirce, Charles S. 1968. *The Collected Papers of Charles Sanders Peirce*. Cambridge, MA: Harvard University Press.
Plessner, Helmuth 1975. *Die Stufen des Organischen und der Mensch*. Berlin: Mouton de Gruyter.

Schäfer, Lothar 1993. *Das Bacon-Projekt: Von der Erkenntnis, Nutzung und Schonung der Natur*. Frankfurt am Main: Suhrkamp.
Schama, Simon 1996. *Der Traum von der Wildnis: Natur als Imagination*. München: Kindler.
Schrödinger, Ernst 1944. *What is Life? The Physical Aspect of the Living Cell*. Cambridge: Cambridge University Press.
Sebeok, Thomas A. 1963. Review of communication among social bees; porpoises and sonar; man and dolphin. *Language* 39(3): 448–466.
Steiner, George 1991. *Réelles présences: Les arts du sens*. Paris: Gallimard.
Uexküll, Jakob von 1980. *Kompositionslehre der Natur*. Frankfurt am Main: Ullstein.
Uexküll, Thure von; Geigges, Werner; Herrmann, Jörg M. 1993. Endosemiosis. *Semiotica* 96(1/2): 5–51.
Varela, Francisco J. 1991. Organism: A meshwork of selfless selves. In: Tauber, Alfred I. (ed.), *Organism and the Origins of Self*. Dordrecht: Kluwer Academic Publishers, 79–107.
— 1997. Patterns of life: Intertwining identity and cognition. *Brain and Cognition* 34: 72–87.
Weber, Andreas 1998. Der sprachlose Spiegel. *Deutsches Allgemeines Sonntagsblatt* 18: 27–29.
Weber, Andreas; Varela, Francisco J. (in preparation): Life after Kant: Natural purposes and the autopoietic foundations of biological individuality.
Wetz, Franz J. 1994. *Hans Jonas zur Einführung*. Hamburg: Junius.
Wilson, Edward O. 1995. *Der Wert der Vielfalt: Die Bedrohung des Artenreichtums und das Überleben des Menschen*. München: Piper.

Познание как выражение: автопойэтические основания эстетической теории природы

Предлагается эстетическая теория природы, опирающаяся на биосемиотическое описание живой природы, которое в свою очередь выводится из автопойэтической теории организмов (Ф.Варела). Результатом реакции на материальные ограничения автопойэтической системы является открытие измерения значения. Во внешнем гештальте автопойэтических систем значение является в виде формы. Существование организмов имеет неотъемлемую эстетическую сторону, посредством которой это существование становится видимым. Природа, таким образом, проявляет известную прозрачность по отношению к своему функционированию: посредством своей телесной саморепрезентации организмы недискурсивно проявляют знаки *conditio vitae*. Значит, живые существа всегда проявляют некоторую экспрессивность как неизбежную часть бытия живым. Это можно назвать и *экстатическим* измерением (Г. Беме, Р. Коррингтон). Автопойэзис напоминает идею Парацельса о

signatura rerum (К. Глакен, Х. Беме): природа прозрачна не потому, что она *дигитально* организована в виде текста или кода, а скорее потому, что она *аналогово* представляет вызываемую автопойэзисом интенциональность. Природа в целом как “живая форма” (С. Лангер) символизирует органическую интенциональность. Основное значение защиты природы, таким образом, — обеспечение “истинного присутствия” нашей души.

Tunnetus kui väljendus: looduse esteetilise teooria autopoieetilistest alustest

Esitan oma artiklis looduse esteetilise teooria, tuginedes elusloodu biosemiootilisele kirjeldusele, mis omakorda on tuletatud organismide autopoieetilisest teooriast (F. Varela). Autopoieetilise süsteemi reaktsiooni tulemuseks materiaalsetele piirangutele on tähenduse mõõtme teke. Autopoieetiliste süsteemide väljapoolses *Gestalt*is ilmub tähendus vormina ja avaldab end sellisena meeltega haaratava moel. Organismide olemisel on taandamatu esteetiline külg, mille läbi see olemine saab nähtavaks. Loodus ilmutab seega teatavat läbipaistvust oma funktsioneerimise suhtes: oma kehalise eneseesituse kaudu ilmutavad organismid mittediskursiivsel viisil *conditio vitae* märke. Seega ilmutavad elusolendid alati algsel tasemel olevat väljenduslikkust kui elusolemise vältimatut osa. Seda võib nimetada ka looduse *ekstaatiliseks* dimensiooniks (G. Böhme, R. Corrington). Autopoieesis sarnanab selle poolest vaatega, mis meenutab Paracelsuse ideed *signatura rerum*ist (C. Glacken, H. Böhme): loodus ei ole läbinähtav mitte seetõttu, et ta on *digitaalselt* organiseeritud teksti või koodina, vaid pigem seetõttu, et ta esitab *analoogselt* autopoieesise poolt esile kutsutavat intentsionaalsust. Loodus tervikuna kui “elav vorm” (S. Langer) sümboliseerib seega orgaanilist intentsionaalsust. Looduskaitse kõige põhimisem tähendus on seega meie hinge “tõelise kohalolu” tagamine.

Wilderness from an ecosemiotic perspective

Christina Ljungberg
English Seminar, Zürich University
Plattenstrasse 47, CH-8032 Zürich, Switzerland
e-mail: cljung@es.unizh.ch

Abstract. "Wilderness" is a concept which has undergone a radical change in recent years. Owing to the scale of global destruction of the wilderness and its various ecosystems, the idea of wilderness has been transformed from its original negative sense as an Other into a matter of public concern. This as replaced the understanding of "wilderness " not only as a place but as a category closely linked with the development of human culture. As the result of human practice and representation, nature is thus also political. Models and concepts of nature in the creative arts can be indicative of a certain culture's relationship with nature, as they communicate prevailing ideologies. This is particularly pertinent to concepts of nature in Canada where wilderness includes vast tracts of forests, lakes and an Arctic North, which has led to a distinctively Canadian relationship between Canadians and their natural environment. The change in the literary representations of interactions between humankind and environment in Canadian fiction — from the "double vision" resulting from the view of the wilderness both as a threatening Other and free space; to the view of threatened nature as a means of identification; and, finally, as a postmodern place of transgression and possibility — invites questions about both the semiotic threshold between nature and culture, and about the function of boundaries in the constitution of identity.

1. "Wilderness" as a cultural concept

The concept of "wilderness" has undergone a radical change in recent years. The scale of the global destruction of the natural environment

and its various ecosystems has transformed the idea of wilderness from a negative concept to a matter of public concern, since its survival is intricately linked with the survival of our own habitat. A growing awareness of the irreversible implications of the destruction of natural spaces by unprecedented forms of human interference with nature has helped shape a new sensibility for our dependency on nature; it has also replaced the understanding of "wilderness" not only as a place, but as a category with which humans are closely linked, and whose ecological sign processes need to be carefully interpreted.

The study of these sign processes is the focus of ecosemiotics, which, according to Winfried Nöth (2001a), is the study of "environmental semiosis", i.e., "the sign processes which relate organisms to their natural environment". Situated at the crossroads between the semiotics of nature and the semiotics of culture, ecosemiotics focuses specifically on the way in which these interactions are determined by signs and processes of semiosis. Hence, although it is most closely related to the semiotic fields of biosemiotics, zoosemiotics and cultural semiotics, ecosemiotics also concerns aesthetics, the visual arts, literature, hermeneutics and theology. The definition of ecosemiotics as "the semiotics of the relationship between nature and culture" has also been proposed by Kalevi Kull (1998: 350), who includes within ecosemiotics the study of the "semiotic aspects of place and role of nature for humans" and the extent of our communication with nature. Locating ecosemiotics in that "part of the semiotics of culture which investigates human relationships to nature which have a semiosic (sign-mediated) basis", Kull also suggests that ecosemiotics may include "the context-dependence of the valuation of nature, differences in seeing and understanding it" (*ibid*.: 351).

Hence, nature is understood as the result of human practice and of representation. It is thus also political; and, as Carolyn Merchant (1996: 61) argues, it is a result of the various ethics that have developed in the western world since the 17th century, and which have been formed by various political, religious and ethical trends. For instance, Biblical passages were often used by political and religious leaders throughout the 18th and 19th centuries to assert the supremacy of humankind and, especially, the right of the white races to exploit and alter the natural landscape; thus, e.g., the Judeo-Christian mandate of Genesis I, 28, was cited, telling mankind to take possession of nature: "Be fruitful and multiply, and replenish the earth and subdue it". This passage was, in fact, quoted by the Puritan John Winthrope when he left England for Massachusetts on the Arabella in 1629; as Merchant

points out, it "reinforced God's command to transform nature from a wilderness into a civilization" (Merchant 1996: 66; see also Nöth 2001a).

Merchant sees the global ecological crisis as a result of "deepening contradictions generated between the dynamics of production and ecology and by those between reproduction and production" (1996: 10–11). However, since these contradictions are linked to the cultural, historical and political background of each particular country, the environmental problems in each country need to be investigated separately, linked as they are to a particular prevalent valuation of nature. This is also true of models and concepts of nature in the creative arts whose representations of the interactions between humans and their natural environment reflect the prevailing system, at the same time as they often move at the forefront of paradigmatic change, creatively conceptualizing new scientific and philosophical thoughts and communicating them to a larger audience. Hence, the arts have, in turn, reflected the mechanistic worldview of Cartesian dualism[1]; the Romantic view of nature as mysterious, resourceful and communicative; or, following Darwin's evolutionary theories, the naturalist view of nature as a battlefield on which only the fittest survive. In contemporary literature, the advances of postmodern science and, in particular, chaos theory have radically changed the view of the relationship between humankind and nature by introducing notions of randomness, plurality and uncertainty.

This is particularly pertinent to concepts of nature and "wilderness" in Canada where the wilderness includes vast tracts of forests, lakes and an Arctic North, which has led to a distinctively Canadian relationship between Canadians and their natural environment. The change in the literary representations of interactions between humankind and the environment in Canadian fiction — from the "double vision" resulting from the view of the wilderness both as a threatening Other and free space, to the view of threatened nature as a means of identification; and finally, as a postmodern place of transgression and possibility — invites questions about both the semiotic threshold between nature and culture, and about the function of boundaries in the constitution of identity.

[1] Carolyn Merchant (1996: 66–67) argues that what she calls "egocentric ethics" is rooted in the 17th century philosopher Thomas Hobbes' notion of nature as a common resource for which everyone competes.

2. "Wilderness" as the cultural Other

Traditionally, "wilderness" has been seen as negative and primitive in relation to civilization and culture. In its original sense, "wilderness" denoted a "wild or uncultivated region or tract of land, uninhabited, or inhabited only by wild animals" (which is implied by its etymological origin, OE *wilddéor*, wild beast and its concrete sense, the suffix "-ness", from OE *nes*) or a desolate "tract of solitude and savageness" (OED). Mostly, "wilderness" has been considered the binary opposition to culture, as an outside "non-culture", which threatens cultural space with chaos and disorder.

Yurij Lotman (2001: 124–125) describes the relationship between culture and non-culture in binarisms, on the one hand, and in topological categories, on the other. According to his localistic theory of the structures of semiotic space, the processes in culture are determined by the semiosphere, which is a space analogous to the biosphere marked by heterogeneity and held together by binarism and asymmetry. Hence, culture functions as a sign system against the background of a non-culture, a relationship Lotman (*ibid*.: 140) depicts in metaphors, such as inside and outside, and center and periphery. The center, for instance, is the place of cultural values where cultural texts are generated and culturally "correct" norms are determined whereas, at the periphery, culture is threatened by chaos and disorder. At the same time, it is this tension that makes the periphery into the place of creative innovation, which will eventually also transform the center of a particular culture.

In the same way, semiotic and cultural individuation is constituted by boundaries creating an internal semiotic space in opposition to external space. Hence, the boundary is the "outer limit of a first-person form", the space which is "ours", "my own", "cultured", or "safe", in contrast to "their space", which is "other", "hostile", "dangerous" and "chaotic" (Lotman 2001: 131).

Lotman's localistic approach seems very apt for descriptions of the Canadian view of the wilderness as the "hostile ", "dangerous" and "chaotic" Other that Lotman (2001: 131) suggests. Unlike the US Americans, who included the concept of "wilderness" in their foundational myths, which Max Oelschlaeger has investigated in his impressive *The Idea of Wilderness*, Canadians have traditionally had a problematic relationship with their natural environment. This is partly for

natural reasons: while the heartland of the United States is one of the world's most fertile regions, Canada consists of one of the "earth's most ancient wildernesses and one of nature's grimmest challenges to man and all his works", as the Canadian historian W. L. Morton (1972: 4–5) puts it. Morton calls attention to the fact that the famous comment by Jacques Cartier, Canada's "discoverer", that Canada was "the land that God gave Cain" has never been seriously contested; instead, "[t]he main task of Canadian life has been to make something of this formidable heritage". Morton's ironic comment on a particularly Canadian response to nature would explain how the awareness of this untouched and seemingly empty nature, which surrounds the populated areas in the south and continues endlessly northwards, has led to a distinctively Canadian concept of "wilderness": one which not only denotes a geographical location and functions as a spatial metaphor, but which is also Canada's most popular cultural myth.[2] Yet it is a European myth, mainly created by the European explorers, settlers, missionaries and soldiers who were unable to read the signs of a nature that was foreign to them, and who conceived of the wilderness they encountered as a threatening Other. Seen only in negative terms, wilderness is the natural "disorder" which upsets the cultured environment, a space outside the social order and Christian morals that is there to be "ordered" or exploited, or both; yet, at the same time, nature also means freedom from the constraints of social rules and regulations. There are thus two readings of the signs of nature, resulting in a strangely ambivalent "double vision" of the wilderness.[3]

This "double vision" also extends to descriptions of the indigenous population, where Native people are rendered either good or bad, with the whites being the norm. Drawing attention to this fact, Margaret Atwood (1995: 39) points out that "[t]he Other is frequently a dump-

[2] According to Atwood in *Strange Things: The Malevolent North* (1995: 19), it is above all popular lore and popular literature that "established early that the North was uncanny, awe-inspiring in an almost religious way, hostile to white men; that it would drive you crazy and finally claim you for its own ".

[3] As Shelagh Grant (1989: 23) has pointed out, in Canadian texts from the 19th century, the North is a "north of the mind, representing challenge, adventure, enchantment, escape, and solitude", inspired by European Romanticism. On the other hand, Northrop Frye (1977: 31) labels the 19th century Canadian relationship with nature schizophrenic, "the sense of loneliness and alienation urgently demanding expression along with a good deal of prefabricated rhetoric about the challenge of a new land and the energetic optimism demanded to meet it". See also MacLulich (1988: 122), who suggests that Canadian representations of the wilderness "dwell on the process of settlement, in which European or "civilized" values are imposed on the native landscape".

ing-ground for anxieties", at the same time as it functions as "a way of unloading our moral responsibilities by defining other people as, by nature, better behaved than we are". Owing to the ignorance of the wilderness and its inhabitants, the dialogue necessary for exchange and understanding of this Otherness did not take place in the early settlements, although Native guides were often used for explorations into the wilderness.

A striking example of the difference in views of nature can be seen in Native art and handicraft, where carvings in wood and stone, birch bark scrolls and masks demonstrate an integrated world view, with an integral relationship between nature and culture and between material and spiritual worlds. In contrast to this pansemiotic and pantheist world where the threshold between nature and culture is practically non-existent, the new settlers worked hard to transform the natural landscape into a cultural one. Hence, as Brian Osborne (1988: 163) points out, the great battle was against the wilderness and, in particular, the vast tracts of forest, with the aim of replacing the wilderness by the "geometrical order of the civilized and domesticated world", i.e., transforming it into a European representation of nature in the New World.

3. "Wilderness" in early English Canadian literature

The view of the natural environment as a raw, alien and undisciplined Other, as the brute force of Secondness, is hence something that distinguishes the early Canadian relationship with nature from the American one, with its romantic implications of a Paradise Lost. In American wilderness romance, for instance, the encounter with nature entails a spiritual journey from which you emerge reconciled with nature and with yourself. This is not so in the Canadian versions of the genre, as Gaile McGregor has convincingly shown in her analysis of the function of American and Canadian wilderness romance. Locating it at the interface between civilization and the wilderness, "precisely on the line where those two realities and those two states of mind come together" (*ibid.*: 3),[4] she compares James Fenimore Cooper's

[4] McGregor also makes the interesting observation that, because Canadians refused to reconcile themselves with nature, it was neutralized and was never sentimentalized to the same extent as in American culture, where it is tied up with nostalgic values (1985: 73).

The Last of the Mohicans (1826) and Major John Richardson's *Wacousta, or the Prophecy: A Tale from the Canadas* (1832). In *Wacousta*, which, according to James Reaney (1991: 540), was written directly as an answer to Cooper's novel, the respective responses to nature and the wilderness are grounded in essentially divergent cultural features. Whereas Cooper's wilderness romance has man engage with a nature that can be both dangerous and benevolent, in Richardson's story about the last of the Indian uprisings against the British Forts Detroit and Michilimackinac, descriptions of nature are virtually nonexistent. This suggests that, although he situates the plot in the midst of wilderness, he does not seem to "see the landscape at all": far from of dealing with it, he not only ignores but even denies it. As MacGregor argues, "while the wilderness — nature — is a major component in the world of Cooper's books, in *Wacousta* it is barely evoked at all" (1985: 4–5).

Throughout Richardson's novel, it is thus what the critical theorist Northrop Frye (1971: 226) labeled "the garrison mentality" that prevails: the "over-imaginative" soldiers are terrified of venturing into the hostile forest, "with their fancies of Indians behind every tree". The civilization/wilderness opposition which, in Cooper's novels, operates in terms of two opposite poles functions differently in *Wacousta*: although they still stand in opposition to one another, they form a static, circular structure in which no reconciliation between man and nature is possible, in contrast to the dynamic process of Cooper's novel, where Natty Bumppo is part of the same interface between man and nature — "the primitive or 'natural' man who serves as mediator between the civilized world and the wilderness 'other' (McGregor 7–8). In *Wacousta*, there is no such semiotic activity, a fact which I would suggest is rooted in the colonial situation. With the cultural center in Britain and not in Canada, the settlers' and soldiers' attempts to impose European norms on a New World environment saw no place for the category of "wilderness": indeed, it is judged "non-existent", as is confirmed by the absence and denial of nature in *Wacousta*.

The lack of mediation between civilization and wilderness leads Northrop Frye (1971: 142–43) to suggest that, because the Canadian Confederation was formed so soon after to the pioneer period, "it was still full of wilderness". In contrast to the steadily westward-moving American frontier, the European travelers entering Canada via the Gulf of St. Lawrence were "engulfed" by the wilderness, whose frontier "was all around one, a part and a condition of one's whole imagi-

native being".[5] Thus, Frye, too, takes a localistic approach to the problem of Canadian identity and its close connection with the natural environment, and asks if "any other national consciousness has had so large an amount of the unknown, the unrealized, the human undigested built into it?".

4. The loss of "wilderness"

This negative view of nature was still fairly predominant when the ecological crisis triggered the environmental movement in the 1960s — with the publication of Rachel Carson's *Silent Spring* (cf. Hoffmeyer 1996: 142) — which coincided with English Canada's search for a national identity. Carson's bestseller even had a Canadian fictional equivalent, in the form of Margaret Laurence's short story, "The Loons", in which Laurence uses the loon's cry as a semiotic node for the Canadian relationship with the wilderness and its indigenous inhabitants, and for the destructive consequences of human encroachment on nature: the Indians become addicted to drugs and alcohol, and the loons vanish, as a result of mercury poisoning, acid rain and commercial trapping nets.

At this point in time, Canada was attempting to define itself against its former mother country and the overwhelming influence of the USA. At the same time, the Quebec Separatist movement threatened to undermine a historically fragile national unity. The idea of endangered nature and, especially, of threatened wilderness suddenly became synonymous with Canada's own cultural situation, a perception that is reflected in the fiction of the 1960s and the 1970s.

This tension is something that Margaret Atwood develops in her novel *Surfacing*, where she radicalizes the boundary between nature and culture by juxtaposing it to the one between the Self and the Other, in terms of both cultural and personal identity formation. As the daughter of an entomologist, she had spent a great deal of her childhood in the wilderness of northern Ontario and Quebec and knew wilderness from personal experience well before she encountered it as a cultural myth. This early experience is something to which she has come back repeatedly in her fiction, and it is within this dual context

[5] Frye's socio-historical and mythopoeitic theories have been criticized as being too culturally nationalist and too reductive; however, many of his observations still seem valid.

that she writes.[6] Placing her narrator at the interface between the English-speaking province of Ontario and the French-speaking province of Quebec, she literally exemplifies Lotman's (1990: 142) observation that semiotic processes are intensified in the frontier areas, since the boundary is the domain of bilingualism. "Now we're on my home ground, border country", says the nameless narrator (Atwood 1989: 8), when she and her companions see the bilingual border sign in the northern wilderness. With 'WELCOME' on one side and 'BIENVENUE' on the other, the road sign both indexically denotes the border between the two provinces, at the same time as it iconically mirrors the deeply felt cultural chasm between the English-speaking and French-speaking populations, and the problem of national identity — although the hybrid election slogans along the road demonstrate a coexistence that, at least on the surface, seems to function.

By using signs of ecological significance, such as birch trees dying from acid rain and lakes being emptied of fish, as indices of a Canadian wildlife threatened by "others" ("Americans"), Atwood's second novel, which quickly achieved cult status when it first appeared in 1972, opened a discussion of what relationship between humans and nature is necessary to ensure an ecological balance. By unmasking nationalist assumptions — showing that the "Americans" the narrator suspects are in fact Canadians — she demonstrates that the roots of the environmental crisis transgress national boundaries. Indeed, "the great Cartesian error" is not only the cause of the ecological crisis but also of the predicament of modern civilization, of the exploitation of humankind and nature, the destructive split between mind and body and between nature and culture, and the ensuing alienation experienced by modern man.

Atwood rewrites this relationship by having her nameless narrator transgress the semiotic threshold between nature and culture, as she embarks on a journey into nature in order to accept the natural within her. The narrator's withdrawal from human company leads her to mis-

[6] As Coral Ann Howells (1996: 22) has pointed out, one of Atwood's first refigurings of the wilderness was her poetic sequence *The Journals of Susanna Moodie* (1970), a rewriting of *Roughing It in the Bush* (1852), the autobiography of the Victorian pioneer Susanna Moodie. In these poems, Atwood shows how Moodie's initial fear of the Canadian landscape, which she first sees as alien and threatening, changes into a reading of the wilderness as a harmonious world that teaches her its secret language. Howells also draws attention to the much darker prospects of survival of the human race discussed in Atwood's more recent works, such as *Wilderness Tips* (1991), which shows a clear shift away from the optimism of the 1970s (1996: 33).

trust signs of human culture, especially language, which she sees as deceptive and manipulative, and instead, to orient herself by non-linguistic signs which she interprets as "rules" informing her of what she must or must not do: she is "not allowed to go back in that cage, wooden rectangle [her parents' cabin]. Also tin cans and jars are forbidden; they are glass and metal. The outhouse is forbidden so I leave my dung, droppings on the ground, all animals do that" (Atwood 1989: 213–15).

The narrator's interpretation of everyday reality as a set of "rules" could be seen as a symptom of schizophrenia; but Atwood has it mark the narrator's entry into the primitive rites of initiation that will enable her to enter a more visionary state. Her attempts to merge with nature by renouncing human cultural practices has her thus regard nature as entirely semiotic: she has a hallucinatory feeling of her body dissolving and of becoming part of the biogenetic processes of the wilderness. Moving back through the phases of evolution, she has a vision of the Amerindian primeval forest of long ago:

> The forest leaps upward, enormous, the way it was before they cut it, columns of sunlight frozen; the boulders float, melt, everything is made of water, even the rocks. In one of the languages there are no nouns, only verbs held for a longer moment.
>
> The animals have no need for speech, why talk when you are a word.
>
> I lean against a tree, I am a tree leaning…
>
> I am not an animal or a tree, I am the thing in which the trees and animals move and grow, I am a place. (Atwood 1989: 216–17)

Seen from a Peircean viewpoint, Atwood has her narrator enact the development of the human mind within nature: her poetic images call up a world moving back to an early state of flow and chance, transforming matter back into energy, from the forest's "columns of sunlight frozen" to the boulders that "float, melt", until "everything is made of water, even the rocks". Her description of this primordial state recalls C.P. Peirce's synechistic theory that matter is mind frozen (CP 6.2777); as Winfried Nöth (2001b) points out, according to Peirce's "anti-dualism and evolutionism" (Santaella Braga 2001), mind and semiosis are prior to matter: "mind comes first, matter last". Peirce's belief in the principle of continuity between mind and matter implies that the self must be included in reflections on one's environment, since mind and matter have evolved together. By having her narrator's hallucinatory experience take place both on a genetic and on a semiotic level, as she goes back to the very beginning of time, Atwood represents her narrator's voyage of self-discovery as an evolu-

tionary process, abolishing the semiotic threshold by showing that mind exists not only in humans, but also in their natural environment.

Yet, becoming part of nature means dissolving the self, and the narrator ultimately pulls back from the idea of unification (even in her symbiotic unity with nature, she still says "I am"). Instead, after taking the Romantic notion of a communicative nature to its almost parodic extreme, Atwood has her re-emerge from this experience; "break[ing] surface", as it were, from a descent into the realm of biogenetic processes and mythic time to "stand[…] …, separate again" (1989: 217). This recovery is represented as a series of shifts in perception, where a carved fish object and a magic fish rock painting mingle with her interpretation of the natural sign of a fish jumping out of the water as a greeting from her drowned father:

> From the lake, a fish jumps.
> The idea of a fish jumps.
> A fish jumps, carved wooden fish with dots painted on the sides, no, antlered fish thing drawn in red on cliffstone, protecting spirit. It hangs in the air suspended, flesh turned to icon, he has changed again, returned to the water. How many shapes can he take.
> I watch it for an hour or so; then it drops and softens, the circles widen, it becomes an ordinary fish again. (Atwood 1989: 224)

Atwood's very detailed description of sign interpretation recalls Peirce's theory of the "real" or dynamical object, whereby an object which exists "in reality" is nevertheless inaccessible to our mind, or can only be accessed by approximation (CP 1. 538; cf. Nöth 2001a). The dynamical object resists interpretation and can even determine the sign in relation to its object whereas the immediate object is the mental representation of this object in the form of our previous knowledge of the world. Atwood's text plays with the difference between the dynamical and the immediate object, between "the Reality which in some way contrives to determine the Sign to its Representation"(CP 4.536) and the already present mental representation of this object, as she represents the narrator's recovery in a series of changes in perception and sign interpretation — the dynamical object of a "real" fish jumping, which awakes earlier mental representations of "fish", such the very concept of "fish", or its various representations, e.g., a wooden handicraft object, an Indian rock painting, or her drowned father, her protecting spirit, until it becomes a "normal" fish again. This return to "normal" perception is the beginning of her regaining her "self": by forming a coherent story of her past experience, she stabilizes her sense of self and re-enters society as an interpreting sub-

ject. Thus, in this novel, the wilderness becomes the site of spiritual revival of the self and of the reconstruction of identity, at the same time as it questions traditional wilderness concepts and myths and advocates a deeper understanding of the fundamental relationship between humankind and nature.

5. "Wilderness in postmodernity"

The idea of wilderness as a place of creative innovation is even more pronounced in Aritha van Herk's "geografictione" *Places far from Ellesmere*, which was published in 1990, at a time when the "cultural nationalism" of the 1970s had faded, and Canada was well on its way to becoming a multicultural society. The Canadian concepts of "wilderness" had widened and diversified, and had become regional, Native, ethnic, or gendered instead — positions perceived as being marginal, which Linda Hutcheon (1988: 3) considers typical both of postmodernism and of Canadian culture, which has always had to define itself against more powerful centers. However, as Hutcheon argues, the margin is "no longer conceived of only as a place of transgression" but also as "the place of possibility", because "[t]he periphery is also the frontier" where borders and limits are challenged and explored. This sounds very similar to Lotman's (1990: 136) notion of boundaries, which he calls "the hottest spots for semiotizing processes": the notion of boundary is ambivalent, simultaneously separating and uniting; it is the place where what is "external" is transformed into what is "internal":

> Since the boundary is a necessary part of the semiosphere and there can be no 'us' if there is no 'them', culture creates not only its own type of internal organization but also its own type of external 'disorganization.' (Lotman 2001: 142)

Aritha van Herk refigures these boundaries into an exploration of the processes behind the cultural representations of landscape and wilderness, and of women. By self-consciously setting the main part of her exploration on Ellesmere Island, one of the most remote places on earth — it is situated in the Canadian High Arctic, on the very edge of cartographic space — she challenges borders as limits, both in a geographical and in a literary sense. An extraordinary work that eludes genre distinctions, the fragmentary text of *Places far from Ellesmere*

challenges traditional notions of narrative by blurring the distinctions between nature and discursive space.

In van Herk's novel, the dialogic semiosis between humankind and landscape is shown to be fundamental to the formation of self-identity. Her exploratory reading of both "wilderness" and civilized discursive space is structured as an investigation of four "explorations sites": her home village of Edberg; Edmonton, her university town; Calgary, where she currently lives; then, finally, she travels to Ellesmere Island in the extreme Arctic, with her male companion, himself an exploration geologist, and a Penguin Classics copy of *Anna Karenina*. Van Herk's investigation of the interrelations between humans and landscape in the Canadian West and North turns into an exploration of how the identity of these landscapes has been altered by civilization and, in turn, has formed those living there. Her description of the Canadian West ties in with Northrop Frye's (1971: 224) suggestion that Canadian civilization expresses "the conquest of nature by an intelligence that does not love it": by forcing the country into geometrical survey grids, "throwing down the long parallel lines of the railway, dividing up the farm land into square-line sections and concession line roads". In *Places far from Ellesmere*, the narrator describes her home village of Edberg as one such "square grid of section lines, homesteads, settlements" (1990: 14), and Edmonton, her university town, as a former fort, the stronghold of the Hudson's Bay Company, which for centuries ruthlessly exploited the North. Calgary, whose recent oil boom has resulted in "grit-blown monoliths … [that] stand for death, another Stonehenge in haphazard phalanx" (*ibid.*: 66), has transformed the wilderness into city monuments, with the pre-historic fossils embedded in the stone walls of the buildings signifying the conquest and death of nature.

By contrast, van Herk's description of Ellesmere, which she pits against this image of death and stasis, is a celebration of processes and of perpetual movement, like that of what she calls the "puzzle-ice" of the arctic:

> Puzzle-ice. Mesmerizing, its slow wash and float, its conundrum melting and reappearance. The chunks themselves islands and the arctic ocean between a liquid light. (Herk 1990: 88)

The constant motion of this arctic landscape, which eludes fixed boundaries and territories, forces the narrator to learn how to deal with chaotic and self-regulatory systems, such as the arctic ice, and to read their signs in order to survive: walking on Ellesmere is like "always

reading an eternal book" (1990: 131), but one whose unpredictability forces you into continuous adjustment. Instead of fixity and stasis, van Herk's narrator seems to prefer motion and mobility, such as her own walking, the nomadic population's way of life, or the constant movement of the "puzzle-ice", as a process of which she becomes part and which parallels her own quest for new modes of interpretation and expression.

By juxtaposing her narrator's reading of the natural signs of the Arctic with her re-reading of Tolstoy's *Anna Karenina*, van Herk has her text represent the process of self-interpretation as dialectic interplay. The boundary location becomes significant, because "[o]nly the north can teach what reading means, and you are a woman in the north, reading a woman written by a man to whom women were a mystery … " (1990: 132). Hence, her narrator's dialogic reading of *Anna Karenina* — she silently discusses Tolstoy's novel and questions his authority by demonstrating that his story about Anna Karenina is pervaded by the 19th century's double morals — which is paralleled with her own experience on the island, has the text enact the process of figuring the "self" in a continuous dialogue:

> But whose invention is she? Tolstoy's? The nineteenth century's? Russia's? The novel's? Yours? She is the north's invention, her figure only dreamable when the eye swings towards the polar star. But how then to read her? Is it possible to read her in the south, from the south? In that blindly south-faced reading, is it possible to read at all? … You are closer to Russia than to home: reading is a new act here, not introverted and possessive but exploratory, the text a new body of self, the self a new reading of place … the closest you can get to reading and still know story is this undiscovered place, the farthest possible reach of all reaches, this island paradise, this un/written northern novel, this desert un/kingdom. (1990: 113)

The dialogic exchange corresponds to the Peircean idea of unlimited semiosis, where "thinking always proceeds in the form of a dialogue — a dialogue between different phases of the ego — so that being dialogical, it is essentially composed of signs" (CP 4.6). Peirce's idea of thinking as dialogue also recalls Michail Bakhtin's notion of dialogism as a fundamental principle for the constitution of identity. According to Bakhtin, the self can only see itself from the imagined perspective of an Other. Otherness becomes "the ground of all existence and […] dialogue the primal structure of any particular existence" (Clark, Holqvist 1984: 65). Hence, the constant crossing of the boundary between the inner I and alterity creates a relationship

between the self and all that is other: "The Bakhtinian self is never whole, since it can only exist dialogically" (*ibid*.).

Van Herk plays with this notion by having the intimate second-person pronoun "you" function both as an Other and as a self-referring second-person address, which blurs the distinction both between self and Other and between the roles of narrator and reader, in the same way as she becomes part of the island, where the interaction between body and environment seems to be one of "pleasure" and "seduction". Thus, drawing water from a river becomes an integrated, synesthetic movement of "buckets and waters and stones and the muscles of shoulder and arm" (Herk 1990: 109), with the parataxis transmitting the feeling of interacting with nature.

Like Atwood, Herk fictionalizes autobiography in order to explore the close relationship between the construction of identity and an existential interaction with nature; and like Atwood, she uses this "journey to the interior" (which takes place on an island in both works) as a device for the cultural mapping of the relationship between humankind and nature. Defining the act of writing as "grappl[ing] with the urgency of transforming reality into a sign" (1996: 229), she has this "transformation of reality" make "the text a new body of self, the self a new reading of place" (1990: 113) in order to map both civilized space, with its history of the human exploitation of natural resources, and the unmapped, undocumented arctic wilderness of Ellesmere Island. Thus, by exploring literary and geographical landscapes by mingling cultural and natural signs, carefully avoiding the "gridlines" laid out by traditional appropriations of literature and landscape, van Herk uses the "empty" space of Ellesmere to break free of the constraints of mapped and civilized space and to negotiate new identities beyond the traditional boundaries between nature and culture.

To conclude, in the face of a continually shrinking natural environment, our perception of the semiotic threshold between nature and culture is becoming increasingly important for the survival of the wilderness and its various ecosystems. Literature, which automatically forces the reader to take the position of an Other, can both reflect and induce an understanding of "outside" or "peripheral" categories such as the wilderness, and help develop an ecosemiotic orientation in order to find new ways of reading the signs of a nature of which we are a part. Hence, the Canadian context of Atwood's *Surfacing* demonstrates the complexity of the relationship between nature and identity, and its implications for a Canadian national identity, whereas van Herk's exploration of both discursive space and wilderness at the lim-

its of cartographic space suggests new ways of articulating shifting positions both in fiction and in nature, and an urge to move away from a specifically Canadian to a more global awareness of our natural predicament.

References

Atwood, Margaret 1970. *The Journals of Susanna Moodie*. Toronto: Oxford University Press.

— 1972. *Survival: A Thematic Guide to Canadian Literature*. Toronto: House of Anansi.

— 1989. *Surfacing.* Toronto: Fawcett Crest.

— 1991. *Wilderness Tips*. London: Bloomsbury.

— 1995. *Strange Things: The Malevolent North in Canadian Literature.* Oxford: Clarendon.

Clark, Katerina; Holquist, Michael 1984. *Michail Bahktin.* Cambridge: Harvard University Press.

Cooper, James Fenimore 1985. *The Leatherstocking Tales*. Vol. 1. New York: Literary Classics of the United States. 2 vols. 3–1349.

Frye, Northrop 1971. *The Bush Garden*. Toronto: House of Anansi.

Grant, Shelagh 1989. Myth of the North in Canadian ethos. *Northern Review* (3/4): 15–37.

Herk, Aritha van 1990. *Places far from Ellesmere*. Red Deer: Red Deer College Press.

— 1996. The map's temptation or the search for a secret book. *Journal of Commonwealth Literature* 31(1): 129–136.

Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Trans. by Barbara B. Haveland. Bloomington: Indiana University Press.

Howells, Coral Ann 1996. *Margaret Atwood*. London: Macmillan.

Hutcheon, Linda 1988. *The Canadian Postmodern: A Study of Contemporary English-Canadian Fiction*. Toronto: Oxford University Press.

Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–371.

Laurence, Margaret 1966. The Loons. *A Bird in the House*. Toronto: McClelland & Stewart.

Lotman, Yurij 2001. *Universe of the Mind: A Semiotic Theory of Culture*. Trans. by Ann Shukman. London: Tauris.

MacLulich, T. D. 1988. *Between Europe and America: The Canadian Tradition in Fiction.* Toronto: ECW.

McGregor, Gaile 1985. *The Wacousta Syndrome: Explorations in the Canadian Langscape* [sic]. Toronto: University of Toronto Press.

Merchant, Carolyn 1996. *Radical Ecology*. New York: Routledge.

Moodie, Susanna 1989. *Roughing It in the Bush*. Toronto: McLelland & Stewart.

Morton, W. L. 1972. *The Canadian Identity*. Toronto: University of Toronto Press.

Nöth, Winfried 2000. *Handbuch der Semiotik*. (2nd ed.) Stuttgart: Metzler.
— 2001a. Ecosemiotics and the semiotics of nature. *Sign Systems Studies* 29(1), (this vol.).
— 2001b. Semiogenesis in the evolution from nature to culture. To appear in Violi, P.; Ala, M. (eds.), *Origin of Semiosis.* Turnhout: Brepols.
Oelschlaeger, Max 1991. *The Idea of Wilderness*. New Haven and London: Yale.
Peirce, Charles S. 1931–1958. *Collected Papers*. Vols. 1–6 (C. Harthorne, P. Weiss, eds.), vols. 7–8 (A. W. Burks, ed.). Cambridge, Mass.: Harvard University Press. [Quoted as CP]
Reaney, James 1991. Afterword. In: Reaney, James *Wacousta*. Toronto: McClelland & Stewart, 540–544.
Richardson, John 1996. *Wacousta, or the Prophecy: A Tale of the Canadas*. Toronto: McClelland & Stewart.
Santaella Braga, Lucia 2001. 'Matter as effete mind': Peirce's synechistic ideas on the semiotic threshold. *Sign Systems Studies* 29(1), (this vol.).
Sebeok, Thomas 1991. *A Sign is Just a Sign*. Bloomington: Indiana University Press.

Дикая природа в экосемиотической перспективе

"Дикая природа" (wilderness) является концептом, который в последние годы существенно преобразился. В результате глобальных маштабов уничтожения природной среды, которому сопутствует и уничтожение дикой природы и ее разных экосистем, дикая природа из изначального отрицательного Другого превратилась в объект всеобщего внимания. "Дикую природу" не воспринимают более просто как место, а как категорию, которая тесно связана с развитием человеческой культуры, и экологические знаковые процессы которой требуют внимательной интерпретации.

В результате человеческой деятельности и репрезентации природа является политизированной. Модели природы и ее изображение в искусстве, в той мере, в какой они выражают властвующие идеологии, указывают на тесную взаимосвязь природы и культуры. Это характерно прежде всего для концепций природы в Канаде, где к дикой природе относится множество озер, лесов и арктические северные территории, в связи с чем выработалось особенное "канадское" отношение к природе. Изменения в литературных описаниях отношений между человеком и окружающей средой в канадской прозе вызывают вопросы о роли семиотического порога и границ между культурой и природой в формировании идентитета.

Metsik loodus ökosemiootilises perspektiivis

“Metsik loodus” (wilderness) on kontsept, mis on viimastel aastatel läbi teinud põhjaliku muutuse. Tingituna looduskeskkonna hävitamise globaalsetest mastaapidest, millega kaasneb ka metsiku looduse ning selle erinevate ökosüsteemide hävitamine, on metsik loodus algsest negatiivsest Teisest muutunud avaliku tähelepanu objektiks. Kasvav teadlikkus looduslike alade hävitamise tagajärgede pöördumatusest on tinginud suurema tundlikkuse meie loodusest sõltuvuse suhtes; ühtlasi ei mõisteta “metsikut loodust” enam mitte kui lihtsalt kohta, vaid kui kategooriat, mis on tihedalt seotud inimkultuuri arenguga.

Inimese tegevuse ja representatsioonide tulemusena on ka loodus politiseeritud. Looduse mudelid ja selle kujutamine kaunites kunstides, kuivõrd need väljendavad valitsevaid ideoloogiaid, viitavad seetõttu kindlale kultuuri suhtele loodusega. See kehtib eriti looduse kontseptsioonide kohta Kanadas, kus metsikus looduses leidub ulatuslikke metsa- ja järvealasid ning arktilisi põhjaalasid, mille tõttu on välja kujunenud eriline kanadapärane suhe kanadalaste ja nende looduskeskkonna vahel. Muutused inimese ja keskkonna vaheliste suhete ilukirjanduslikus kujutamises Kanada proosas — alates metsiku looduse kahetisest tajumisest nii ähvardava Teise kui ka vaba ruumina kuni ohustatud loodusega identifitseerumise ning selle mõistmiseni postmodernse piiriületuste ja võimaluste kohana — tekitavad küsimusi nii looduse ja kultuuri vahelise semiootilise läve kui ka piiride rolli kohta identiteedi kujunemisel.

Nature between fact and fiction: A note on virtual reality

Svend Erik Larsen
Department of Comparative Literature, Aarhus University
Langelandsgade 139, DK-8000 Aarhus C, Denmark
e-mail: litsel@hum.au.dk

Abstract. The paper places the trendy notion of virtuality and virtual reality in a conceptual and historical context that makes it useful in a semiotic perspective. Virtuality is connected with the classical notion of fictionality, in its meaning of both invention and deception. Historically an active, a passive, and a neutral version of the concept can be distinguished. The notion is reinterpreted as a variant of the semiotic processes of deixis. In relation to nature — scenarios, prognoses, hypotheses, etc. — virtuality is seen as a means of anchoring the human subject in nature instead of constructing a nonreal universe separated from it.

1. Fact, fiction, and nature

Nature is part of our world of experience and therefore a material fact. On the other hand, nature can never be exhaustively accounted for in any experience, is it individual or shared, immediate or accumulated, instantaneous or mediated. Therefore, an essential and not just accidental part of our relationship to nature is that there is always a *beyond* any sensual experience that can only be grasped in symbols or in a symbolic activity by which we produce nature as a conceptual complex or just as an image. What we experience is always both experienced as something and imagined as something, whether the context be aesthetic, mythological, scientific, agricultural, ecological, etc. The

goal of some approaches is to make experience and imagination meet in a synthesis — reality shall conform with the theoretical models of it; the goal of others is to maintain the opposition. Imagination transcends and deny the material experience in favor of a larger cosmological totality. To put it briefly, one might say that nature, in any context, is always both fact and fiction or rather always positioned between the two; in short: nature is always part of some process of semiosis.

In this general sense, fiction or fictionality does not only refer to a world of literary imagination. A brief glance at literature may give us an idea of its general meaning. Latin *fingo* both means 'I deceive' and 'I invent'. The opening of Honoré de Balzac's novel *Illusions perdues* (1837–1844) tells us that the events of the novel take place before the Standford printing press was invented. How can he talk sensibly about things that are not yet there? It is a reality for us and the narrator, but a mere illusion for the characters or just not conceivable for them. The simple piece of information accentuates the difference between two worlds with a different ontological status.

Another chapter, opening the second part of the same novel, relates to us that "neither Lucien, nor Mme de Bargeton, neither Gentil, nor Albertine […] ever talked about the events on this journey to Paris". The narrator does not say anything about it either. Here, the fiction is construed in such a way as to points to something existing for the characters only, but which is also conceivable for us who know that Paris is a city on the map, although we will never come to know what happened during this tour. The reality to which "our" Paris belongs cannot provide us with any supplementary information. The tacit events are entirely undefined in the fictitious universe as well as in ours, but not in the same way.

Fictionality is a way of both separating and unifying different worlds that exist under different ontological conditions. It allows both to invent a world from a different perspective and at the same time to deceive the agents in one world when facts are presented according to the conditions of the other. Thereby a third world is constructed in which the questions of invention and deception are formulated and answers may be suggested. In this sense, literature and scientific enterprise are not essentially different, but they operate under different conditions regarding the methodology and validity of questions and answers, of invention and deception.

Fictionality is a semiotic means of enlarging or reducing the number and kinds of worlds we are faced with and of increasing or reduc-

ing the conditions on which they exist. From this perspective, fictionality is not a monolithic notion of artistic creation, but a general feature of the language-conditioned semiotic activity of humans. The analytical potential of fictionality becomes apparent if we see it in relation to the contexts in which the construction of alternative worlds takes place and if we consider the oppositions that define the specific position the fictional context. From this contextualized position also follows that there are specific limits to the worlds of fiction, depending on the context and on the conditions which allow the worlds to be distinguished. From a semiotic perspective, three relevant contexts are shown in Figure 1.

CONTEXT	DEFINING OPPOSITION	CONDITION/ LIMIT
referential	*real/nonreal*	*Human experience*
media specific	*Immediate/ Constructed*	*Expressibility*
communicative	*Reliable/ Nonreliable*	*mutual understanding*

Figure 1. Defining contexts of alternative worlds.

In a *referential* context, the basic defining opposition of fictionality holds between *reality* and *nonreality*, whereas in a *media specific* context, the basic defining opposition is that between *immediacy* and *construction*. When fictionality is placed in a *communicative* context, the defining opposition holds between *reliability* and *nonreliability*. In these three contexts, fictionality is positioned in the domains of *nonreality*, *construction*, and *nonreliability*.

Therefore, in a referential context, fictions reduce or enlarge the kind and number of worlds we are engaged in, according to the limits of human experience. For example, in the case of Balzac, the reference to the Standford printing press is an experience in our own, but not in the fictionally constructed universe. In a media specific context, fictions reduce or enlarge the kind and number of worlds we are engaged in according to the limits of the expressibility of the various media involved. For example, in the case of Balzac, the narrator remains silent *vis-à-vis* the readers, who are never to know about the details of the journey of which the fictional characters are perfectly

well informed. Finally, in a *communicative* context, fictions reduce or enlarge the kind and number of worlds we are engaged in on the conditions of the limits of mutual understanding. In our example from Balzac, the narrator remains silent, but we imagine easily the troubles and embarrassments of the journey and why the characters remain silent. On the other hand, we also realize that neither the narrator nor the characters are entirely reliable because we will never be able to know whether they hide details from us. Fictions are hence not simply nonreal, constructed, and nonreliable, but they are semiotic constructs that allow us to discuss conditions and limits of human experience, expressibility, and mutual understanding.

This is why the construction of fiction is useful and even necessary when our relationship to nature is concerned. Nature is often supposed to transcend or simply do away with the various oppositions and conditions and, particularly, their context dependence. It seems as if nature goes beyond any human context, but this is not so, at least not any more. Nature does not state unambiguously what reality beyond human *experience* really is; nor does it offer a self-evident presence beyond any particular *medium* of expression or an immanent meaning beyond any *communicative* understanding.

Thus, in the realm of *reference* it is useless to distinguish between an earthquake and the melting down of the Chernobyl nuclear plant: the size and the consequences of the events are of the same scale independently of the degree of human intervention before, during, and after the fatal event. Whether released by humans or not, the nuclear process follows its own course. As far as the *medium* is concerned, the electronic media has blurred the basic difference between what is constructed and nonconstructed, at the level of highly sophisticated landscape scenarios, surgery equipment related to our bodies, laboratory simulations related to the terrestrial or planetary environment, as well as at the level of everyday self-perpetuating media constructed pseudo-events.

Finally, as to *communication*, the suggestive metaphor of a hole in the catchy term of the "the ozone hole" — like a hole in the roof that needs repair — is an example of what can be communicated convincingly to a large public. However, this metaphor has nothing to do with the selected chemical data referred to and listed in media specific digitalized messages received from the measurement technology by which the details of the ozone concentration and location in the atmosphere are defined more precisely. Such data cannot be deciphered by any single lay person or expert nor the details of the inseparably inter-

twined politico-scientific-technological criteria for the selection of ozone as a phenomenon most relevant among other possible natural deviations from a hypothetically balanced situation.

If nature in earlier times transgressed the dichotomies of real vs. nonreal, immediate vs. constructed, and reliable vs. nonreliable in the domain of the real, the immediate, and the reliable, one might say today that nature blows up these dichotomies at their opposites. It is because of nonreal constructions of a not entirely reliable character that we can relate to nature under modern conditions. The Rio convention on the environment of 1992, with its arguments based on mixed natural-political criteria and its ensuing principles for nature protection and political decision making, is the first major global sign of nature as factual fiction or fictional fact. At any rate, nature is in no way outside the game of contextualization, fictionality, and constructibility. Basically, the changing place of nature in human reality since the 20th century has been a reason why we are forced to reconsider what fictionality and constructibility is or might be. In a cluster of relevant terms the notion of *virtuality* has been the most enticing in this reconsideration of the reality of nature.

2. Virtualities

In the Western World, any kid between 8 and 80 will relate virtual reality to some kind of electronic gadget with gloves and glasses and similar outer space type of outfit, something that is not really real. Hence, it might be inferred that virtual nature is fake nature, theme park nature. Analogically, virtual cities may be taken as utopian prospects, Piranesi drawings, futuristic urban planning never to be realized. Let me try to suggest a different interpretation of virtuality in line with the above reflections on fictionality.

The term ‘virtual reality’ has first been used in American English, but even without translation, it has entered other languages, for instance, my own mother tongue, Danish, and this is not by chance.

First, the technological capacity of the US to produce the virtual reality equipment as a popular toy as well as a powerful tool is evident — the term and the thing was born together in the US, like jeans and coke.

Second, words like ‘virtual’, ‘virtuality’, or ‘virtually’ have a much more widespread use in everyday English than in other European lan-

guages, where similar words are also part of the vocabulary, as for instance in French, but on a narrower semantic basis as a comparison with Webster's or Roget's *Thesaurus* with any French *Dictionnaire de synonymes* will show. This linguistic fact explains why we, in English, so easily construct a virtually — as it were — endless chain of terms like 'virtual nature', 'virtual cities', 'virtual water', 'virtual landscape', 'virtual sex', 'virtual space' — all with virtual reality as the hidden point of reference. Here, we have an inflated semantics that forces us to ask whether we are dealing with the same type of virtuality or reality in all cases. What are the consequences if we are, or if we are not? Does it matter to be concerned with historical semantics, or is it just an example of academic acrobatics?

Third, constructive or playful approaches to reality seen as natural to humans is a fundamental idea in Western thought, based on a rich stock of dichotomies such as actual vs. virtual, real vs. fictional etc. Since Plato and Aristotle we have either been denigrating or praising the second term of the opposition but rarely, if ever, we have taken a neutral stance to it. This is not the case in all cultures, not even in all high-tech societies. In Japan, e.g., nature is seen as a constructed aesthetic phenomenon expressing emptiness quite different from the spontaneous European sublime expressing trans-human values.

Therefore, my point here will be that it is important to consider semantics and history, especially in our own culture, both for our conceptual and practical relation to our environment.

The notion of *virtuality* is opposed to the one of *actuality*, which we have inherited from the medieval scholastics, who shaped it by their endless ruminations on the modes and appearances of reality. The opposition in Greek was the one between *dynamis* and *energeia*. I will distinguish between three meanings of virtuality which today seem to grow apart to the point of confusion. Even in the innocent use of the word 'virtual', 'virtuality', or 'virtually', these meanings play around with us both in everyday communication and in scientific or otherwise consciously elaborated contexts. I will dub the three meanings, or rather three argumentative strategies, the *active,* the *passive* and the *neutral* meanings.

3. Active virtuality

Virtuality most often means 'the power, the capacity of something to be actual'. This is the *active* sense. The basic assumption is that the identity of a phenomenon relies on the fact that it has some immanent formative power enabling it to move from one state to another, which is more appropriate for this phenomenon and makes it more fully developed. In classical philosophy, this engendering virtuality used to be identified with the form of the thing, its inherent possibility to reach a kind of final state of being fully actualized. The fully grown tree would actualize the virtuality of the seed (analogically, in the case of human beings, we refer to their *virtues*).

Hence, the actual state is not different from the virtual one, but it is the effect of the virtual power. The actual makes the virtual visible or palpable, but it does not transgress it. The virtual form is still there also in the actual state. Otherwise, there would be no actuality. They are levels of the same reality. There is no *temporal* difference between virtual and actual. We do not have first the virtual then the actual. Virtuality is a timeless process releasing power, whereas actualization is a process.

From Greek and Roman philosophy — for instance from the teleology in Cicero's *De natura deorum* (45 BC) — this way of thinking was easily integrated in Christian thought culminating in Scholasticism, virtuality being basically identified with the creative power of God inherent in everything created as its purpose. The virtual and the actual are similar but not identical phenomena, and always co-existing and mutually interdependent and — particularly — equally real and immediately natural.

When Aristotle describes the good city in the seventh book of his *Politica* (ca. 350 BC), he outlines the features of the right place to build a city. Such a place is given by nature as a virtual city-place, and it remains such a place the more the city is actualized as a good city. The place allows for a city. If the urban development destroys the virtuality of the place, the actual city will crumble, as Augustine claimed for Rome in *De civitate dei* (ca. 425 AD). The whole notion of *genius loci* in relation to nature is related to this aspect of virtuality.

4. Passive virtuality

Virtuality has a *passive* meaning, too, also handed down from classical philosophy. Matter, *substratum*, *hypokeimenon*, and such concepts

refer to aspects of reality without an inherent form or an active formative capacity, without *dynamis*. Matter in this sense is void of forms and therefore ready to receive any form that may turn it into things with an identity. It is undetermined and therefore virtually everything else. 'Virtual' means that matter is a *tabula rasa*. Here the relation between actual and virtual is different from active virtuality. In the former case, the virtual is a permanent immanent determination of the actual, in the latter, actualization makes virtuality disappear, often in degrees — certain things are more actual than others. The *tabula rasa* is more or less filled out and is no longer *rasa*. When things are actual, they are no longer virtual. Therefore actuality and virtuality are fixed properties of something, not, as in the case of active virtuality, stages of an ongoing process. The virtual and the actual are mutually exclusive opposites.

In his *Novum Organon* (1620), Francis Bacon claims that nature has no power to become actual and thus to become real nature without human intervention. Humans release the virtuality of nature, turn it into actual and real nature in order to make God's intentions visible as mediated by humans. Being actual means being no longer virtual, which is an inferior state, ultimately brute and shapeless nature. To Bacon, therefore, natural history and the history of technology are but one and the same natural history. This is the dawn of empiricism, of the natural and the applied sciences. Previously to this period, human intervention was also necessary for passive virtuality to be actual, but only in a process of cognition, not of practical action, as, for instance, in Aristotle's theory of the mind, as presented in his psychology, *De anima* (ca. 450 BC).

In this work, Aristotle interprets our mind as an organ different from our more specialized senses in its capacity to perceive all forms *and* to reflect upon them. Our mind has a double structure. It is a receptive mind and a reflective mind, and this twofold nature constitutes the virtuality of the mind. The mind is empty but not passive. It is not a *tabula rasa*. In this context a temporal dimension is involved: first virtual and unspecified, then actual and specified. Here we have a premeditation of the notion of virtuality later developed in the applied sciences and planning processes seen as finite processes developing from a plan to a result.

This approach can be found, for instance, in Abbé Morelly's utopian city, as described in his *Code de la nature* (1755). Nature is a passive, quantitatively constituted, and ordered harmony of proportions. Through human intervention, this harmony may be transposed

to other areas and thereby realized or actualized, for instance, when the harmonious layout of a city, irrespective of its location, mirrors the harmonious, measurable, and quantifiable proportions of nature. Here, and in contrast to Aristotle and the classical concept of *genius loci*, the form defines the site — Athens is a form developed on a virtual, natural site, Brasilia is a form transposed and forced upon an arbitrary place, its virtuality being its plan, as drawn by urbanists and developers, just like the urban grid of New York invented in 1811 before any sensible person could imagine that Manhattan could be the site of a proper city (cf. Glaab, Brown 1983: ch. 12).

5. Neutral virtuality

A third meaning of virtual, the *neutral* one has grown from modern science, first from Newtonian mechanics and the theory of optics that is part of it and later also from nuclear physics. Here, terms like 'virtual image', 'virtual work', or 'virtual state' refer to theoretical constructs that have no empirical status whatsoever outside the language of their theories. 'Virtual work', e.g., is a theoretical construction of the infinite number of hypothetical states that a moving object passes through from one position to another according to the laws of mechanics. These states cannot be singled out and or observed. They are simply identical with their mathematical formula, a calculus, and have no other identity.

The 'virtual image', too, is a construct, according to the laws of optics. An image is virtual and not real if it looks as if it comes from another place or object than that from which the rays really comes. If you look at a stick in water, for instance, it looks broken. The linear prolongation above the water surface from the part of the stick that is below the surface will constitute a virtual image. The 'virtual state' of 'virtual particles' refers to theoretically constructed particles used to explain what is going on between charged particles. "They […] are not in the real state, i.e., directly observable, they are constructs to enable the phenomenon to be explained in terms of quantum mechanics" (Isaacs *et al*. 1991: s. v.).

In all such instances the virtual is opposed to what is real, and virtuality is not bound to any active force or any passive receptivity of anything as in the first two instances of virtuality. Thus, there is no change from a virtual to an actual or real state of things. Virtuality is

not a property of anything, it is exclusively bound to the medium that makes it manifest, be it a theory, a formal language, or an optical piece of equipment. Virtuality belongs to the symbolic structure of the semiotic system involved and not to the referential dimension of signs, as in the case of Aristotle's active, or Bacon's passive virtuality.

The third version of virtuality interprets the pair 'virtual' vs. 'actual or real' as exclusive opposites like in the passive sense of virtuality, but it does not entail any ontological assumptions that cannot be deduced from the medium in question. The relation between virtual and actual or real, therefore, is arbitrary or, to phrase it slightly differently, it is media determined all the way through. Reality is simply the sum total of all empirical phenomena as far as they follow the laws of physical mechanics, of optics, or whatever a formal language can define as real.

In the active and the passive conception of virtuality, however, ontological assumptions are important in their own right. In the first case, reality is a synthesis of actuality and virtuality in a self-governing process. In the second case, matter is empty and therefore part of a process governed by the forms that are imposed on it and it is precisely its emptiness that makes it possible for forms to act as forms. In the third case, matter, as empirical reality is neither processual nor empty, but dead material brought to life, as it were, through theoretically based mental or material constructs. According to John Locke and the materialist philosophers of the 17th and 18th centuries, the mind is also empty *and* dead in this sense. It has no structure of its own but what is imposed upon it through the senses. Ideas are understood from theoretical models constructed on the basis of causal relations between material things.

6. Virtual reality

It seems clear to me that 'virtual reality' in the sense of computerized gloves and glasses or in terms of powerful tools for the construction of scenarios in the planning of bridges or landscapes are virtual in the third sense, absorbing the second, the passive one, but in a deontologized sense. There is a temporal relation between virtual and actual, as in the case of the passive virtuality — from a scenario which is first to a reality which is second —, but the relation between them is arbitrary, as in the case of the neutral virtuality based, as it is, on an ex-

plicit methodology of semiosis. In neither of the cases the virtual and the actual are levels of the same reality: virtuality is nonreal as a hypothetical sketch on certain media specific conditions, actual reality is the end result.

We need to reintroduce the first, the active sense, but without of its mainly teleological metaphysics. My claim is that it is both necessary in relation to nature and possible in relation to theory and practice to bring about this reintroduction. However, it is not a choice that goes without saying. It is a matter of theory, definition, and decision, because everyday language does not make any choice for us.

I find the combinations of virtuality and reality equally confusing both outside and inside the casual context of everyday communication. The problem is that we cannot return to a prescientific notion of virtuality, e.g., to the one of Bacon. The technology that makes the relation between virtuality and reality arbitrary to a certain extent is simply present everywhere around us. Our entire social structure, materially and symbolically, presupposes it. Bacon is right: natural and technological history *is* the same history. But nevertheless, I will try to restore the ontological dimension of the notion of virtuality lost in the passive and neutral conception but without adopting the metaphysics that usually goes with it.

In this respect, it is worth while remembering that the classical notions of reality have had two important characteristics: on the one hand, reality is not real without human participation (but not necessarily human control). On the other hand, it is not anthropocentric in the modern sense of utilitarianism with human control and human purposiveness as its core. In contrast, post-Newtonian reality obeying natural laws of mechanics is indifferent to human participation. If humans are involved, they are real in the same sense as all other things: the mind functions according to material causality, and the body is a particular kind of bio-mechanical machine. The contrast to this conception is an anthropocentric version of reality, seeing reality as an environment around our perceptions and mental projections — an *Umwelt*. This viewpoint is a consequence of Kantian and Romantic philosophy leading to phenomenology and, for instance, Jakob von Uexküll's biosemiotics. This basic epistemological anthropocentrism is not bound to any utilitarianism, but is a way of grasping bodily human presence as fundamentally mediated by perception, cognition, and symbols.

It is evident that the gadget version of virtual reality constructs and also presupposes an anthropocentric space, whereas in the virtual real-

ity scenarios for planning of bridges, landscapes etc. human presence makes no difference to the functioning of the scenario as a technical construct. Humans are just another component or factor. We may say that plus minus human presence indicates two possible worlds at the same ontological level. However, if we wish to draw this difference, a basic difference in our understanding of reality, the distinction will have to be imposed on the neutral definition of virtuality which is the basic definition in a technologically hyperdetermined human reality. In order to propose an ontologically loaded but nonutilitarian conception of virtuality, I will make a detour into fiction and literature before I return to nature.

7. Possible worlds and human location

The American literary theorist Marie-Laure Ryan has developed the notion of possible worlds in such a direction. In her *Possible Worlds, Artificial Intelligence, and Narrative Theory* (1991) she does not use the term virtuality, but reality and actuality, instead. She defines a "system of reality*"* as a set of distinct worlds. "The system has a modal structure and forms a modal system *if* it comprises a central world surrounded by satellite worlds. The center of a model system is its *actual world*, the satellites are alternative possible worlds" (Ryan 1991: vii). The modality is of course expressed in the 'if'. "The actual world, the center of our system of reality, is the world where I am located" (Ryan 1991: vii).

Now, an *alternative possible world* is one of the other worlds in the modal system. The *textual reference world* is the world for which a given text claims facts (e.g., a set of quantitative data, such as, 'King Lear has three daughters'). To Ryan, a text is any media specific presentation of a world (we cannot talk about representations because we are dealing with possible worlds). The *textual actual world* is an image of the textual reference world proposed by the text in pictures, numbers, letters, gestures, etc. Ryan also makes other distinctions relevant for her narrative theory that I have to omit here.

The main point for me is not the logico-technical definition of possible worlds, but her claim that the actual world is part of, and determines, reality as a set of distinct worlds, whether possible or not. It is the basic modality of the system, as Ryan puts it. The possibility for humans to be located is essential — with symbolic means, e.g., the

deictic functions of language and other semiotic systems, or material means for bodily location, e.g., walking, working, building. To the act of location belongs the very production of plans, projections, possibilities, alternatives, etc. in any medium. Reality is the whole set of possible worlds around an actual world. Making plans for a future state of affairs is a way of locating oneself in the actual world, of changing positions etc. Planning is not the process of presenting something that is nonreal, but may eventually become real in the future. It is an intervention in the system of reality. Virtuality, is then, so to speak, the localizability of a phenomenon, its possibility to be related to the actual world.

Ryan goes a step further in claiming that the actual world is not only the world in which I am located but "from which I speak" (Ryan 1991: 17), thereby linking inextricably the notion of actuality to the production of symbols, suggesting an "indexical theory of actuality [where] speech acts always take place in the actual world for their participants" (Ryan 1991: 22).

Here, the bottom line is that virtuality is a human construction — in any material medium, language, pictures, machines — by which humans anchor themselves in an actual world. Virtuality is a semiotic process. Therefore, like any other semiotic process virtuality related to human participation cannot work without ontological assumptions concerning the status of the sign and its object as, for instance, in Charles Sanders Peirce's semiotically adapted realism. When virtuality is put to work it works mainly through deictic functions by which we anchor ourselves in a bodily universe, thus embedding the different possible worlds from the point of view of an actual world. Virtuality is first of all a semiotic process through which we produce human location, and it is only accidentally bound to a specific — and spectacular or sophisticated — technology or other specific material media. The deictic symbolism is intimately and most fundamentally related to our bodily presence.

The otherwise stimulating book by Thomas Pavel, *Fictional Worlds* (1986), presents possible worlds as a system of parallel worlds, but not, as Ryan does, as semiotic process of location. This is another useful conception of fiction and literature. It makes fiction accessible as a specific human — and not just logically analyzable — activity based on a human dependence on semiotic systems and thereby on an anthropocentrism more basic than utilitarian systems of human interest.

Another characteristics of virtuality is the one pointed out by Lubomir Doležel in his *Heterocosmica: Fiction and Possible Worlds* (1998: 222): "Fiction thrives on the contingency of worlds emphatically asserted by the idea of possible worlds: every world and every entity in the world could be or could have been different from what it is". With this in mind, our view of virtuality can be stretched a little, and we arrive at the following definition: virtuality is a human construction — in any material medium — by which humans anchor themselves in an actual world in view of its possible changes. Virtuality, then, carries with it the conditions and limits of the possible changes.

Nature, in this context, is an aspect of our actual world with specific conditions and limits for changes through human intervention. We cannot have a relation to nature without constructions, without fictions, without virtualities.

In different historical epochs, the phenomenon, which we see as virtual, tends to change. For Aristotle, the place or the site constituted the basic virtuality of space. For a modern planner, the model or plan or the scenario is the basic virtual unit explicating the conditions and limits of the natural site. Actualizing or realizing a virtuality is then to find ways, conditions, etc. for locating the plan or the model in an actual world, but it is not simply to make a reality as close as possible to the picture or the model. It is a tool for location and participation in *our* actual world. Virtual reality articulates the conditions and limits for our references, our means of expression, and our communicative understanding.

In a certain sense, then, we have returned to Aristotle, namely in the sense that virtual and actual are not fixed properties of certain phenomena, but relative stages of process. An urban plan is just as virtual as the ground to be built on and both are, as virtual phenomena, part of an actual world. However, once built, the urban environment is itself virtual in relation to what may happen in and with the city. Virtual and actual constitute links in a long chain. They are different levels of one reality. There is no way of saying that a plan, which was once not real, has finally become realized, and then it is over. The plan has always been real in the sense that it is a possible world in a given system of reality. This is the basic difference to Aristotle: the virtual and the actual are tied up with our decision-making and sign production. Ecological decision-making and sign production is but one type of process framed by virtuality.

Being virtual in this sense means having the power to enter in this process, not simply to change from plan to reality. Therefore, if a plan is virtual in this sense it will take into account continuously changing relations between virtuality and actuality, following a product from the origins of its raw material to its ultimate destruction. If a plan is virtual only in the passive or neutral sense, it only indicates the transformation from plan to thing or from unformed material to final product, and thereafter God knows what might happen to the resulting waste or byproducts. To see virtuality, as suggested, unites virtuality once more with virtue. It implies that our relation with nature is an ongoing process in which we participate. It makes us responsible all the way through, with virtual constructions to spell out — verbally, visually, or otherwise — for the conditions and limits of our participation. It obliges us constantly to locate and relocate ourselves in the actual world and the nature we live in.

References

Aristoteles 1921. *Politica. The Works of Aristotle* 10. Oxford: Clarendon.
Aristoteles 1931. *De anima. The Works of Aristotle* 4. Oxford: Clarendon.
Augustinus 1955. *Vom Gottesstaat*. 1–2. Zürich: Artemis.
Bacon, Francis 1994. *Novum Organon.* Chicago: Open Court.
Cicero, Marcus Tullius 1967. *De natura deorum.* London: Loeb.
Doležel, Lubomir 1998. *Heterocosmica: Fiction and Possible Worlds.* Baltimore: John Hopkins University Press.
Glaab, Charles; Brown, A. Theodore 1983. *A History of Urban America*. 3rd ed. New York: Macmillan.
Isaacs, Alan *et al*. 1991. *Concise Science Dictionary.* Oxford: Oxford University Press.
Locke, John 1979. *An Essay Concerning Human Understanding*. 2 vols. New York: Dover.
Morelly, Abbé 1950. *Code de la nature.* Paris: Raymond Clavreuil.
Pavel, Thomas 1986. *Fictional Worlds*. Cambridge, Mass.: Harvard Univ. Press.
Ryan, Marie-Laure 1991. *Possible Worlds, Artificial Intelligence, and Narrative Theory*. Bloomington: Indiana University Press.

Природа между фактом и вымыслом: о виртуальной реальности

В статье модное понятие виртуальности и виртуальной реальности ставится в концептуальный и исторический контекст, который позволяет его рассматривать в семиотической перспективе. Виртуальность связана с классическим понятием фикциональности, как в смысле вымышленности, так и в смысле обманчивости. Исторически можно выделить активную, пассивную и нейтральную версии концепта. Это понятие подвергалось переинтерпретации и как вариант семиотических процессов дейксиса. В отношении к природе – сценарии, прогнозы, гипотезы и т.д. — виртуальность представляется скорее в качестве средства прикрепления человека к природе, чем в качестве средства конструирования ирреального универсума, отделенного от природы.

Loodus fakti ja väljamõeldise vahel: tähelepanek virtuaalse reaalsuse kohta

Artiklis asetatakse moekas virtuaalsuse ja virtuaalse reaalsuse mõiste kontseptuaalsesse ja ajaloolisse konteksti, mis muudab selle semiootilises perspektiivis produktiivseks. Virtuaalsus on seotud klassikalise fiktsionaalsuse mõistega, nii selle väljamõelduse kui petlikkuse mõttes. Ajalooliselt on eristatavad kontsepti aktiivne, passiivne ja neutraalne versioon. Mõistet on ümber interpreteeritud kui deiksise semiootiliste protsesside varianti. Seoses loodusega — stsenaariumide, prognooside, hüpoteesidega jne. — nähakse virtuaalsust pigem inimsubjekti loodusesse kinnistavana, kui loodusest lahutatud ebareaalset universumi konstrueerivana.

Thinking with animals

Andreas Roepstorff
Department of Social Anthropology, University of Aarhus
Moesgaard, DK-8270 Hoejbjerg, Denmark
e-mail: etnoroep@au.dk

Abstract. A central claim of biosemiotics is the ascription of semiotic competence to nonhumans. For strange historical reasons, this claim has been quite controversial in much of standard biological discourse. An analysis of ethnographic material from Greenland demonstrates that people regard animals as nonhuman "persons", i.e., as sensing and thinking beings. Like humans, animals are supposed to have knowledge about their environment. Taking this semiotic competence as a fact beyond any doubt enables skilled hunters and fishermen to rely not only on their own interpretation of the environment, but also on the animals' interpretation of their environment. The behaviour of fish, seals, and land animals, meditated by their acknowledged semiotic competence, can thus be interpreted as giving signs about the behaviour, e.g., of whales and icebergs. This *a priori* ascription of semiotic competence is also apparent in discussions about management and regulation of animals. Rather than discussing whether "the stock" is depleted, much of the discourse among fishermen and hunters focuses on whether animals can be semiotically disturbed by what people are doing.

For several decades, a dichotomy between nature and culture has been a backdrop of anthropological theories, whether grounded in materialism, such as cultural ecology and Marxism, or in symbolism, such as structuralism or interpretive anthropology (Descola & Pálsson 1996). However, in recent years, a general shift of focus in ethnographic studies has questioned the reality of this dualism. Instead of being taken as a given fact, as a background allowing for the interpretation of various phenomena, the highly specific and concrete interpretations

of the nature–culture dichotomy in a given context has been put into question (Roepstorff & Bubandt 2002).

This development in anthropology and ethnography appears to run parallel with the recent developments in semiotics where, in a similar vein, the nature–culture dichotomy has become an analytical question. In particular, biosemioticians have claimed for more than a decade that it is indeed meaningful to study sign processes outside of the human realm (Sebeok 1988), and in ecosemiotics the question of how sign-processes are mediated between humans and their environment has become the focus of investigation.

Based on ethnographic material from West-Greenland, this paper reexamines Claude Lévi-Strauss' classical statement on the cognitive relationship between humans and animals (Lévi-Strauss 1963).

In moving back and forth between ethnographic descriptions and an analysis that touches on both eco- and biosemiotics, the study attempts to demonstrate how these three perspectives may be fruitfully interrelated in simultaneously calling into question the reality of the nature–culture dichotomy. The analysis demonstrates that embedded in the interactions between humans and animals is a fundamental understanding of the similarities and differences between humans and nonhumans. It is suggested that the choice of a semiotic as opposed to a physical stance towards the nonhuman world is a question inscribed in larger issues of a cosmological nature, and that the distinction between humans and nonhumans is central to how people relate to, and act in, the world.

In his classical study on *Totemism*, Lévi-Strauss (1963: 69) harshly criticizes the overtly materialist and functionalist explanation of totemism held by the British social anthropologists Malinowski and Radcliffe-Brown. As an alternative, Lévi-Strauss suggests that in totemism, "natural species are chosen not because they are 'good to eat' but because they are 'good to think'" (*ibid.*: 89). Thinking, according to Lévi-Strauss, is nothing mundane. In thinking, animals are not primarily "creatures that are feared, admired, or envied". Instead, "their perceptible reality permits the embodiment of ideas and relations conceived by speculative thought on the basis of empirical observations" (*ibid.*). The reality of totemism may therefore be "reduced to that of a certain mode of thought. [… Its] image is projected, not received; it does not derive its substance from without. If the illusion contains a particle of truth, this is not outside us but within us" (*ibid.*: 104).

Lévi-Strauss's claim that the relationship of humans to animals is first of all conceptual and not about proteins avoids a number of prob-

lems. However, his understanding of thinking appears to create a whole set of new problems to which I will return later. Meanwhile, I will shift my focus to the ethnographic scene.

The scene

From 1996 to 1998, I conducted a number of ethnographic fieldworks in western Greenland focusing on the relationship between perceptions of nature and management of living resources. A central issue was to examine how the Greenlandic hunters and fishermen related to the animals they pursued. I was mainly interested in marine animals, such as fish, seals, and whales. These animals were generally described as quite sensible beings that would usually try to get what they wanted, e.g., prey and partners, while avoiding what they did not want, such as unpleasant or dangerous things, places, or encounters (Roepstorff 2000, 2002). This representation may not seem very exotic. On the contrary, it should appear very straightforward, and this was also how I found it in the beginning. However, the position entailed some consequences that were both logical and most surprising.

Let me give an example. Economically, the most important species for the Greenlanders I was working with, is the Greenland halibut, a rather large fish of the flounder family. The species is said to be particularly fond of living in places with deep water and active glaciers or large icebergs. Now, active glaciers and icebergs are very beautiful, but they are also very dangerous to be nearby. The combination of a lot of compressed ice (most of which is under water), the ongoing melting, and the strong currents is a very unstable cocktail. Therefore, an iceberg or the front of a glacier may suddenly tip, break into pieces, or literally explode, and this can cause gigantic waves and turbulences. The consequences for anyone nearby, either on the ice or in a boat, may be literally devastating. However, it is in these very hostile places that the Greenland halibut prefers to be, so there may be very good reasons to try to be there if you are a fisherman. In the very same areas, and partly for the same reasons, one may also encounter seals, popping up and down the water between the ice floes. As several of my informants told me, this is a very good sign. Like humans, seals are not particularly fond of being near an iceberg that suddenly explodes. However, every fisherman knows that seals have better ways of knowing whether an iceberg will break than humans. As long as

there are seals around, it is considered fairly safe to be there for humans as well, but if the seals suddenly disappear, it may, indeed, be time to cut the lines and get going in a hurry.

Some of the explanations claimed for this relationship did not appear very unusual. Seals have a very good sense of hearing. They are constantly in the water, and they are therefore very likely to register, understand, and react to changes in the sounds that the glacier constantly emits. Many fishermen, while being inside their boat, have heard themselves how the constant conglomerate of sounds from the water and the ice may suddenly change shortly before something is going to happen. In knowing the behaviour of icebergs, the Greenlandic fishermen and hunters thus do not only rely on direct observation. The behaviour of seals, meditated by their acknowledged semiotic competence, can routinely be interpreted as giving signs about the behaviour of glaciers and icebergs.

There are several similar instances of the use of the competence and interpretation of a species to get knowledge about something that is invisible to humans. A classical example, first described some 100 years ago, is the relationship between the sudden disappearance of the Greenland halibut and the imminent arrival of Beluga whale that allegedly predates on this fish. When discussing this issue, one of my informants claimed that he knew for a fact that the fish knew about the arrival of the Belugawhale, but it was indeed amazing and peculiar how how the fish could know from a distance that its enemy was on its way.

Animals as nonhuman "persons"

My observations are quite in accordance with a general finding of anthropological field studies of hunters in the Arctic, namely that animals are considered nonhuman "persons" (Fienup-Riordan 1990: 168).[1] According to this view, humans and animals are alike in that they are all living beings, and they are all "situated in a field of relations which, as it unfolds, actively and ceaselessly brings form into being: humans as humans, geese as geese, and so on" (Ingold 2000: 51). The notion has two very important and interrelated implications.

[1] Very similar analyses have been given for the Yup'ik Inuits in Alaska by Fienup Riordan, for the North American Indian groups of the Cree (Scott 1996), and for the Ojibwa by Hallowell (Ingold 2000: 90).

Firstly, animals are "persons" equipped with consciousness as a consequence of their being alive (*ibid*.). Secondly, the relationship of animals and people were traditionally based on complicated exchanges based on the particular "personalities" of each species (Fienup-Riordan 1990: 168).

According to the description above, animals are sensible and sensing beings able to get what they want, such as prey and partners, while avoiding what they do not want, such as unpleasant things, places, or encounters with predators. This account of the nature of animals is hardly controversial. However, claiming that animals are "persons" is likely to appear absurd, perhaps even perverse (Ingold 2000: 90), since in the West, speaking of persons is to tell solely of the thoughts, intentions, and actions of human beings (*ibid*.). Nevertheless, even in the West, there are several instances where animals are treated like persons. For instance, pets are spoken to, expected to understand, given a name, and perhaps even taken through life cycle rituals, such as burials (*ibid*.). One may also use the animal's knowledge and senses to find things invisible to humans like one can train a dog to find explosives or drugs. This is not much different from the Greenlanders' use of the seals' behaviour to interpret the ice or the weather conditions. Thus, even in the West, animals may well be thought to be equipped with person-like qualities. However, these examples are the exception that proves the following general rule: to be a person is to be human, and animals can only be persons to the extent that 'humanity' has "'rubbed off' on them through close contact with humans" (*ibid*.: 91).

To be a person in a Western context implies hence to be touched by culture. Such a view is fully in accordance with the Cartesian dualism of mind vs. body and culture vs. nature. The two semantic axes appear to run more or less in parallel. Mind as well as personhood presupposes that a living being is impregnated with culture.

Of course, the concept of dualism is an abstraction. Nevertheless, the validity of this opposition can be demonstrated by semantic analysis as discussed above In other spheres, similar studies have shown that whole sets of meanings in verbal and nonverbal practice are structured in accordance with a general understanding of personhood as an immaterial mind , which is impregnated with culture, inhabiting a physical body, which is a concretization of nature (Lakoff & Johnson 1980; Kirmayer 1988).

The traditional Inuit understanding of human existence, by contrast, is not structured in this dichotomy. *Inuk*, a human being, is rather

understood as consisting of *timi*, usually translated as 'body', of *tarneq*,[2] usually translated as 'soul', and *ateq* usually translated as 'name' (Rink 1974; Nuttall 1992; Nuttall 1998: 182). Of these three concepts, the meaning of *tarneq* is probably the one that is most difficult to grasp, partly because the first missionaries picked on this notion as the translation for the Christian idea of the soul. However, the Christian understanding of an immortal soul, did not comply well with the traditional Greenlandic understanding, as indicated by Crantz who wrote in 1820: "There are indeed some [Greenlanders] who believe, that their soul is not immortal or different from the living principle in other animals; but these are of the most stupid sort" (quoted in Nuttall 1992: 184).

The usual translation of *tarneq* is *soul*, *mind* (Berthelsen et al. 1990). It is generally thought that the word is etymologically connected to *tarraq* ('shadow', 'reflection') and *taarneq* ('darkness') (Nuttall 1992: 65), but the matter has not been settled. According to the traditional Greenlandic belief, animals and people alike have a *tarneq* that is somehow embodied in the *timi*. In her discussion of the cosmology among the Yup'ik Eskimos in Alaska, Fienup-Riordan (1990: 168) notices that a somewhat similar stem, *takar* unites people and animals: "The qualities of personhood shared by humans and animals establish the basis for a mutual and necessary respect. Respect is understood in both positive and negative terms. Perhaps the most often used term is *takar-* ('to be shy of, respectful toward, and/or intimidated by')". However, specialists of Greenlandic etymology are not certain whether and how there is a relationship between the *takar* among Yup'ik and *tarneq* in Greenland,[3] and it is now generally

[2] To complicate matters further, *tarneq* is sometimes described as being identical with, at times different from *anersaaq*, 'breath' ('soul') (Nuttall 1992: 65–66; Birgitte Sonne, personal communication). However, for the current discussion, the more subtle distinction between *tarneq* and *anersaaq* can be ignored..

[3] The word *tarneq* consists of the stem *tar-* (*taq-*) and the suffix *-neq* which generally denotes an abstract noun like the English words ending in *-ness*. Another word using a similar stem is *taqippoq* (to be shy) that is apparently used both for people and animals. Experts on Greenlandic are, however, not certain whether the stems in *tarneq* and *taqippoq* are indeed one and the same and whether it may be related to *takar* among the Yup'ik. Etymologically, there is probably no direct connection, but the words appear to be part of a complicated semantic field in which unusual transformations are likely to have occurred due to various linguistic taboos (Mike Fortescue, personal communication). In common usage, *taqippoq* and *tarneq* are generally not considered to be connected. There may be a semantic link, though, either directly or via the common features of 'shadow' and 'darkness'. If there has been such a link in Greenlandic, it may have been made explicit in the secret language of the *angakut*

thought to be impossible to separate the original meaning of *tarneq* from its later Christian connotations.

Of the three concepts *timi*, *tarneq*, and *ateq*, only the word *ateq* has traditionally been considered to be uniquely possessed by humans. Naming in Greenland carries a strong social importance. This is not the place to give a full account of the concept, but traditionally as well as today, a child is considered to be linked socially and spiritually to the deceased persons whose names they carry, just as persons with the same name are considered to be somehow connected (Nuttall 1992: 67–69).

Now, if this abstraction is taken to be as real as the Cartesian view in Western thought, we have two very different understandings of the difference between humans and animals. In both cases, humans and animals are distinguished, since humans have something that animals do not have. Cartesian dualism, however, postulates that humans have an immaterial mind in a material and physical body, while nonhumans are nothing but material and therefore they have no mind. According to the traditional Inuit understanding, by contrast, both humans and animals have minds and bodies, although only people have *ateq* the name (soul).

I do not claim that this abstraction of a "traditional" Inuit understanding is passively being enacted in contemporary Greenland, nor do I claim that Westerners are merely passive reproducers of Cartesian dualism. However, thinking with animals, as I describe it above, appears rather incompatible with a Cartesian dualism but it is well in accordance with a traditional Inuit tri-partite understanding of humans and animals,. We will return to this topic below after a discussion of how the understanding of animals is related to ecological concerns.

Environmental protection as Umwelt protection

During the last decade, the environmentalist debate has reached Greenland and environmental issues have become a major concern for many. At times, the environmentalist discourse runs counter to ideas about management and protection of "nature" already held locally, but there is at times a strong convergence between local management and nature protection proposals and the environmentalist discourse. How-

(shamans), but this can not be established with certainty. It remains for experts in Inuit languages to pursue this matter further (Robert Petersen, personal communication).

ever, although there may be some agreement as to the measures, they appear to arise partly from different ways of thinking, as the following two examples may show.

Is gillnet fishing misbehaving?

The deep ice-fjords in Western Greenland have always been favoured as a habitat of the Greenland halibut. The best fishing site is in the vicinity of Kangia, Ilulissat icefjord, a highly spectacular location with the magnificent Jakobshavn glacier, the most productive one of the Northern hemisphere, located in the bottom of the fjord. Since the early 20th century, the halibut has mainly been caught by means of long-lines, but since the 1980's, an intensive gill-net fishery from smaller (30') cutters has begun. Since 1993, based on mathematical modelling, biologists have been calling for a reduction in fishing pressure, initially because it was feared that the stock was directly threatened, later because it was estimated that CPUE (catch-per-unit-effort) could be raised if the fishing pressure was reduced (Roepstorff 1998). Banning the very efficient gillnet fishery was considered to be an efficient measure against overfishing. The proposed ban on gillnets was partly supported by Royal Greenland, a commercial company owned by Greenland Home Rule, who in practice has an almost total monopoly on buying and processing the fish. One of the reasons of this support was that Royal Greenland found out that many fish caught in gillnets were damaged, causing a deteriorated meat-quality in the production line. Hence, both arguments against gillnets are concerned with the body of fish, although for different reasons. While the factory is interested in receiving specimens whose bodies are as unimpaired as possible, the biologists are concerned about an abstract body of the fish, the stock, which is an ideal sum of all the individual specimens (Roepstorff 1998).

Among the fishermen, there has been concern about the gillnets, too. Based on local initiatives, the use of gillnets was banned in certain zones inside the ice fjords. There appears then to be a general agreement on some limitations on the use of gillnets. However, the arguments that I recorded among the fishermen were generally very different from the ones heard from the industry and from biologists.

One of the central concerns discussed among fishermen is the existence of "ghost-nets", that is, gillnets that have been lost, but are still actively fishing in the water. Nets are easily lost when they are set in

regions of much ice, which is precisely in the zones where gillnet are banned, and the fishermen regularly urge on the municipality to do something to clean the water of lost equipment. Fishery biologists acknowledge that lost nets may continue to fish for a while, but they generally claim that in terms of pure biomass, it is a negligible quantity, since the nets usually get entangled very quickly and will therefore no longer pose any kind of threat to the stock. Among the fishermen, by contrast, there seems to be less concern with the body than with the mind of the fish. In order to understand how this is the case, let us look in detail at another concept.

As shown elsewhere (Roepstorff 2000, 2002), the notion of overfishing is commonly translated as *aalisapilunneq* in Greenlandic. In contrast to the English concept, *aalisapilunneq* does not merely describe a technical process affecting an abstract stock, but the word has the morally negative connotation of someone taking more than what one needs. Whereas the arguments of the biologists and of the industry are framed in a discourse concerning "the rational use of a limited body of fish" the fishermen's arguments are embedded in a moral discourse concerning need, waste, and concern for the fish in a very particular way. In a logic where "taking more than one needs" is frowned upon, the possible existence of ghost-nets fishing without satisfying the needs of anyone is, indeed, something evil. Gillnet fishermen claim, on the other hand, that the problem is not related to the technology as such, but rather to the materials being used. Modern materials will not deteriorate in the water, and longlines and gillnets alike may therefore cause problems if they are used without care. That the fishermen's discourse differs from the one of the biologists is, for instance. indicated in the following argument of a dedicated gillnet fisherman: "I don't understand why they accuse us gillnet fishermen of overfishing [*aalisapilunneq*]. We only catch that we can sell [due to the catch specificity of the nets], whereas the longline fishermen also catch small fish that they have to discard. It is not we, but the longline fishermen that catch more fish than needed, and they are therefore guilty of *aalisapilunneq*".

However, the sea "pollution" discussed by the fishermen is not primarily a disturbance of an abstract, general environment. The problem is, rather, that the ghost-nets are thought to interfere directly with the Umwelt of the fish, understood in an Uexküllian sense as interfering with the fish's subjective understanding of its surroundings (Uexküll 1921; Ingold 1995). This was clearly stated by a fisherman who had just shifted from gillnets to longlines, allegedly on moral

grounds: “These lost nets keep fishing, and the fish don’t like the smell [of untended nets with rotten fish]. If only we could ban the nets, the fish would again be evenly distributed in the fjord”. In a similar vein, a passionate longline fisherman stated: “These nets — there is also a lot of pollution. Sometimes the nets drift into the icebergs, and then they can not find their nets, they just stand there somewhere. [...] The best fish are caught on longlines. They [i.e., the gillnet fishermen] only think about themselves. They don’t think about the fish”.

Disturbing the seals

Another important local environmental issues while I was doing fieldwork was the question of snowmobiles. In contrast to most other Arctic territories, the use of snowmobiles is heavily regulated in Greenland. In the area of Ilulissat, snowmobiles are only allowed in a narrow transport corridor along the coast. Elsewhere, the only allowed means of transportation is the dog sledge. In a fervent debate, it was argued that partly in concern for tourists, partly in concern for people without access to dog sledges, a wider use of snowmobiles should be allowed in the back country. The discussion was heated further by the arrival of a young Danish ecologist who attempted to introduce “sustainable tourism” in a Greenlandic context. He brought with him figures to prove how much pollution, in terms of emission etc., was produced by snowmobiles. The issue became tenser when a dispensation was granted to allow a film team to operate from a camp deep in the back country, which caused much snowmobile traffic for weeks. To complicate matters further, the film team had hired one of the strongest opponents of the snowmobiles, a Greenlandic tourist outfitter, as one of their consultants. To the strong displeasure of hunters and fishermen, this consultant thus moved around the back country on a large snowmobile. Rumors among the fishermen had it that during the filming, he did not dare to enter the fishing and hunting grounds alone, for fear of the consequences. The issue of the ban of snowmobiles was entangled in a latent ethnic and economical conflict (Dahl 2000: 236). Many temporary Danish occupants were unable to get into the back country since they do not have access to dog sledges and the tourist industry and the snowmobile rental were mainly in the hands of families that were not native Greenlanders. However, this was not how the discussion was framed. People mainly expressed concern for the ani-

mals. According to the hunters, the problem was that the seals in Kangia were particularly shy, and snowmobiles would scare them away, which would interfere with the hunt. As in the issue of the ghost-nets, the main argument was not concern for the environment in an abstract sense. Rather, it was a matter of not interfering with the seals' Umwelt, since mediated by their inherent shyness, this would stop the interaction between men and animals.[4]

In both cases discussed so far, the underlying logic appears to be the same. The Greenlandic fishermen and hunters are concerned about their environment, and they claim that there is a clear relation between human behaviour and the availability of fish and seals. However, the relation is not the same as the one envisaged by most wildlife biologists or environmentalists. Fully in line with the basic idea that animals are sensing and thinking beings, the Greenlanders are concerned about not disturbing what they perceive as the animals' understanding of their environment (for a similar finding see Morrow & Hensel 1992) . To use Uexküll's biosemiotic distinction, they are concerned with protecting the animals' Umwelt rather than protecting an abstract, general environment as it is characteristic of most environmentalists' and standard conservationists' approach. To a dualist, such as the early missionaries in Greenland or most contemporary environmentalists, this conception runs very close to an anthropomorphism that fails to distinguish between humans and nonhumans. However, this appears not to be the case. Rather, the conception is well in accordance with a 'traditional' Greenlandic understanding of humans and nonhumans, where the difference between humans and nonhumans is not a matter of the existence of a 'mind' or a 'soul,' but rather a question of humans being more than just body and mind (soul). My claim is not that Umwelt protection is generally a better strategy than environmental protection. It is quite clear from my research (Roepstorff 2000) and from similar evidence elsewhere in the Arctic (Fienup-Riordan 1990) that although many hunters and fishermen are very

[4] It is tempting to see a parallel between the alleged shyness of the seals and the concepts of *taqippoq*, *tarneq* and *takar* discussed above (note 3). In contemporary Greenland, sealing is still very much affiliated with maleness. This connection is inscribed in the language, where the words *angut*, 'man', and *anguvoq*, 'to catch a seal', are derived from the same root. Fieldwork evidence suggests that the spring hunt for seals in Kangia is indeed not just a matter of proteins, and Greenlanders with various ordinary jobs take some days off to participate together with professional hunters and fishers. The hunt may involve a ritual-like communal sharing of raw heart, liver, and blubber from a newly shot seal.

concerned with how human behaviour interacts with the Umwelt of particular species (that again, is related to the particular mind, or perhaps shyness of a given species), not much attention is being paid to whether fishing or hunting reduces the numerical stock, that is, the abstract, total body of all the specimens out there. In other words, it is as if both focusing exclusively on Umwelt protection and focusing exclusively on environmental protection foreground one aspect only while backgrounding other aspects that are rendered opaque. The integration of a perspective "from within" and "from without", a focus on Umwelt and a focus on environment, appears to be one of the most important challenges facing contemporary attempts to outline a human ecology that, like ecosemiotics, is both concerned with meaning and matter (Kull 1998a, 1998b; Hornborg 1996).

Conclusion

I began this essay by adopting Claude Lévi-Strauss's metaphor of "thinking with animals". As with all other structures identified by Lévi-Strauss, totemism and other religious ideas are the outcome of the particular way human minds try to understand the word. In doing so, "the mind operates in ways that do not differ in kind from those that have unfolded in the world since the beginning of time" (Lévi-Strauss 1972: 119). Lévi-Strauss refuses to uphold any particular mental difference between modern and primitive societies. This refusal of a particular mental dichotomy between moderns and primitives, between myth and science (Scott 1996), has become increasingly important in contemporary anthropological theory. However, in the case of Lévi-Strauss, abandoning one dichotomy appears to involve a very high cost, namely the reinforcement of another dichotomy between nature and culture. Because he insists on this distinction being fundamental, "thinking with animals" becomes ultimately a question of "from within" rather than "from without".

Greenlandic fishermen appear to think with animals in a way very different from the one identified by Lévi-Strauss. It is not a question of using animals as more or less arbitrary resources for the embodiment of "speculative thought". Instead, they think along with animals, i.e., they use much more concretely ideas of how animals think about the world to get to know it, and this knowledge has consequences for the way they act in the word.

These examples show that it is in the constructive interplay between the inside and the outside that animals are good to think with, and thinking with animals appears to reveal more than the general, abstract mechanisms of the mind. Resulting from a combination of specific ideas about the world and an interaction with that very world, the outcome of "thinking with animals" is a knowledge object that contains elements of both the world and of a particular way of knowing it. Ideally, then, studying these products may shed light both on the world and on the perception of it.

The relationship to animals is hence extremely interesting for anthropology, biosemiotics, and ecosemiotics. In my Greenlandic study, it appears that it is the perceived similarities between animals and people that allows humans to think with animals, just as it is the difference between animals and people that allows one to do different things to animals — eat them for instance. My most recent fieldwork has been in brain imaging laboratories, and it appears, in a similar vein, that it is the perceived similarities that allow one to think with animals, just as it is the perceived differences that allow one to treat them very differently. In the first case, it is the material similarity between humans and, say, a pig, that allows us to treat the pig body as an experimental model for human bodies. Similarly, it is the perceived difference (nonperson, no mind) that allows one to kill the pig in various ways solely for the purpose of acquiring knowledge about it and, by extension, about human beings.

This suggests that instead of maintaining *a priori* a sharp distinction between culture and nature, the more interesting issue is how, in a particular case, the borderline between "culture" and "nature" and between humans and nonhumans is drawn. It is not a question of seeing nature as either "really real" or "fully constructed and full of meaning". On the contrary, "nature" appears to be both at the same time, really real and completely semioticized. The interesting question is, therefore, to follow in detail how this comes about, how in one move, identities, competences and "natures" are distributed among humans and nonhumans. The shift from a classical biological perspective to a biosemiotic perspective is an interesting attempt to reconfigure the border between humans and nonhumans. If it is true that nonhumans, just as humans, rather than inert bodies, are mindful entities endowed with semiotic competence, the question remains: what is it, then, that separates humans from nonhumans? The traditional answer among the Inuits would be that this difference lies in the name and all that follows from it, an embeddedness in and an ability to create symbolic,

social, and meaningful networks transcending the single individual. In strange ways, this idea is not entirely different from the claim in contemporary biosemiotics that it is indeed the symbolic faculty that renders people unique among the animals (Deacon 1997; Roepstorff 2001).

References

Berthelsen, Christian; Jakobsen, Birgitte; Kleivan, Inge; Nielsen, Frederik; Petersen, Robert; Rischel, Jørgen 1990. *Grønlandsk Dansk Ordbog, Oqaatsit*. Nuuk: Atuakkiorfik.

Dahl, Jens 2000. *Saqqaq: An Inuit Hunting Community in the Modern World*. Toronto: University of Toronto Press.

Deacon, Terrence W. 1997. *The Symbolic Species: The Co-evolution of Language and Brain*. New York: W.W. Norton & Company.

Descola, Philippe; Pálsson, Gisli 1996. Introduction. In: Descola, Philippe; Pálsson, Gisli (eds.), *Nature and Society: Anthropological Perspectives*. London: Routledge, 1–19.

Fienup-Riordan, Ann 1990. *Eskimo Essays: Yu´Pik Lives and How We See Them*. New Brunswick: Rutgers University Press.

Hornborg, Alf 1996. Ecology as semiotics: outlines of a contextualist paradigm for human ecology. In: Descola & Pálsson 1996: 45–63.

Ingold, Tim 1995. Building, dwelling, living: How animals and people make themselves at hone in the world. In: Strathern, Marilyn (ed.), *Shifting Contexts: Transformations in Anthropological Knowledge*. London: Routledge, 57–80.

— 2000. *The Perception of the Environment*. London: Routledge.

Kirmayer, Laurence J. 1988. Mind and body as metaphors: Hidden values in biomedicine. In: Lock, Margaret; Gordon, Deborah (eds.), *Biomedicine Examined*. Dordrecht: Kluwer, 57–93.

Kull, Kalevi 1998a. On semiosis, Umwelt and semiosphere. *Semiotica* 120(3/4): 299–310.

— 1998b. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 340–370.

Lakoff, George; Johnson, Mark 1980. *Metaphors We Live By*. Chicago: Chicago University Press.

Latour, Bruno 1993. *We Have Never Been Modern*. New York: Harvester Wheatsheaf.

Lévi-Strauss, Claude 1963. *Totemism*. London: Beacon Press.

— 1972. Structuralism and ecology. In: Lévi-Strauss, C., *The View from Afar*. London: Penguin, 101–120.

Morrow, Phyllis; Chase, Hensel. 1992. Hidden dissension: Minority-majority relationships and the use of contested terminology. *Arctic Anthropology* 29: 38–53.

Nuttall, Mark 1992. *Arctic Homeland: Kinship, Community and Development in Northwest Greenland*. London: Belhaven.
— 1998. States and categories: Indigenous models of personhood in Northwest Greenland. In: Jenkins, Richard (ed.), *Questions of Competence: Culture, Classification and Disability*. Cambridge: Cambridge University Press, 176–193.
Rink, Hinrich 1974 [1875]. *Tales and Traditions of the Eskimo: With a Sketch of Their Habits, Religion, Language and Other Peculiarities*. London: C. Hurst & Company.
Roepstorff, Andreas 1998. Virtual stocks, experts and knowledge traditions. In: Dorais, L.J.; Nagy, M.; Müller-Wille, L. (eds.), *Aboriginal Environmental Knowledge in the North*. Quebec: GETIC, Université Laval, 95–122.
— 2000. The double inter-face of environmental knowledge: Fishing for Greenland Halibut. In: Neis, B.; Felt, L. (eds.), *Finding Our Sea Legs: Linking Fishery People and Their Knowledge with Science and Management*. St. Johns: ISER Books, 165–188.
— 2001. Brains in scanners: An Umwelt of cognitive neurosicence. *Semiotica* 134(1/4).
— 2002. Clashing cosmologies: Contrasting knowledges in the Greenlandic fishery. To appear in: Roepstorff, A.; Bubandt, N.; Kull, K. (eds.), *Imagining Nature. Practices of Cosmology and Identity*.
Roepstorff, Andreas; Bubandt, Nils 2002. Introduction: The critique of culture and the plurality of nature. To appear in: Roepstorff, A.; Bubandt, N.; Kull, K. (eds.), *Imagining Nature: Practices of Cosmology and Identity.*
Scott, Colin 1996. Science for the West, myth for the rest? The case of James Bay Cree knowledge construction. In: Nader, Laura (ed.), *Naked Science: Anthropological Inquiry into Boundaries, Power and Knowledge*. New York: Routledge, 69–86.
Sebeok, Thomas A. 1988. ‘Animal’ in biological and semiotic perspective. In: Ingold, Tim (ed.), *What is an animal?* London: Routledge, 63–76.
Uexküll, Jakob von 1921. *Umwelt und Innenwelt der Tiere*. Berlin: Springer.

Думая вместе с животными

Центральным утверждением биосемиотики является приписывание семиотической компетенции и другим существам кроме человека. По странным историческим причинам это утверждение в “нормальном” биологическом дискурсе часто оспаривалось. При анализе этнографического материала Гренландии оказывается, что люди относятся там к животным как к “личностям”, т.е. чувствующим и думающим существам. Считается, что животные, как и люди, имеют знания о среде своего обитания. Признание такой семиотической компетенции в качестве бесспорного факта позволяет искусным рыболовам и охотникам опираться не только на свою интерпретацию окружающей среды, но и

на интерпретацию ее животными. Поведение рыб, тюленей и других животных, обусловленное их семиотической компетенцией, можно, таким образом, интерпретировать как приписывание ими значения поведению, например, китов и айсбергов. Подобное априорное присуждение семиотической компетенции проявляется и в спорах по поводу управления и регулирования численности животных. Большая часть дискурса рыболовов и охотников не столько посвящена вопросу о том, "на исходе ли запасы", сколько сосредотачивается вокруг вопроса, могут ли животные быть семиотически дезориентированы действиями человека.

Mõeldes koos loomadega

Biosemiootika keskseks väiteks on semiootilise kompetentsi omistamine veel teistelegi olenditele peale inimese. Kummalistel ajaloolistel põhjustel on see väide olnud "normaalses" bioloogilises diskursuses tihti vaieldav. Gröönimaa etnograafilise materjali analüüsist ilmneb, et inimesed suhtuvad seal loomadesse nagu mitteinimestest "isikutesse", ehk nagu tundvatesse ja mõtlevatesse olenditesse. Arvatakse, et loomad nagu inimesedki omavad teadmisi oma elukeskkonna kohta. Suhtumine sellisesse semiootilisse kompetentsi kui ilma igasuguse kahtluseta fakti võimaldab osavatel jahi- ja kalameestel toetuda mitte üksnes enda interpretatsioonile oma keskkonnast, vaid ka loomade interpretatsioonile oma keskkonnast. Kalade, hüljeste ja loomade käitumist, mis on tingitud nende tunnustatud semiootilise kompetentsi poolt, võib seega interpreteerida kui teadete andjat, näiteks vaalade ja jäämägede käitumise kohta. Selline semiootilise kompetentsi *a priori* omistamine ilmneb samuti saakloomade reguleerimise ja majandamise alastes vaidlustes. Ei arutleta mitte niivõrd selle üle, kas "varud on ammendunud", vaid suur osa kala- ja jahimeeste diskursusest keskendub pigem küsimusele, kas loomad võivad olla semiootilistelt häiritud inimeste tegevusest.

Ecosemiotics and the sustainability transition

Max Oelschlaeger
McAllister Chair of Community, Culture, and Environment
Northern Arizona University, Flagstaff, Arizona, USA
e-mail: max.oelschlaeger@nau.edu

Abstract. The emerging epistemic community of ecosemioticians and the multidisciplinary field of inquiry known as ecosemiotics offer a radical and relevant approach to so-called global environmental crisis. There are no environmental fixes within the dominant code, since that code overdetermines the future, thereby perpetuating ecologically untenable cultural forms. The possibility of a sustainability transition (the attempt to overcome destitution and avoid ecocatastrophe) becomes real when mediated by and through ecosemiotics. In short, reflexive awareness of humankind's linguisticality is a necessary condition for transforming ecologically maladaptive cultural forms. As a multidisciplinary, interdisciplinary research program integrating the human and natural sciences, ecosemiotic inquiry closes the gap between biophysical ecology and human ecology. A provisional outline of a pragmatic theory of ecosemiotics attempts to describe the processes by which adaptive cultural changes might be facilitated and points toward substantive content areas that constitute sites for further research. Ecosemiotic inquiry frames cultural codes as these shape and reproduce the ongoing stream of individual and societal choices that shape distinctively human existence in a larger context of biophysical realities that drive natural selection. However, while ecosemiotics is a necessary condition for the sustainability transition, it is not a sufficient condition.

1.

The matrix is everywhere ...
It is the world that has been pulled over
your eyes to blind you from the truth.
Morpheus, *The Matrix*

The emerging epistemic community of ecological semioticians (hereafter, ecosemioticians) and the multidisciplinary field of inquiry known as ecological semiotics (hereafter, ecosemiotics) offer a radical and relevant approach to what has been termed "the global environmental crisis". The term "radical" is warranted if for no other reason than the manifest failures of action taken within the existing rubric of scientific, technological, economic, and political rationality. "Rationality" itself is linguistically mediated, and therefore can only be comprehended from within language (Bernstein 1983; Lawson 1985; Toulmin 1958). The legitimating narratives that define rationality across economics and even the natural sciences are, from an ecosemiotic perspective, irrational (Wright 1992). The term "relevant" implies that ecosemiotics can "do work", that is, facilitate *the sustainability transition* — the simultaneous attempt to overcome destitution and to conserve the evolved planetary (biophysical) order (and thus avert ecocatastrophe) (Board on Sustainable Development 1999).

The ecosemiotic thesis as advanced below is twofold. First, that humankind qua human is a language animal. And second, that reflexive awareness (linguistically mediated self-consciousness) of humankind's linguisticality is a necessary condition for the transformation of ecologically maladaptive cultural forms (created through and encoded by language). The truth that drives the ecosemiotic thesis is that, whatever the illusions of *The Matrix*, cultural processes of selection (economic, political, philosophical, religious, and so on) are finally subject to natural selection (Cavalli-Sforza 2000; Ehrlich 2000). The risks of ignoring such a truth are enormous, if incalculable: mass extinction of species, global climate change, and the collapse of civilization. The opportunities created by affirming the ecosemiotic thesis are also enormous, but positive, that is culturally and naturally adaptive. (I gloss over crucial epistemic points here: as Putnam (1995: 12) argues, the truth works. "Since our claims get their substance from the roles they play in our lives, an account of truth will gain its substance from the accompanying account of how to get truth".)

Some may believe that such a claim is extreme. For one reason, the present forum offers the opportunity for an elliptical argument at best. A knock down argument is not possible. For another, the argument is rhetorically (architectonically and critically) directed at either the "already convinced" or those who are "leaning in the direction" of the ecosemiotic thesis.

2.

I begin with the obvious: humankind stands on the brink of multiple ecocatastrophes. These include an anthropogenic mass extinction event (Wilson 1992), anthropogenic climate change (Firor 1990), and runaway population growth. From an ecosemiotic perspective, such problems represent a pervasive disconnection between the dominant cultural codes and the natural, underlying systems upon which all cultures depend. Estimates are that at least fifteen million years would be required for the web of life to heal itself; that the consequences of climate change would fundamentally disrupt the world's food supply and political order; and that at best the planet can sustainably support approximately two billion people living somewhere between subsistence and consumerist lives.

Effectively these three facts constitute the hard realities of an evolutionary process that has within fifteen thousand years transformed the biophysical world from one to which the human species was loosely coupled (in a causal sense) to one where the human species is closely coupled (Allen, Hoekstra 1992; Firor 1990; Wilson 1992). Further, despite national and international efforts to take ameliorative actions, such as UNCED (1992) or the Kyoto Accord (1998), the rates of habitat destruction and species extinction continue to increase, the evidence of anthropogenic climatological perturbations continues to grow, and population (as well as consumption) continues to escalate. Clearly, the picture of the human estate painted here is gloomy, even neo-Malthusian ('neo' since technology is not ignored, as with Malthus, but indicted).

But there are mitigating realities. One is that since the middle of the Nineteenth Century, and especially in the last two or three decades, we have learned more about *the sources of our humanity* than in all previous history (Ehrlich 2000). Which is to say that the ecosemiotic thesis points toward a watershed event — a paradigm shift — in human self-comprehension. Far more has happened than can be detailed or even sketched here. Yet even a brief narrative must begin with the work of Charles Darwin, who intuited correctly that

> the difference in mind between man and the higher animals, great as it is, certainly is one of degree and not of kind. [...] If it could be proved that certain high mental powers, such as the formation of general concepts, self-consciousness &c., were absolutely peculiar to man, which seems extremely doubtful, it is not improbable that these qualities are merely the incidental

> results of other highly-advanced intellectual faculties; and these again mainly the result of the continued use of a perfect language. (Darwin 1874: 106–107)

In effect, the specific difference between the human species and the other primates generally, and chimpanzees specifically, is grounded in the fact that we are language animals — *Homo narrans*. This point is affirmed by many, but consider D. Bickerton (1995), who argues that humankind is

> *not* unique in most of the ways in which we have been made out to be. That is, we do *not* come equipped with wisdom, logic, vast cognitive powers, novel problem-solving capacities, immaterial minds, immortal souls, and all the other baggage that has been imputed to us at one time or another. We have language grafted onto a primate brain, and that's it. We are still animals, but this two-edged gift that has been laid upon us obliges us to live in ways no other animal could conceive of. (Bickerton 1995: 156)

Following in Darwin's wake, much has happened, with evolutionary biological studies, such as those of P. Lieberman (1984; 1998), who argues that a few biological changes explain the uniqueness of human linguistic and cognitive behavior; archeological-anthropological studies, such as those of R. Leakey (1992), who traces the natural history of the protohumanoids to species *Homo sapiens* through the co-evolution of brain and language; anthropological-linguistic studies such as those of D. Bickerton (1990; 1995); and multidisciplinary, interdisciplinary human studies such as the work of L. L. Cavalli-Sforza (2000; Cavalli-Sforza, Feldman 1981), T. Deacon (1998), and P. Ehrlich (2000).

I have touched on only a few of dozens of lines of inquiry, so my inferences and conjectures must be considered provisional. Then again, all truth claims are fallible. Two points are in order. One is that no credible understanding of humankind (generally, societally, or individually), from 'A' for anthropological to 'Z' for zoological, can sunder itself from biological reality, including the biological basis of language. And that said, no credible understanding of a cultural system — understanding by culture the accretion of information through language, that is, the culturgens or memes that direct human action within a cultural context — can therefore be sundered from biological underpinnings. Which is to say that, as we enter into the new millennium, ecosemiotics itself is rooted in biological soil.

Many have touched on this in a variety of ways. One is the philosopher, M. Merleau-Ponty (1968), who speaks of the awesome birth of vociferation, of the breath that, unlike the chirps and growls and

bugles and sounds of all other creatures, becomes talk, of the talk that guides human action and becomes culture, of the culture that unintentionally becomes a plague upon the earth. But that is another story, elaborated in detail by many (Abram 1996).

More immediately relevant is the conjecture that the evolution, *ab initio*, of cultural forms generally and political-economy specifically is driven by demographics, that is, human population growth (Johnson, Earle 1987). Jumping over fifteen thousand years of history, we come to the existing world order (which some have mistakenly characterized as the "New World Order": there's nothing new about something that has been thousands of years in the making). Try thinking of the existing world order — its legitimating narratives and political-economy, technologies and industries, factories and agricultural fields, systems of communication, transportation, and finance, hospitals and schools, and so on — as the outcome of a long process of cultural evolution. Even the world's poorest populations have some stake in the existing system, for without it, however inequitable and unjust, the end would soon come.

3.

Examined through the lens of ecosemiotics, the so-called global environmental crisis is a concatenation of *unintended consequences*. Human beings did not sit down around a collective table and intentionally decide to grow without limit, to convert the earth to one vast factory supporting themselves alone. No grand narrative was constructed to guide humans in the exploitation of the earth's biophysical systems with neither concern for future generations of humans nor care for the rest of the creatures. Rather humans in particular places and at particular times were making decisions and taking actions that enabled material survival and offered psychological meaning. Cultural schemes that gave individuals a sense of purpose and that provided adequate material sustenance endured. Those that failed simply collapsed — either in the short-run, through catastrophe (epidemics, famine), or in the long-run, through the inability to adapt to changed circumstances, such as soil salinization due to irrigated agriculture.

The evolution of political-economy, from band society to the urban-industrial state and the New World Order, has been biologically

driven by the metabolic demands of ever-increasing numbers of humans. Cultural systems survived by evolving ad seriatim the political, technological, and other schemes, including codes governing sexual reproduction, necessary for environmental exploitation and maintenance of the social order. The present world order sustains six billion people, in varying degrees of material comfort, political freedom, psychological well-being, and physical health. If the objective was to create a world order that exploits the environment for the purpose of sustaining six billion humans for some indeterminate but clearly limited period of time, then we have succeeded. Global environmental crisis was an unintended consequence.

The readers and author of this essay are fortunate to be counted among the twenty percent of the world's "haves", a population enjoying unprecedented levels of affluence and political freedom. We are the beneficiaries of the evolved cultural system. The "global middle class" is held culpable by some for human destitution and the global environmental crisis. Perhaps this charge has merit. More importantly, the world's haves arguably have the resources to facilitate the sustainability transition. There are at least two reasons why. One is that Agenda 21, the Kyoto Accord, and other conversations concerning the sustainability transition, such as the report of the Business Council for Sustainable Development (Schmidheiny 1990) and proposals for the reform of industrial capitalism (Hawken 1993; Hawken *et al*. 1999), are arguably the beginnings of an adaptive response. For the moment, however, they fail. Why?

Because these attempts to forge an alternative destiny are unconsciously entangled in a cultural narrative that separates human interests from the naturally evolved world. Such schemes are linguistically naive. For example, Agenda 21, in the parlance of ecosemiotics, perpetuates strong anthropocentrism, the privileging of ill-advised, narrow, and ecologically untenable human interests. Like the maps of the world drawn by Europeans c. 1400, Agenda 21 leaves the articulations that describe the terrain of a sustainable world marked as *terra incognita*. Critics, such as R. J. Johnston (1989) and N. Georgescu-Roegen (1971), have shown us the limited possibilities for reform inherent within the dominant discourses of political-economy and economics. The dominant narratives underlie the unintended consequences that threaten the future. Yet, even given its shortcomings and limits, at least Agenda 21 has started the conversation concerning sustainability. It needs time. Ecosemiotics can help.

Second, the so-called information revolution portends changes as radical in outcomes as the agricultural and industrial revolutions. Pessimists believe that the "E-society", including genetic, nano, and robotic technology, is driving us in the wrong direction, threatening oblivion of the human species itself. Nature, on several accounts, is increasingly a simulacrum, a virtual reality. Thus the information revolution is the penultimate disconnection of culture and nature. Optimists argue the opposite thesis, claiming that new technologies, including the information revolution, will ensure ever greater abilities for economic development while simultaneously diminishing environmental impacts.

Ecosemioticians are more guarded, believing that the E-society is, indeed, a revolution in the communication and distribution of information. Facilitated through language, the replication of culture depends on the communication of information. But silicon-based, machine networks do not and can not make decisions about what culturally counts and what does not. *Or what nature permits*. Clearly, information and calculation are necessary for the sustainability transition. But information and calculation can also hasten humankind down the present path and/or even a worse path. Which underscores the importance of the ecosemiotic thesis. We are the only species capable of intentional (conscious) evolution. Yet we are overdetermined by the dominant paradigm that not only sustains us in the near-term, but creates the illusion of civilizational takeoff.

Much like the recent Concorde catastrophe, industrial culture is increasingly vulnerable to "minor mishaps", bifurcations that cascade into disaster. Like a mass extinction event. We are also capable of avoiding catastrophe, at least that of our own making. "In wildness is the preservation of the world", wrote the sage of Concord, Henry Thoreau, nearly 150 years ago. Conventionally read as a preservationist, Thoreau is better read as the first thinker to directly engage the question of deliberate cultural adaptation. Arguably, he is a proto-ecosemiotician (Oelschlaeger 1991).

Cultures constructively adapt their foundational narratives to the exigencies of existence. Or they die. Thoreau wondered how humankind might create stories that connect rather than separate us from earth. How might we reconnect human flourishing with evolved biophysical complexity? In large measure, of course, that is the task of the inclusive discursive community of scientists, corporate leaders, politicians, and many others. But ecosemioticians could and arguably should be the catalyst for such conversations.

4.

> *Language bestowed on its possessor powers that yielded far more than mere survival, powers that effectively conferred on our species the stewardship of earth. Yet, formidable as these powers were, they carried within them the seeds of destruction. Language had given us, not enough, but too much: not just the stewardship of earth, but the capacity to destroy species weaker than ourselves, and even features of the environment on which our own survival might depend. Yet language is at the same time the nurturer and facilitator of all that is best in us, all that seeks to avoid such a fate and to bring us back into unity with the rest of creation.*
>
> (Bickerton 1990: 256)

Karl Marx among others observes that philosophers have long speculated about the world, forgetting that the most important task is to change it. If ecosemiotics is to be more than academic entertainment, then an outline is in order, however provisional or elliptical, of how the ecosemiotic thesis facilitates intentional cultural change. Any pragmatic ecosemiotics must at some point affect "ecosemiosis", that is, the overlap of human ecology and biophysical ecology, the chaotic interface of the body of culture and the body of nature. The divide of biophysical ecology or nature and human ecology or culture is not only intellectually untenable but also dangerous, threatening catastrophic and irreversible change in biophysical processes (Golley 1993). The dominant cultural codes — economics, politics, ethics, psychology, and so on — perpetuate that separation, thus leading the human species toward a fateful rendezvous with natural selection. A theory of ecosemiotics should describe the processes by which adaptive cultural changes might be facilitated.

Premises 1 through 10 below offer *the beginnings* of such a theory. The premises are stated elliptically, followed by a brief commentary. Premises 1–10 are intellectual "promissory notes" pointing toward substantive content areas that constitute sites for ongoing conversation, continuing earlier conversations articulated by and within various epistemic communities. K. Kull (1998: 348), for example, notes the potential for ecosemiotics to "become a large and important field of research with considerable practical applications". Premises 1–10 basically move from the general toward the particular, from the past to

the present, and from theory to praxis (that is, problem driven premises concerning social reconstruction). Finally, the theory of ecosemiotics should be thought of as roughly analogous to the theory of evolution and what has been called "Darwin's Century". Part of the genius of Charles Darwin was his ability to integrate multiple theories — such as geology, paleontology, botany, and zoology — into a comprehensive theory, namely, evolution. Ecosemiotics awaits its Darwin. The author does not aspire to that role, but rather self-identifies as a minor prophet foretelling things to come. Rather than being driven by a single figure in the Cartesian tradition of solitary thinkers, the advance of ecosemiotics is better conceptualized in terms of distributed creativity.

P1. Following in Darwin's wake, the specific and crucial difference between the human species and our closest mammalian kin (chimpanzees, with whom we share more than 99 percent of our genetic makeup) is language. Language enables uniquely human culture. *Evolution → Language → Culture*

P2. The biological driver for the evolution of culture (e.g., political-economy, technology) is population. *Population → Cultural Innovation*

P3. Cultural forms are carried by memes (culturgens, ideas, stories) which are analogous to genes: memes are to the individuals who constitute the body of culture as genes are to the organisms that constitute the body of species. *Language → Narratives/Ideologies → Body of Culture*

P4. Memetic codes organize themselves into co-adapted complexes that guide the present and overdetermine the future. *Cultural Past → Present → Overdetermined Future*

P5. Just as genes define species, so memes define cultures. Just as genetic mutations determine adaptive fitness of organisms in environmental context, so memetic changes define the adaptive fitness of cultures. Memetic changes are typically overdetermined by the dominant codes; thus, "paradigm change" is exceedingly difficult. *Intentional changes → Circumscribed by the Past → Unintended Future*

P6. Ecosemiotics can mitigate cultural overdetermination, thus facilitating a "paradigm shift". *Ecosemiotically Facilitated Change → Deliberate Future/Sustainability Transition*

P7. There are two obvious ways to change cultural stories. One is to delegitimate the dominant code or important aspects (master memes) of that code. The other is to offer alternative symbolic struc-

tures. *Delegitimation + Alternative Stories → Sustainability Transition*

P8. Myths are foundational (architectonic) stories; it follows that rapid societal change can be induced through mythic innovation and/or reconstruction. *Mythic Alternatives (Foundational Stories) → Sustainability Transition*

P9. Distributed creativity and inclusive political participation are vehicles for cultural transformation. *Innovative Thinking + Policy Change → Sustainability Transition*

P10. We are *Homo narrans*, storytelling culture-dwellers. Culture cannot be reinvented *ex nihilo*; yet ecosemiotics tells us that alternative, sustainable futures are possible. *Homo narrans → Ecosemiotics → Alternative Futures*

5.

> *... Language underlies and constitutes the very possibility of human social life, including knowledge, institutions, and social-natural interactions ... But if language characterizes and constitutes human beings, then the idea of language must be logically prior to the idea of being human, and both human beings and human society must be understood in terms of the active and organizing structure of language ... ... For language to be effective ... [logically implies] that it can sustain its own possibility, that the organized use of language will sustain the possibility of human actions and social life, and thus the possibility of language.*
>
> (Wright 1992: 16)

At this juncture, seemingly, books and more books, conferences and more conferences, are required to flesh out the details of the ecosemiotic thesis. However, linguistic convention requires brevity. Simply put, the premises above converge on the notion that we are language animals (Darwin 1874; Taylor 1985). *Homo narrans.* Storytelling culture-dwellers. The so-called gene shortage problem alone definitively undercuts alternative hypotheses (Ehrlich 2000). The ecosemiotic thesis, regardless of the fallibility of the premises above, opens humankind to the possibility of conscious evolution, sometimes termed “meta-biological evolution”.

Natural selection, working over tens of thousands of years, constituted the biological basis of language; with language came the move

into distinctively human culture. Culture can be and has been defined in many ways, but at the heart of any viable account lies the notion that the essence of culture is the symbolic accrual of experiential learning (the school of hard knocks) and the subsequent transmission of these lessons within generations of humans as well as between succeeding generations. Such transmission is accomplished linguistically rather than genetically. L. L. Cavalli-Sforza's (2000; Cavalli-Sforza, Feldman 1981) work is unsurpassed in the study of genes, culture, and language. With language and the move into culture, humankind becomes what has sometimes been termed a "symbolic species" (Bickerton 1990). "Symbolic analysis is the basis for a remarkable new level of self-determination that human beings alone have stumbled upon" (Deacon 1998: 434).

Once the threshold was crossed from late Paleolithic hunting and gathering, characterized by band society, into early sedentarism — an event likely precipitated by a prehistoric food crisis, itself driven by the collapse of Pleistocene grassland ecosystems — the nature-culture interface was dramatically transformed, beginning with political-economy. For Paleo-hunter-gatherers economic utility vanished at the margin of portability (Sahlins 1972). Today the converse is the case: the body of culture — with six billion human metabolisms — is insatiable. From an ecosemiotic perspective such an outcome is not mysterious, however complicated, since the so-called ecological transition from Paleolithic to Neolithic culture was facilitated and continuously mediated by language. We are caught up in that ongoing history of effects. One obvious way is evident in the fact that, as J. W. Bennett (1976: 140) notes, "There is no built-in mechanism restraining the human proclivity to use, and expand the use, of natural substances — this has to be consciously developed under special circumstances". Cultural codes that eventuated in technologies and institutions supplying necessary and desired material goods endured; those codes failing the test were selected out.

However, the move into linguistically mediated culture did not and does not exempt humankind from the economy of nature. The epigraph at the start of this section (Wright) powerfully, if elliptically, drives home that point. (Although industrial capitalism and its associated ideologies present the appearance that the modern individual has escaped natural limits — excepting death — consumerism is "window dressing", that is, a distraction from our continuing situatedness in nature.) For cultural codes (memes, culturgens) — literally the instructions for the production and reproduction of the body of culture — are

ultimately subject to natural selection. "Thus, each cultural decision must pass two levels of control: cultural selection acts first through choices made by individuals, followed by natural selection, which automatically evaluates these decisions based on their effects on our survival and reproduction" (Cavalli-Sforza 2000: 178).

However, there are some crucial differences between genes and biological evolution, and memes and cultural evolution. *Cultural codes can be intentionally changed*; genetic change is by mutation. Further, cultures (like species) endure over longer periods of time than individuals; thus, decisions made by individuals that favorably affect their own survival and reproduction in the short-term can have long-term consequences that adversely affect the sustainability of a culture. Finally, cultural codes profoundly affect the choices made by individuals. Some call this phenomenon the "preschematization of language".

> With increasing urgency...we are led to ask...whether there may not be hidden in our experience of the world a primordial falsity; whether, in our linguistically transmitted experience, we may be prey to prejudices, or worse still, to necessities which have their source in the linguistic structuring of our first experience of the world and which would force us to run with open eyes, as it were, down a path whence there was no other issue than destruction. (Gadamer 1988: 491)

Thus, a focus for inquiry within the ecosemiotic community is on cultural codes as these shape and reproduce the ongoing stream of the choices that shape distinctively human existence in a larger context of biophysical realities that drive natural selection.

For example, technology is a vital area for ecosemiotic inquiry. "Techno-narratives" mediate the technological processes and institutions employed by a culture to enable the survival of human organisms. Donna Haraway's *Modest Witness* (1997) is arguably an ecosemiotic *tour de force*, surveying and apprising a comprehensive array of symbolic forms that constitute "the figuration" that constitutes and reconstitutes the technological body of culture. Whatever the unintended consequences of technology, civilization would collapse without the near-term continuation of present day technologies, regardless of long-term consequences. From the perspective of ecosemiotics, technological innovation must be involved in any sustainability transition. Just as clearly, as many have argued, the narrative of cultural progress as engendered by technology fails on multiple tests.

The dominant narratives of the New World Order (including techno-narratives) are legitimated by a powerful, interwoven mythic complex, termed "Cornucopianism". The ideas of progress — roughly, that the human future will be better than the past, especially as measured by economic success, that is, the conversion of natural resources into needed and desired material goods — and technological control — roughly, that through applied science the human species has the means to achieve the aforementioned progress — constitute the heart of Cornucopianism. They are, in a phrase, foundational myths.

If we think of myths as architectonic forms, as rhetorical structures that undergird the basic woof and warp of society, then K. Burke's (1950) sage reflections help us understand how and why Cornucopianism rules.

> For [architectonic] rhetoric is not rooted in any past condition of human society. It is rooted in an essential function of language itself, a function that is wholly realistic, and is continually born anew; the use of language as a symbolic means of inducing cooperation in beings that by nature respond to symbols. (Burke 1950: 43)

If this is the case, the present efforts of those who would reconstruct the world — for example, so-called Agenda 21, the New World Order — are to no avail. Why? Because such efforts are ecosemiotically naive. The possibility of intentionally making the sustainability transition (i.e., conscious evolution) implies — a necessary but not sufficient condition — a linguistically mediated awareness of the basic codes/meme complexes that overdetermine the body of culture *and* the ability to use "the tools of language". Criticism. Delegitimation. Poetry. Myth. Parable. Mythopoesis. Rhetoric. Communication.

6.

If sufficiently successful, and mankind escapes the dark abysses of its own making, then truly will the future belong to man[kind], the only product of biological evolution capable of controlling its own further destiny.
(Handler 1970: 888)

The epigraph at the beginning of this essay (from the film *The Matrix*) turns on sophisticated insights into the nature of human reality. We live in worlds hung on the loom of language, that is, the stories that provide the woof and warp through which the shuttle of our individual and collective lives passes back and forth. Yet the weaving of the fabric of culture remains opaque to those who cannot affirm the ecosemiotic thesis, for consciousness remains tightly bound within the matrix of daily life.

Consider two examples of the matrix that blinds us from the truth. Recall *The Wizard of Oz*, and the scene where Dorothy's dog, Toto, pulls back the curtain hiding a short, pudgy man who has been manipulating a device that controls the movements and voice of a fearsome apparition — *The Wizard of Oz*. The instant the curtain is pulled back, the game is up. Oz is no longer the Wizard, but only a human who, as it turns out, still provides useful help to the Dorothy and her confreres. Almost everyone, even children, "gets it", that is, the exposure of the Wizard as a fraud.

The other matrix that blinds us from the truth can be illustrated simply by ecosemiotically reconsidering the term "global environmental crisis". The world historic project that is industrial capitalism — the so-called New World Order — linguistically legitimates such a notion. But the ever increasing prospect of mass extinction of species, global climate change, and explosive population growth confirms the irrelevance of such a notion. For global environmental crisis is itself part of a matrix that pulls the symbolic wool over our eyes.

Global environmental crisis is in truth a crisis of language, which is to say a human crisis, a dark abyss of our own making. N. Evernden (1985) points out the irony that self-identified environmentalists fail to realize "the very entity they defend — environment — is itself an offspring of the nihilistic behemoth they challenge. It [including terms like "global environmental crisis"] is a manifestation of the way we view the world". The matrix lives. Ecosemiotically redescribed "we are not *in* an environmental crisis, but *are* the environmental crisis" (Evernden 1985: 134).

Which is to say that if it is through language that we have been disconnected from nature, then reconciliation must also be effected through language. But self-conscious awareness of the reality of language is a necessary condition for such a reconciliation. Just as Columbus's voyage to the so-called new world refuted the flat earth hypothesis, or just as heliocentric ideas dismantled geocentrism, or just

as the evolutionary hypothesis played havoc with supernaturalism, so ecological semiotics radically challenges conventional ideas concerning humanity and/or culture. There are no fixes for "global environmental crisis" within the dominant code, only tinkering and more of the same. *The possibility of a sustainability transition becomes actual when mediated by and through ecosemiotics*.

Yet clearly the ecosemiotic thesis itself must be tempered. J. Kristeva's (1989) insights into "language, the unknown", are relevant, for there is no specifically human place outside language from which to explain language, to know language, to use language. "Method" and "discipline" are social and linguistic artifices that deceive the linguistically naive. The ecosemiotic thesis, as discussed here, is not a sufficient condition for the sustainability transition. But it is arguably a necessary condition, one that reveals more than it conceals. For without the conscious ability to escape the overdetermination of the past, the future will bring biocultural catastrophe.

References

Abram, David 1996. *The Spell of the Sensuous: Perception and Language in a More-than-Human World*. New York: Pantheon.

Allen, Timothy F. H.; Hoekstra, Thomas W. 1992. *Toward a Unified Ecology*. New York: Columbia University Press.

Bennett, John W. 1976. *The Ecological Transition: Cultural Anthropology and Human Adaptation*. New York: Pergamon Press.

Bernstein, Richard J. 1983. *Beyond Objectivism and Relativism: Science, Hermeneutics, and Praxis*. Philadelphia: University of Pennsylvania Press.

Bickerton, Derek 1990. *Language and Species*. Chicago: University of Chicago Press.

— 1995. *Language and Human Behavior*. Seattle: University of Washington Press.

Board on Sustainable Development, Policy Division, National Research Council 1999. *Our Common Journey: A Transition Toward Sustainability*. Washington, D.C.: National Academy Press.

Burke, Kenneth 1950. *A Rhetoric of Motives*. Berkeley: University of California Press.

Cavalli-Sforza, Luigi Luca 2000. *Genes, Peoples, and Language*. Translated by Mark Seielstad. New York: North Point Press.

— and M. W. Feldman 1981. *Cultural Transmission and Evolution: A Quantitative Approach*. Princeton: Princeton University Press.

Darwin, Charles 1874 [1871]. *The Descent of Man, and Selection in Relation to Sex*. 2nd ed. London: John Murray.

Deacon, Terrence W. 1998. *The Symbolic Species: The Co-Evolution of Language and the Brain*. New York: W. W. Norton.
Ehrlich, Paul R. 2000. *Human Natures: Genes, Cultures, and the Human Prospect*. Washington, D.C.: Island Press.
Evernden, Neil 1985. *The Natural Alien: Humankind and Environment*. Toronto: University of Toronto Press.
Firor, John 1990. *The Changing Atmosphere: A Global Challenge*. New Haven: Yale University Press.
Gadamer, Hans-Georg 1988. *Truth and Method*. Translated by Garrett Barden and John Cumming. New York: Crossroad Publishing.
Georgescu-Roegen, Nicholas 1971. *The Entropy Law and the Economic Process*. Cambridge: Harvard University Press.
Golley, Frank B. 1993. *A History of the Ecosystem Concept in Ecology: More than the Sum of the Parts*. New Haven: Yale University Press.
Handler, Philip (ed.) 1970. *Biology and the Future of Man*. London: Oxford University Press.
Haraway, Donna J. 1997. *Modest_Witness@Second_Millennium: FemaleMan©_Meets_OncoMouse™*. London: Routledge.
Hawken, Paul 1993. *The Ecology of Commerce*. New York: Harper Collins.
Hawken, Paul; Lovins, Amory; Lovins, L. Hunter 1999. *Natural Capitalism: Creating the Next Industrial Revolution*. Boston: Little, Brown & Co.
Johnson, Allen W.; Earle, Timothy 1987. *The Evolution of Human Societies: From Foraging Group to Agrarian State*. Stanford: Stanford University Press.
Johnston, R. J. 1989. *Environmental Problems: Nature, Economy, and State*. London: Belhaven Press.
Kristeva, Julia 1989. *Language the Unknown: An Invitation into Linguistics*. Translated by Anne M. Menke. New York: Columbia University Press.
Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–369.
Lawson, Hilary 1985. *Reflexivity: The Postmodern Predicament*. LaSalle: Open Court.
Leakey, Richard E.; Roger Lewin 1992. *Origins Reconsidered: In Search of What Makes Us Human*. New York: Doubleday.
Lieberman, Philip 1984. *The Biology and Evolution of Language*. Cambridge: Harvard University Press.
— 1998. *Eve Spoke: Human Language and Human Evolution*. New York: W. W. Norton.
Merleau-Ponty, Maurice 1968. *The Visible and the Invisible*. Translated by Alphonso Lingis. Evanston: Northwestern University Press.
Oelschlaeger, Max 1991. *The Idea of Wilderness: From Prehistory to the Age of Ecology*. New Haven: Yale University Press.
Putnam, Hilary 1995. *Pragmatism: An Open Question*. Cambridge, Mass: Blackwell.
Sahlins, Marshall 1972. *Stone-Age Economics*. New York: Aldine de Gruyter.
Schmidheiny, Stephen 1990. *Changing Course: Report of the World Business Council on Sustainable Development*. Cambridge: MIT Press.

Taylor, Charles 1985. *Human Agency and Language: Philosophical Papers 1*. Cambridge: Cambridge University Press.
Toulmin, Stephen Edelston 1958. *The Uses of Argument*. Cambridge: Cambridge University Press.
Wilson, Edward O. 1992. *The Diversity of Life*. Cambridge: The Belknap Press of Harvard University Press.
Wright, Will 1992. *Wild Knowledge: Science, Language, and Social Life in a Fragile Environment*. Minneapolis: University of Minnesota Press.

Экосемиотика и переход на экономное существование

Формирующаяся эпистемологическая общность экосемиотиков и мультидисциплинарная область исследования, называемая экосемиотикой, предлагают радикальный подход к так называемому глобальному кризису окружающей среды. Доминантный код не отражает проблемы окружающей среды и, закрепляя экологически несостоятельные формы культуры, этот код определяет и (наше) будущее. Посредством экосемиотики может быть реализована возможность перехода к экономичному способу существования (справляясь с дефицитом ресурсов и предотвращая экокатастрофу). Иными словами, знание лингвистической зависимости человечества является необходимым условием для изменения экологически плохо приспособившихся форм культуры. В качестве мульти- и интердисциплинарной исследовательской программы, объединяющей гуманитарные и естественные науки, экосемиотический подход заполняет пробел между биофизической экологией и экологией человека. Предварительная теория экосемиотической практики стремится описать процессы, с помощью которых можно облегчить приспособленческие культурные изменения, и указывает на существенные области, могущие стать полями дальнейшего исследования. Экосемиотика изучает коды культуры, так как именно они оформляют и репродуцируют беспрерывный поток индивидуальных и общественных выборов. Эти выборы характеризуют и создают специфику человеческого существования в более широком контексте биофизической действительности, которая направляет естественный отбор. Хотя экосемиотика и является необходимым условием для перехода к экономичному существованию, это не достаточное условие.

Ökosemiootika ja üleminek säästlikule eluviisile

Kujunev ökosemiootikute episteemiline kogukond ja ökosemiootikaks nimetatud multidistsiplinaarne uurimisvaldkond pakuvad radikaalset ja

asjakohast lähenemist niinimetatud globaalsele keskkonnakriisile. Dominantne kood ei kajasta keskkonnaprobleeme ning põlistades ökoloogiliselt ebakohased kultuurilised vormid määrab see kood ka (meie) tuleviku. Ökosemiootika poolt vahendatuna võib realiseeruda võimalus üle minna säästlikule eluviisile (ületades puuduse ja vältides ökokatastroofi). Lühidalt öeldes on teadlikolu inimkonna keelesõltuvusest vajalik tingimus ökoloogiliselt halvasti kohastunud kultuuriliste vormide muutmiseks. Multi- ja interdistsiplinaarse humanitaar- ja loodusteadusi ühendava uurimisprogrammina täidab ökosemiootiline lähenemine tühimiku biofüüsikalise ökoloogia ja inimökoloogia vahel. Ökosemiootilise praktika esialgne teooria püüab kirjeldada protsesse, mille abil hõlbustada kohastumuslikke kultuurilisi muudatusi, ja osutab sisuliselt olulistele valdkondadele, millest võiksid kujuneda edasise uurimise alad. Ökosemiootika uurib kultuurikoode, kuna need kujundavad ja reprodutseerivad individuaalsete ja ühiskondlike valikute katkematut voolu. Need valikud iseloomustavad ja kujundavad inimeksistentsi eripära laiemas biofüüsikalise tegelikkuse kontekstis, mis suunab looduslikku valikut. Kuigi ökosemiootika on vajalik tingimus säästlikule eluviisile üleminekuks, ei ole see piisav tingimus.

Bioinvasion, globalization, and the contingency of cultural and biological diversity: Some ecosemiotic observations

Claus Emmeche

Center for the Philosophy of Nature and Science Studies, Niels Bohr Institute,
Blegdamsvej 17, DK-2100 Copenhagen, Denmark
e-mail: emmeche@nbi.dk

Abstract. The increasing problem of bioinvasion (the mixing up of natural species characterising the planet's local ecosystems due to globalisation) is investigated as an example of an ecosemiotic problematic. One concern is the scarcity of scientific knowledge about long term ecological and evolutionary consequences of invading species. It is argued that a natural science conception of the ecology of bioinvasion should be supplemented with an ecosemiotic understanding of the significance of these problems in relation to human culture, the question of cultural diversity, and what it means to be indigenous or foreign. Bioinvasion, extinction of native species, and overall decrease in biodiversity, may go along with decreased cultural diversity; as when the loss of local agricultural traditions lead to genetic erosion. There are possible ecosemiotic parallels between language extinction and species extinction, both being related to globalisation. It is argued that the case of bioinvasion reveals the existence of two kinds of ecosemiotic contingency, (1) evolutionary open-ended and partly random generation of new species and extinction of old ones; (2) the historicity of culture in general and "culture's nature" specifically in the demarcation of a set of landscapes characteristic to a particular nation and piece of human history.

According to the biosemiotic turn in contemporary philosophy of nature, our relationship to nature as human beings is deeply embedded in semiotic processes, characterized by continuity between types of sign

(and sign interpretation systems) that are natural and types of sign interpretation that are cultural.[1] Hence, it is difficult to say where nature begins and culture stops, and such an attempt at "purifying" what is natural and what is cultural can be critizised as a highly artificial inheritance of Cartesian dualism (cf. Hoffmeyer 1996), historically specific to a "modern" mode of thinking and organizing social life (Latour 1991). Moreover, dualism between nature and culture is incompatible with a foundational concept in biosemiotics, the concept of semiosis in C. S. Peirce and his whole philosophy of *synechism*, i.e., the doctrine of continuity, according to which the cosmos is only capable of further evolution so far as it "is mind, and so has life" (CP 6.289). From that perspective it is recognized that what we categorize as natural and cultural processes are deeply interwoven and can only in theory be separated — which does not mean that in particular theoretical contexts we are not forced to make such distinctions. Furthermore, "the synechist will not admit that physical and psychical phenomena are entirely distinct [...] but will insist that all phenomena are of one character, though some are more mental and spontaneous, others more material and regular. Still, all alike present that mixture of freedom and constraint, which allows them to be, nay, makes them to be teleological, or purposive" (CP 7.570). The biosemiotic turn in thinking and theorizing about nature and communication, principally based on a Peircean perspective, may also have implications for the pursuit of a truly general *ecosemiotics*, defined as "the semiotics of the relationships between nature and culture" (Nöth 1996, 1998; Kull 1998) with special focus on nature's role and meaning for humans.

An ecosemiotics must be non-dualist in its outlook and yet, facing concrete problems, it has to acknowledge true differences in the meaning of nature when seen from the point of views of biology and other natural sciences and when studied by various human science approaches focusing on the significance of natural processes for cultural and social practices. There are interesting affinities between ecology and ecosemiotics in theory and practice. Since the so-called global civilization is advancing much more hastily in material than in ethical directions (to put it mildly), ecosemiotics becomes most relevant to the understanding of the many challenges to sustainability in a world in which the cultural, linguistic and biological diversity is seriously

[1] See special issues of *Semiotica* 120(3/4), 1998, and 127(1/4), 1999. See also Nöth (2000) section IV.6 on biosemiotics.

threatened. In that sense, ecosemiotics may be important to ecology as a science, as well as relevant for the ecological dimension of politics.

Ecosemiotics includes, *inter alia*, the study of semiotic aspects of the relations between local human populations and their local ecosystems. As the scope of ecosemiotics is broad, this comprises both the study of anthroposemiotic processes (including mythological, ideological, political, and aesthetic aspects of humans relation to the non-human parts of nature), and the study of biosemiotic processes (such as the effect of human intervention both upon the horizontal semiosis between various species in an ecosystem, and upon the vertical or evolutionary semiotic processes). It is important to note that the very distinction presupposes a non-animistic and (partly) scientific world view in which we can distinguish the symbolic meaning that for instance wolves or bears have to us from the semiosic processes involved in the very life of these animals. This is not to say that the very symbolic meaning of animals in an anthroposemiotic context does not play any role in our decisions about conservation strategies for wolves or bears and thus for the continued biosemiosis of these organisms.

The aim of the present study is to present to the ecosemiotic community a case of scientific, social, and environmental relevance, namely bioinvasion as an effect of globalization. It will be noted briefly that there are possible ecosemiotic parallels between language extinction and species extinction, as both are related to globalization. It is important to reflect upon what can be learned from the case of bioinvasion regarding the methods and foundations of ecosemiotics as a field of study.

Bioinvasion — an ecosemiotic disturbance

Biologically, ecosystems are local systems of communities of plants, animals, and microorganisms and their interactions with the specific physical, chemical, and geological environment. The tropical rain forest in the Amazon area is not identical with the tropical rain forest of central Africa, each large ecosystem has a specific composition and a complicated structure of local habitats or subsystems, each again with a characteristic species composition. Thus, ecosystems have a diversity of species, some of which may be found in a variety of different ecosystems, but many are naturally restricted to a few or one specific kind of ecosystem.

Bioinvasion has come to denote the (intended or non-deliberate) introduction by human activity of non-native species into ecosystems in which such species have not been found before, and in which they tend to become *invasive*, that is, they spread, colonize and become established, often at the cost of the distribution range of some of existing species.

Bioinvasion has not only become a threat towards the local ecological stability of a known local flora and fauna. When *Homo transportans*, the travelling human, is moving the planet's species of plants and animals all around, it may, as we shall see, influence the core of evolutionary processes. The consequences cannot be predicted precisely, but the overall tendency is clear, that is, to decrease biodiversity, and with it, ecosemiotic difference. But bioinvasion as a problem and phenomenon is not only about what happens in Nature, it is seriously consequential regarding how humans conceive nature and culture. There is even a certain danger that everyday concepts about homely and foreign are being mixed with similar concepts in a scientific-biological version.

The points to be developed more in detail below are these: (1) Bioinvasion on a global scale is an ecosemiotic phenomenon with long term consequences for biological evolution. Bioinvasion can contribute to perturb the balance between two rates: the rate at which new species are formed and the species extinction rate. The net effect will be a decrease in species number and ecosemiotic variety. (2) Evolution takes place in local ecosystems. An ecosystem is more than the sum of its species and is characterized by a complex material and semiotic dynamics. This makes it difficult to predict the effect of disturbances. But for "the worst case" it remains inevitable that increased bioinvasion will globally decrease biodiversity and disturb the evolutionary dynamics. (3) Indigenous, native, and foreign are terms for properties that seem to be used in two quite different spheres: Culturally in the debate in many European countries about the transformation by immigration of demographic relatively homogenous societies into multicultural societies; and "naturally" in the context of nature conservation and bioinvasion. It is crucial to distinguish these contexts and, at the same time, be able to see how they both have their actuality related to the process of globalization. Xenophobia on behalf of Nature may not be misplaced, but the parallel between fear of globalization on the cultural level and fear of bioinvasions in ecosystems should not be politically misused.

The exotics arrive

Invasion of foreign species to the local habitats of plants and animals have been called a quiet and unnoticed catastrophe. Many Europeans believe that the giant hogweed or cow parsnip (*Heracleum pubescens*), introduced from Caucasus, can out-compete local species of hogweed in Central and Northern Europe. The giant herb plant evidently changes some habitats dramatically, though out-competing has not been documented. However, this is only a minor example of a wide-ranging pattern of mixing and blending the planet's local species straining the original environments. It may lead to ecological chaos when exotic organisms suddenly appear at unexpected places and eventually spread as a pest because no natural enemies, as in the exotic's native surroundings, dampen the population in the invaded areas.

Numerous examples have been reported, both aquatic and terrestrial. A well-known and illustrative case is the introduction into Lake Victoria in the 1950s of the Nile Perch, with devastating consequences for the endemic[2] species of cichlids. The Nile Perch is a predator fish that can grow up to 2 meters long. The first decades of its life in the lake passed on quite smoothly, but in the 1980s its population density exploded. The native species vanished, and a survey concluded that some 200 species had disappeared completely (Goldschmidt *et al*. 1993). This did not end the drama. Around 1990, the water hyacinth (*Eichhornia crassipes*), a native plant of the Amazon Basin brought to Africa as a pool ornament in the nineteenth century, arrived at Lake Victoria. It is one of the world's fastest growing plants, and in the absence of fungi and insects that feed on it and the presence of enough nutrients, it covers the waters by dense mats. By 1996 it was strangling 90 % of the lake's shoreline, completely changing the sea ecosystem and deoxygenating the waters. One result was that by 1997, "ten thousands of fishing families had lost their livelihoods to the weed; many had abandoned the lake and moved into the city" (Bright 1999: 90).

[2] Endemic, i.e., found only at this local site and nowhere else. An amazing high percentage, 44% of the known global biodiversity of plants and 35% of all non-fish vertebrates are endemic to just 25 separate "hotspots" on 12% of the earth's surface. These areas are under acute threat, principally through forest clearing — overall, only about 12% remains in its original state (see Kitching 2000).

Bioinvasion is particularly serious in many small islands like Hawaii, which is home to some of the most unique and endangered rain forest ecosystems on earth. Extreme isolation, diversity of habitat zones, and a moist tropical climate have given rise to very high rates of endemism in these islands. Over 90% of the species native to Hawaii are endemic. On the island of Maui, many species are unique to Haleakala volcano or the west Maui mountains. Today Maui is home to 91 threatened, endangered or proposed endangered species. The continued invasion of Maui by alien (non-native) plants, animals, insects, and microorganisms poses the greatest threat to the future existence of these native ecosystems (Bright 1999). Specific information about bioinvasion can be found on many web sites (such as the Global Invasive Species Programme website, GISP 2000).

Bioinvasions can have different causes, most of which can be traced back to the breakdown of natural barriers between ecosystems due to globalization. *Globalization* is here understood in its sociological sense as the transgressing expansion of the Western way of life (including commerce, political, economical, social, and communicative structures, functionally partitioned institutions, and an outlook on nature predominantly oriented at control) at the expense of more traditional or premodern forms of life. A marker of globalization is "the intensification of world-wide social relations which link distant localities in such a way that local happenings are shaped by many miles away and vice versa" (Giddens 1990: 64). Another way to put it is to assert that globalization is the extension of imperialism, capitalism, and the world market by new means; the ecosemiotic effect of which is to extend the symbolic domain of exchange value into new areas of the semiosphere. Money as a symbolic exchange system has the social advantage that otherwise incommensurable phenomena may be compared. But the systematic abstraction from use value (and intrinsic value) involved in exchange may have the drawback of creating a risky non-knowledge of the effects of transplanting the things exchanged, especially when such "things" are not just dead artefacts but organisms with a life and environment of their own.

As ecosystems are extremely complex, it is notoriously difficult to predict the risk of real invasion and unbalance by the deliberate introduction of a new species (as in horticulture and agriculture), or by accidental "leakage" or other forms of unintentional importation. The crypto-ecosemiotician Gregory Bateson often emphasized that the real ecological unit was not the organism as such, but the relation between the organism and its environment (Bateson 1972). Without its envi-

ronment, including its Umwelt, an animal is not real, and when transplanted to a different environment, we are dealing with a quite different and potentially risky unit.

It is a general feature of scientific findings that the answers are far from definitive. This is especially true in the context of bioinvasion where knowledge is lacking on several levels about ecological factors influencing the growth of populations such as climate, competition, the ecosystem's potential for new niches, stability and diversity of ecosystems. At the greater time scale, the very process of evolution may be affected if all is finally squeezed into the same juice of one single hyper-ecosystem.

Scientifically bioinvasion must be seen as a (human-created) phenomenon of nature, deeply related to human forms of life and understanding. It affects the environment, but is also about a part of the anthroposemiotic Umwelt — of our conceptions and presuppositions. Combating bioinvasion is not a form of cultural xenophobia, though it might be mistaken for that. Thus, one should also analyse the ecosemiotic question of possible parallels between the fear of foreign species in nature and the fear of people from other ethnic groups; especially in an atmosphere where terms like xenophobia, tolerance, and political correctness are degenerating to mere rhetorical devices.

Finding balance in the dynamics of nature-culture hybrids

Bioinvasion threatens biodiversity. The variety of species in an ecological society shrinks if exotic species invade and press the native ones, eventually so much that they become extinct. This kind of pollution of flora and fauna is not the same as spilling oil that is diluted with time. The perturbation of an existing and delicate balance between local species of a biological community may irreversibly change the characteristics of an ecosystem such as a forest, a bog, a swamp or a marine area.

One could ask, sceptically, whether nature as such is not always dynamic and ever changing, and whether bioinvasions or immigrations of non-local species is not a far more permanent and natural phenomenon in ecosystems, following, for instance, climatic fluctuations. Climate change has always favoured some species at the ex-

pense of others. We as humans may be concerned if species appreciated by us are driven back, but honestly, does Nature care?

The answer is, briefly, that no, nature is dynamic, but yes, nature is not careless or indifferent. The argument is one that relates ecosemiotics, biosemiotics, and bioethics to each other. As a premise it is crucial to distinguish nature as merely matter (as often supposed to be the point of view of physics, though this is a crude simplification) from nature as complex, living dynamical systems (systems realizing purpose, semiosis, intentionality, and value). Humans can manipulate and partly control living nature, but unrestricted attempts at mastery over nature rebound on humans in the form of unpredictable and undesirable side effects concerning health, economy and beauty. Some philosophers have argued that when someone has polluted a lake, nature is not brought out of balance — the stinking algae puddle that was formerly a lake has simply achieved another balance (Thyssen 1982) — thus trying to locate all value on the human side of the nature-culture divide; seeing humans as primarily belonging to a "second nature", and in that sense always transcending the "first nature" of physical and biological systems. Structurally, this position is similar to some versions of social constructivism claiming that the fact of pollution is a fact manufactured by the fabric of science within a particular cultural setting of human values with no privileged claim to universality or truth (for a critical survey of different forms of social constructivism, see Collin 1997). There is no question here of denying that "pollution" is partly a normative concept. But against the provoking view that there are no objective (person- or culture-independent) preferences for the clean lake, one should remember that it is basic (also to all environment protection work) that we can distinguish between nature as merely matter (careless about pollution) and nature as living systems, whose parts are vulnerable and who has (and makes) meaning — both biologically for the involved species themselves (Hoffmeyer 1996) and practical, aesthetic, and ethical signification to us as humans: neither salmons or salmon fishermen are indifferent to pollution.

Organisms have their own preferences, they prefer certain habitats to others. Values in this elementary sense are located in nature. An advantage concerning this simple point is that it escapes endless and abstract hair-splitting on whether values are always set by humans or whether nature can have intrinsic values, because most people will recognise that each individual species of plants or animals prefers and

(in that pragmatic sense) "values" particular places to be in or grow in a heterogeneous environment.

Even though "original" nature in industrialized countries is becoming very rare or even an idealization, and even though a landscape is a mix or a hybrid (*sensu* Latour 1991) of natural processes and cultural disturbances, it is to a high degree meaningful to talk about animals, plants, and microorganisms as beings that partake in larger wholes, ecosystems, which have qualities of both a natural and cultural kind. A lake can loose so many of its qualities that organisms that formerly lived there search other places (if they can), or simply become extinct. If so, the ecosystem will also appear of less value to us. In that very basic sense, all ecosystems are also ecosemiotic systems with intrinsic values.

Knowledge of ecosystems

Classical ecology focused on dynamical properties of especially "natural" ecosystems (not influenced by human activity), including the general processes of speciation and extinction. Modern ecology continues this tradition, but also investigates that special hybrid dynamics of spontaneous, deliberate, and unintentional processes unfolding when humans' material use of natural resources intensifies. What is highly worrying is not species extinction as such, for during the whole history of life on the planet, new species have evolved and others have gone. It has been estimated that over 99% of the species that ever existed on earth have become extinct (Stanley 1998). This is the rate at which biodiversity is generally deteriorated, which is worrying because manmade extinction highly exceeds the rate at which evolution creates new species at the geological time scale. The number of species is related to the number of qualitatively fitted ecosystems.

The quality of ecosystems can be conserved, increased, or reduced, or completely threatened, and bioinvasion has shown to be an often overlooked contributing factor in the general deterioration of biodiversity, both globally and nationally (Hobbs 1989; Drake *et al*. 1989).

There are much missing in our knowledge of foreign species which appear by the help of humans in ecosystems they would not normally reach and become established. The detection of bioinvasions often demands careful monitoring to achieve detailed data about the actual species composition of various types of ecosystems. As the total size

of the population of a given species is subject to natural fluctuations — because of climatic variations, fluctuations in populations of other (predator, prey or parasite) species, nutrient supply and so forth — this demands often data for long periods of time. Even in a small country like Denmark where wildlife and wild vegetation have been mapped and monitored reasonably in detail, more fine — grained monitoring programmes are needed, the same is indeed still more true for larger nations.

The species as a part of a whole with systemic properties

Saying that bioinvasion is an ecological problem points to the fact that what is effected in a local landscape by the exotics is not only the population sizes of the individual species but systems of species — ecosystems. Properties of ecosystems do not reduce to properties of the organisms of each species. The diversity of species, the carrying capacity of the system and its balance (or temporary stability) are some of the properties that biologists fear to be threatened by bioinvasion, but one may also add the experiential qualities we as humans associate with wild or semi-wild nature. Even though there have been considerable arguments and scientific controversy within ecology about how precisely to define concepts like biodiversity, ecological balance and stability, there are reasons for keeping in mind the general reality referred to by these notions and their ecosemiotic dimensions. This can be summarized in four items.

1. In analogy to an organism, an ecosystem has a certain thresholds of tolerance for specific parameters (e.g., temperature, nutrients, toxic chemicals). Within these thresholds, the organisms of a particular species and their environmental relations may adapt to perturbations, but if the changes become too powerful, the system is pushed beyond its "homeostatic plateau" (that area or interval of tolerance between the higher and lower parameter values within which adaptation is possible), and the system is transformed to a quite different kind of ecosystem. The system has been changed — or destroyed. Pollution of a lake with artificial fertilizers is a well-known example, but also the introduction of a foreign species into a lake can, as we have seen, push the lake beyond its original dynamics and make the ecosystem of a different kind. For instance, the omnivorous pollution-tolerating common

carp (*Cyprinus carpio*) was introduced to Europe from Asia by the ancient Romans, and have during the late nineteenth and early twentieth century been introduced to many other places of the world, including the Southern United States, where it has transformed many clear lakes to algal ponds, displacing local fish species (Courtenay *et al*. 1992).

(*Excursus*: We see here that bioinvasion and globalization are processes as old as civilization, indeed an aspect of it, but only when such processes are becoming more fully realized can we grasp or develop, in an almost Hegelian sense, the full implications and meaning of these concepts. This is an ecosemiotic point. When the civilizing process extends to Nature's own "self-organizing" systems, it may have catastrophic consequences when another developmental logic is imposed on natural systems. Natural systems have natural barriers. The nature of capitalist civilization is breaking down all barriers for the sake of free exchange of "goods" and resources.)

Changes from one ecosystem to another may be described on an abstract level by the language of complex dynamic systems.[3] The differences between different attractors in the whole "ecological state space" (that may be described quantitatively within this physical approach by simulating some mathematical models of particular systems), and the eventual existence of stable periodic, quasi-periodic, or chaotic attractors within some parameter range, may throw some light on issues of predictability and stability of ecosystem behavior; however, it is also important to relate such approaches to the communicative or semiotic network that are part of emergent biological processes that gives coherence and stability to ecosystems.

2. Biodiversity is a measure for the richness, variety, and multitude of organisms in an ecosystem. Monocultures like a cotton field have only few other species than the one species cultivated (by use of herbicides and eventually gene-spliced herbicide resistance in the crop); a pine plantation or a rubber estate have some more species, and a wild deciduous forest have far more. The concept of biodiversity covers the ecosystem level (the variety of ecosystems in a landscape), the species level (within an ecosystem), and the level of genetic variation within a single species. Evidential signs indicate that next to the destruction of habitats, bioinvasion is what contributes most to the erosion of biodiversity at all three levels (Vitousek *et al*. 1997). Furthermore, the de-

[3] For a general survey on notions of complexity, see Emmeche (1997). A popular introduction to "the sciences of complexity" is Coveney and Highfield (1995).

struction of habitats makes it easier for introduced species to become invasive; colonizing species can profit from the decreased level of competition which is an effect of habitat destruction (IUCN 1999). The number of species in an ecosystem is only a rough measure of biodiversity, as this concept from a biosemiotic point of view must involve qualities related to the unique pattern of relations between different species in their total activity. This activity is not simply ruled by physical laws in the usual sense, but is guided by the final causality of sign action. For instance, in the tropical forest one often finds a relation between species in a pattern like this: species *A* depends on species *B* (eventually plus a few more), *B* depends on *C*, and *C* depends on *D* and *D* depends on *E* — that is, chain-like structures of relations with interconnections between the chains. The loss of a single species may effect all the following in the chain.

3. Stability of ecosystems, understood as a kind of buffering capacity against perturbations, has often been claimed to be related positively to a system's biodiversity. There was a tradition in ecology in the 1970s according to which high diversity guaranteed high stability. More recent research in ecology has seriously questioned this assumption and has shown that this relation is not unambiguous, but can only be perceived a rule of thumb with many exceptions (Ludwig *et al*. 1997; Doak *et al*. 1998). The insight of "chaos" in physics (non-linear dynamics) made ecologists realize what was overlooked before, namely that (1) even in high-diverse systems small changes, such as the elimination of a single species, may create a whole cascade of effects so that some form of "butterfly effect" is actualized: a little change may have extreme effects. (2) In practice it will often be impossible (due to non-linearity and extreme sensitivity on initial conditions) to predict whether there will be a cascading effect or not, which should happen if a so-called "key species" of the ecosystem is involved (this concept is also debated, however). The lesson of chaos is a high degree of modesty regarding our capacity to predictive control of ecosystems.

4. Evolution needs heterogeneous environments. Nature has, by spontaneous processes, evolved new species since the first life made its appearance here on the Earth for approximately 3.800.000.000 years ago. Geology, climate, and other physical processes have contributed to create the environmental heterogeneity — which of course has physical as well as semiotic aspects — such as the difference between land, sea, lakes, mountains, and other important — we might call them primary — differences. Upon this base of primary heteroge-

neity, there exist layers upon layers of bio-generated heterogeneity which have been crucial to the evolution of new species. The combination of physical and biotic factors leads, by nature's tendency to complexify and take new habits, to the creation of a very high number of different habitats. Both the primary geophysical-geographical and the additional layers of heterogeneity create barriers between the species. (In an abstract sense similar to the creation of barriers between different newly generated syntactic and semantic habits in the evolution of different languages, such as in pidgin languages; but of course, this is just an analogy not to be pursued further here.) Geographical and other forms of isolation are among the important preconditions for speciation — Darwin's finches are a well-known example. An ecosystem is at once open to energy (and to some extent to matter) and relatively organizationally closed regarding its species. There exist characteristic and relatively stable communities (of plants and animals) in various ecosystems.[4] Evolution and environmental heterogeneity are the historical foundation for the generation of biodiversity. Globalization and bioinvasion threaten to dissolve this fundament. The increased mobility of local species "hitchhiking" on humans may lead to decreased variety of different specific local ecosystems. What looks like increased "ecosemiotic freedom" so to speak, becomes in fact increased uniformity and a standardization of nature. An example are the aquatic communities of invertebrate animals found within the big harbours all over the world and in nearby coastal areas, where one finds the remarked tendency that these ecosystems are becoming more and more similar to each other, among other things, because of intake and release at such places of huge amounts of ballast waters in big tankers and other transport ships.

Thus, biodiversity can no longer be considered simply as a question about the number of species in a local ecosystem. There are examples of introduced species that have enriched the local habitat without becoming invasive, but the existence of non-linearity ("chaos") in com-

[4] One of "the earliest clear recognitions of the existence of particular assemblages of different species" (Kormondy 1965: 118), i.e. the community concept in ecology, was Edward Forbes, who in 1844 published a "Report on the *Mollusca* and *Radiata* of the Aegean Sea, and on their distribution considering as bearing on geology" (reprinted in Kormondy 1965). The word *ecology* is usually credited Ernst Haeckel (in 1865), but according to Kormondy (1965: xiii) it was a Reiter who first formed the term one year before Haeckel. Communities in ecology were probably first systematically studied by the botanist Eugen Warming.

plex systems and the historical examples of exotics that have exploded in population size only after a long period of low level density in the new area should keep us from experiments, remembering how extremely difficult, if not impossible, it would be to predict those introductions that are risky and those that are not (i.e., not disturbing the balance between the indigenous species). Each owner of a garden may like to design a local paradise, but the ecosemiotics of gardening and similar projects cannot be quite so innocent as before the era of globalization.

It is important to realise that a species is not simply a species. The species is part of an ecological context, a totality, in which it systematically plays a role in that particular ecosystem. Being a part of a whole, it is in this case to a high degree the whole which imprints upon the species its characteristic ecological properties. An analogy can be made from the relation between an enzyme and a cell. Looked at purely chemically, the enzyme is simply a protein compound with a particular three-dimensional structure, but in the cell's metabolism, the enzyme has a specific function due to the relation between its form and the set of actual specific substrates. Function is here an emergent property (a property of a higher order than simply a chemical property), that is, the role of the enzyme cannot be characterized on the protein-level, because the role is a relational property determined by the whole network of other substances in the cell with particular functions. In analogy, a species is something one might characterize purely anatomically and morphologically, but as part of an ecosystem the species has a functional role in the network of relations with other species in the ecosystem. *Functionality* (in ecology, or in molecular biology, or even in ecosemiotics) is thus be regarded as involving final causality (a purpose-like form of causation, *sensu* Peirce), and more to the point, this final causation (Santaella Braga 1999) is related to the hierarchical or level-structured organization of life, with emergent properties and a kind of downward constraint (downward causation, cf. Andersen *et al*. 2000) from the whole to the individual parts.

The function of a species can be more or less decisive for other species and if a species disappears it may have short or far-ranging implications. An example of a little trophical cascade is the introduction of a predator who eats the zooplankton in a lake, which makes the plant plankton bloom, and finally this depletes the water's oxygen resources. Due to its many components, an ecosystem may certainly have possibilities for maintaining its most general functions (e.g., photosynthesis) by regulatory compensation, that is, one component takes

over if another one disappear (the system has a buffering capacity, see Jørgensen 1997). However, the lessons from bioinvasions have been that the qualitative indicators for a system's stability and identity (such as specific composition of species) are important. It is not insignificant which species in the concrete case are filling out the role as primary producers. The point is that bioinvasion is not about species as single atoms, but about systems with ecological end semiotic properties on different levels. Such systems are at once evolutionary and ecological. The evolutionary consequences of bioinvasion are alarming. As in the risk assessment analysis of atomic nuclear plants, one operates with the worst imaginable case, one should try to include the worst possible consequences of bioinvasion in a global, evolutionary perspective.

Global spread and evolution: the extinction of difference

Let us invent a little thought experiment. We do not need computers to do the simulation. It is about an extremely simplified and artificial universe, but the claim is that it nevertheless reflects certain aspects of evolution on this planet and the threat against evolution in form of bioinvasion.

We let the evolution in our constructed universe span over three epochs: The original *pan-epoch*, when the planet's living places are connected and continuous, with very few basic types of ecosystems (somewhat corresponding to the archaic coherent supercontinent Pangaea that existed for about 200 millions years ago). The dynamic *split-epoch*, where evolution gets speedy after the genesis of great geographical barriers between different regions of the earth (as the planet with the same continents and all that environmental heterogeneity we know today). Finally, there is the *inva-epoch*, where the barriers dissolve (as with the globalization of today).

(1) In the pan-epoch, the starting state of the system, there are in our little scenario only three ecosystems — defined by basic ecosemiotic differences: mountain /lowland /sea — each with 3 species, in total only 15 species.

(2) Then we let the evolution run for some billions of years. In this new split-epoch both new ecosystems and new species are generated. We get 10 different kinds of mountain-ecosystems, 10 different kinds of lowland ecosystems, and so forth, so now we have in total 30 eco-

system types, and for each of them there are generated about 50 new species by evolutionary processes like natural selection, organic selection, sexual selection, niche specialisation, genetic drift, and soon. So now our little universe has around 1500 different species in total.

(3) Then comes the inva-epoch, corresponding to the re-creation of a kind of super-continent. For some reason the barriers between the 30 ecosystems are obliterated. The evolutionary forces continue to act, and with them the action of living signs, but in contrast to the split-epoch, where the evolutionary processes in combination with geographical and other sorts of isolation acted to generate new species, the total mix-up following the increased connectivity between ecosystem types results in a competition-dependent reduction, both in number of species and in the number of ecosystem types. First we come down to 700 species, and as some of the extinct species were key species in the ecosystems generated in the split-epoch, the number of types of ecosystems (such as lowland ecosystems) is further reduced, and so on. The result: 15 different ecosystems, each with 9 species, in total 135 species. If we take species number as a measure of biodiversity, the whole story thus goes from 15 up to 1500 and then down to 135 species.

Now one should not take this thought experiment more seriously than it is: A pedagogical illustration of the connection between the evolutionary process and the (physical, climatic, geographical and semiotic) barriers between habitats, which is a very important precondition for the biodiversity on earth. A less dramatic scenario could have illustrated that biodiversity can grow locally but diminish globally (for instance of each ecosystem could sustain 60 species after the invasion, but it was more or less the same species all over). It is certainly possible to elaborate on the thought experiment, simulate mathematically sophisticated models, make the conditions more precise and realistic, run the interactions in a more complicated way, and experiment by varying the parameters and preconditions (see, e.g., Kaufman *et al*. 1998). It is beyond this note to discuss such models here, and it will hardly change the basic point, namely that we can point to three kinds of states or phases, the third one being ecosemiotically unattractive, and that we have certain possibilities of avoiding it or at least slowing down the rate at which we approach it. The phases can also be called:

Pangaea: The youth of multicellular life, with few ecosystems and few species.

> *Gaia*'s many continents and heterogeneous systems, with high biodiversity. Now.
> *Hyperpangaea* appears: A hyper-ecosystem with a lower global biodiversity. Tomorrow?

In the actual history of life there have sometimes appeared situations that on a similar scale may be compared to the generation of a hyperpangaea (or biological "globalization"). For about 70 million years ago a land was created connection via the Panama isthmus between the formerly isolated North and South American continents. Before the collision of these continents, since the break-up of Pangaea (for about 200 million years ago), evolutionary processes had generated a series of parallel forms of marsupials in South America and placental mammals in North America. The placental sabre-toothed tiger and the marsupial sabre-toothed tiger were thus geographically isolated, but occupied parallel ecological niches. After the establishment of the land connection — and the following "natural" bioinvasion — occurred a temporary increase, during the very exchange period, in the number of mammal families (in North America from 25 to 35, in South America from 30 to 40), but this richness was short-lived. After this period, the number of families was stabilised on each continent at the old level. However, it was not the same families as before, and in total, the number decreased. Especially in South America, the original fauna faced hard challenges, and about 40% of the original mammal families went extinct as a consequence of competition with the species from the north (Heinberg 1987; May 1978). This indicates that the possible niches for mammals on the two continents were generally filled, and that the ecological parallels between the placental and marsupial mammals were real, which was why co-existence was not possible.

It does not take much ecological imagination to conceive of the evolutionary consequences of a total globalization at present. Phase 2 and 3 can be viewed as the extremes on a scale on which we move daily a little step in the wrong direction.

Bioinvasion as a cultural threat

The expanding world market redistributes enormous quantities of commodities, labour, and capital. We cannot return to the time before globalization, and few want to decrease the commercial, scientific, and cultural exchange between nations. But this does not mean that we

wish for a world in which all differences have disappeared or all cultures have become one. It should raise concern (not least in semiotic circles) that linguistic diversity is decreasing so dramatically and that the current estimates, based on the present rates of language death, say that only about half the world's 6000 existing living languages will survive the next 100 years (Grenoble & Whaley 1998; Crystal 2000; Ostler 2000).

Correspondingly, nature's diversity of habitats, species, and local variants of wild or domesticated species are under pressure. Globalization endangers both forms of diversity, and interestingly, there can be connections between conservation of local types of ecosystems and local types of cultures. A threat against one may lead to a pressure on the other and vice versa (Posey 1999; Nettle & Romaine 2000). For example, genetic erosion will follow from the loss of local traditions of farming or agriculture. The distribution of genetically modified crops is world-wide connected to the extension of industrialized forms of agriculture and cultivation, in particular, when the peasant buys herbicide, herbicide-resistant seed, and artificial fertiliser, and the local varieties gradually disappear. In Northern Europe, the heather and moor lands, the hay harvest meadows, and the commons are examples of culturally affected ecosystems whose existence depend crucially on the specific method of agricultural work that created them.

But should bioinvasion be conceived of at as a cultural menace? If a nation's borders are historically accidental compared to natural borders, one would characterize "the national nature" almost as a social and historical construction to the extent that political and not biogeographical borders determine which species belongs to the flora of Mexico, USA, or Canada, and is represented in handbooks with titles like *The Wild Flowers of Canada*. (Of course, it is not nature as such, but its representation in books or ideas which is a social construction in this sense. We will bypass the conceptual difficulties with making that distinction between nature in itself and the ways we represent nature.) The ecosemiotics of bioinvasion must thus also be investigated as a cultural phenomenon.

Xenophobia applied to nature?

Though the term bioinvasion has not yet been adopted in ordinary language, it is easy for lay persons to get a fairly good idea about its

meaning: "Is it not something that crawls in across the border and expands and that you cannot keep down — quite uncontrolled?". The word evokes the right intuitions. But in some minds who hold themselves to be rather sophisticated, there exists a certain form of carelessness over the quiet disorder of bioinvasions, that has to be commented on, namely a form of carelessness or dereliction that is rooted in a postmodern scepticism concerning all forms of postulates about an original, authentic nature. If there is no such originality (that a sceptic may have good reasons to suspect) then there is nothing that can be invaded or threatened in its authenticity, — seems to be the argument that reduces the increased concern over of bioinvasions as something similar to ethnocentricity and xenophobia transferred to nature — and the whole discussion begins to look like a remix of films such as *Jurassic Park* and *Matrix*. Though it is difficult to expect that the very ironic attitude or the shrug of shoulders is something you can argue with, there appears to be the need of repudiating this form of carelessness resting on a fallacy and a general scepticism concerning the reality of an impoverished ecosemiosis.

The answer to the sceptic is that even though it is true that originality and authenticity are highly relative concepts, and to a certain extent illusory in relation to the small spots of "wild nature" found in many industrialized countries, bioinvasions are in no way illusions. They are in fact in the process of changing the ecosystems globally as well as locally. The sceptic may be right in insisting that historically and anthroposemiotically what is counted as "Canadian nature" and thus what is being invaded is merely accidental, however, we must be make more precise in respect what is accidental, accidentiality or contingency means. This clarification, coming from both science and the humanities, is also part of the ecosemiotic analysis of the nature-culture hybrids.

The landscapes of a given nation, such as the Danish nature, has to be understood also by taking departure from the ideological aspects of the phenomenon of nationality, including the national landscapes which in Denmark for instance is found depicted by the so-called "golden age painters" (artists, such as C. W. Eckersberg, Chr. Købke, and J. Th. Lundbye from the romantic period in the first half of the nineteenth century). Contemporary research in the science of human history has reached an understanding of the nation and the people as a construction originating at a certain point in history and eventually disappearing again as a coherent project. Connected with the construction of Denmark as a nation is the creation of a national identity,

which demands a certain consensus about what belongs to the national literature, the treasure of songs, a story of a common history of the people, a folk character, an official national language (uniting or repressing the richness of dialects), and so on. By using the term "construction" it is not claimed that it is something unreal or necessarily made by a set of deliberate decisions, but that one should not take at face value this story about the essence of a national identity (or the idea of a people's united folk character from the time immemorial), and that it is an illusion to believe that it can be excavated and purified. What is at stake is rather a political project in a given historical situation related to the institutional creation of a national state with sharp borders, based on military and economic power, internally in relation to a society's interest groups and externally in relation to the powers of other states. To the national construction belongs also the construction of a national flora and fauna, where the sciences of zoology and botany in the eighteenth and nineteenth centuries map the kingdom's (or the republic's) plants and animals. Later on, in the twentieth century, updated versions of these sciences begin to relativise and deepen the understanding of which species were "original" or indigenous since the latest glacial ages and which were introduced — without really altering the common conceptions (or golden age imaginations) of the national nature and its authenticity. In the whole story about the national, there is a point — very central to the question about bioinvasion — where the research in the humanities on the national construction meets scientific research in the generation of the landscapes; the key word here is contingency as a very special form of accidentiality and randomness.

Contingent nature

Contingency means that something might have been otherwise, but not totally otherwise — it is a special mixture of historical accidentiality and necessity. (Contingency is indeed an aspect of habit taking in Peirce's sense, its category is thirdness, its causality is final, and so, here in this context, it is used to specify more in detail one of the ecosemiotic workings of habit formation in relation to the nature-culture hybrids). To give a picture, contingency is like going through a maze by throwing a coin and let the heads or tails decide whether to go right or left at each crossroads. The route is determined by random

accidents, but it is not chaotic or completely random; it contains an element of necessity, namely the interplay between the events of casting the coin and the structure of the labyrinth determining which routes are possible in the future.

Contingency may be found in nature as well as in culture. Contingency has been used as a specific concept in evolutionary biology by Gould (1989) to characterize in which sense the individual species, like our own, were not — at the origin of life or of multicellular animals — predetermined to appear as a product of evolution. Had the circumstances been different (such as for instance in the Cambrian explosion of life forms for about 570 million years ago), intelligent life forms might have evolved from molluscs rather than vertebrates (to spell it out, we might have been squids). Similarly, had the geological conditions been a little different than they were during the creation of such a group of landscapes now called Denmark, this country's "national" flora and fauna might have been totally different. Nevertheless there is also lawfulness, regularity, and order in the way the living environment is structured, and one aspect of this structure is the fragile balance of many ecosystems.

In the human context of the history of ideas, contingency is used to denote the lack of stable traditions and the rootlessness of humans in a modern world where the single individual becomes disconnected from an organic community with traditional customs and morals, is liberated, and released, and thereby exposed to an existential vacuum. In this, illusion about a firm cultural anchorage is dissolved in the etching bath of declassification, alienation, and postmodern irony (Thomsen 1988; cf. eventually Rorty 1989). In parallel with this we realise that the landscapes we were used to see as the quintessence of the nation's typical nature (in Denmark the patchwork of beech forests, heather hills, oatfields, meadows and commons) could have been quite different had the history been a little different. Had the Danes been conquered by the Finns two hundred years ago, birch would have been the national tree and beech just a local deviation (counterfactual processes are in fact a serious topic in contemporary history).

The point is not that because a given piece of nature's landscapes is contingent — both in the sense of natural science as a local product of the cosmic evolution and in the sense of the humanities as an ideological construction — we can be careless about bioinvasions. That would be a fallacy of enormous dimensions. Nature has neither biologically nor culturally that constancy and existence-invulnerability that would mean that we could take it for given — nature has become

vulnerable during the civilizing process — and because of that are we obliged to be particularly attentive towards the connections between humans and nature and the causes of change in these relations. Being contingent, nature — or our national prides — could have been different. That nature which is immediately relevant to us is not cosmos at the birth of the universe or the universe's remote end; it is nature as a coherent system of living ecosystems, which are truly socioecological and ecosemiotic systems, because the landscape is a nature-culture hybrid, a mix of something physical, biological, cultural, and social.

Furthermore, an ecosemiotic systems has its own life, that is to say a certain kind of integrity in the coherent complex of organic, cultural, and social relations, and being alive, it is vulnerable. We have the obligation to try to avoid or diminish unintentional damages on the system following from human activity. Bioinvasion is such a damage. Thus it must be combated, also as a cultural threat against the individual nations' landscapes, but with full consciousness about the contingent aspects of that mosaic of landscape types and nature-culture components that together constitute a nation's "ecosemiosystems". Thus, in particular cases, we will always have to discuss where we will draw the border between wanted and unwanted species, and this distinction is of cultural value though the underlying reality is the historical continuity between all species that make up all biodiversity.

Let it be?

To recapitulate, globalization is, as any child knows, imperialism's continuation of the extension of the world market by other means, while bioinvasion as an ecological sequel is not a quite new disease. When the European colonizers settled in Africa, South America, or Australia, they had an uneasy feeling or a vague fright of all the unknown and foreign and different in the new colonies' nature, that seemingly made them blind to its other kind of beauty.[5] They founded acclimatization societies, especially in the nineteenth century, and organized extensive introductions of hundreds of plants and animal

[5] Bright (1999: 134) calls it "colonial angst — an anxiety of difference" that is hard to reconstruct today when we can reach to anywhere in the world within 24 hours, but in the early phases of colonial expansion, being in the colonies could be felt like being at the end of the Earth and "could be frightening or repugnant to European sensibilities" (*ibid.*).

species from "the civilized world" (North America and Europe), to the colonies in Asia, Africa and Australia. This included putting out such "homely" species as starlings, goats, pigs, and rabbits in these new environments (Crosby 1986). Very often, this had catastrophic consequences for the local indigenous species and sometimes for the farmers themselves, for instance, when the cattle starved and the farmers had to give up their farms under the Australian rabbit plague that endured for almost a century, until the introduction of the Brazilian rabbit virus in the 1950s.

As you look upon nature, so you treat it. Since the invention of agriculture, human beings have been tempted to see every piece of nature as a potential field, plantation or mine, — or like a garden that can be managed by a gardener. Ecosemiotics should help us to understand the limitations of that view of nature and recognise the complexity of the interplay between human activity and ecological and evolutionary processes. We should not be scared about the foreign, but avoid that the culturally foreign is demonized and that the naturally foreign is snatched away from its local contexts. In ecology, certain things are best to be as they are and where they are.

This may sound as mere conservatism disguised in scientific and scholarly arguments, and thus as a case of scientism. However, this is not the case. The ecosemiotics of bioinvasion is a good example of the fact that we may not always advance in understanding by imposing old conceptual schemes — like the received ways of distinguish between progressive and conservative or between science and politics — on our actual problems.

References

Andersen, Peter Bøgh; Emmeche, Claus; Finnemann, Niels Ole; Christiansen, Peder Voetmann (eds.) 2000. *Downward Causation. Minds, Bodies and Matter.* Aarhus: Aarhus University Press.

Collin, Finn 1997. *Social Reality*. London: Routledge.

Courtenay, W. R.; Williams, J. D. 1992. Dispersal of exotic species from acquaculture sources, with emphasis on freshwater fishes. In: Rosenfield, Aaron; Mann, Roger (eds.), *Dispersal of Living Organisms into Acquatic Ecosystems*. College Park, MD: Maryland Sea Grand College.

Bateson, Gregory 1972. *Steps to an Ecology of Mind*. New York: Ballantine Books.

Bright, Chris 1999. *Life Out of Bounds. Bio-invasions in a Borderless World.* Worldwatch Environmental Alert Series. London: Earthscan Publications.

Coveney, Peter and Highfield, Roger 1995. *Frontiers of Complexity: The Search for Order in a Chaotic World*. New York: Ballantine Books.

Crosby, Alfred W. 1986. *Ecological Imperialism: The Biological Expansion of Europe, 900–1900*. Cambridge: Cambridge University Press.

Crystal, David 2000. *Language Death*. Cambridge: Cambridge University Press.

Doak, D. F.; Bigger, D.; Harding, E. K.; Marvier, M. A.; O'Malley, R. E.; Thomson, D. 1998. The statistical inevitability of stability-diversity relationship in community ecology. *The American Naturalist* 151(3): 264–277.

Drake, J. A.; Mooney, H. A.; Di Castri, F.; Groves, R. H.; Kruger, F. J.; Rejmanek, M.; Williamson, M. (eds.) 1989. *Biological Invasions: A Global Perspective*. New York: John Wiley & Sons.

Emmeche, Claus 1997. Aspects of complexity in life and science. *Philosophica* 59(1): 41–68.

Giddens, Anthony 1990. *The Consequences of Modernity*. Stanford: Stanford University Press.

GISP 2000. *Global Invasive Species Programme*, coordinated by SCOPE (the Scientific Committee on Problems of the Environment), IUCN (International Union for the Conservation of Nature) and UNEP (the United Nations Environment Programme) (http://jasper.stanford.edu/GISP/).

Goldschmidt, Tijs; Witte, Frans; Wanink, Jan 1993. Cascading effects of the introduced Nile Perch on the detrivorous/phytoplanktivorous species in the sublittoral areas of Lake Victoria. *Conservation Biology* 7: 686–700.

Gould, Stephen Jay 1989. *Wonderful Life: The Burgess Shale and the Nature of History*. New York: W. W. Norton.

Grenoble, Lenore A.; Whaley, Lindsay J. (eds.) 1998. *Endangered Languages: Language Loss and Community Response*. Cambridge: Cambridge University Press.

Heinberg, Claus 1987. Økosystemet, struktur og evolution. In: Bonde, N.; Hoffmeyer, J. (eds.), *Udviklingsideens Historie. Naturens Historiefortællere bd. 2*. København: G.E.C.Gad, 252–287.

Hobbs, Richard J. 1989. The nature and effects of disturbance relative to invasions. In: Drake et al. 1989, 389–405.

Hoffmeyer, Jesper 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press.

IUCN, 1999. *Draft IUCN Guidelines for the Prevention of Biodiversity Loss due to Biological Invasion.* Background paper. Fourth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (Montreal, Canada, 21–25 June 1999) (http://iucn.org/themes/biodiversity/sbstta4/guidelines.pdf).

Jørgensen, Sven Erik 1997. *Integration of Ecosystem Theories: A Pattern*. 2nd ed. Dordrecht: Kluwer.

Kaufman, J. H.; Brodbeck, D.; Melroy, O. R. 1998. Critical biodiversity. *Conservation Biology* 12(3): 521–532.

Kitching, Roger 2000. Biodiversity, hotspots and defiance. *Trends in Ecology and Evolution* 15(12): 484–485.

Kormondy, Edward J. (ed.) 1965. *Readings in Ecology.* Englewood Cliffs: Prentice-Hall.

Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–371.
Latour, Bruno 1991. *We have Never been Modern*. New York: Harvester Wheatsheaf.
Ludwig, D.; Walker, B.; Holling, C. S. 1997. Sustainability, stability, and resilience. *Conservation Ecology* 1(1): 7.
May, Robert M. 1978. The evolution of ecological systems. *Scientific American* 239(3): 81–90.
Nettle, Daniel; Romaine, Suzanne 2000. *Vanishing Voices: The Extinction of the World's Languages*. Oxford: Oxford Univ Press.
Nöth, Winfried 1996. Ökosemiotik. *Zeitschrift für Semiotik* 18(1): 7–18.
— 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–342.
— 2000. *Handbuch der Semiotik*. (2. Auflage.) Stuttgart: Verlag J. B. Metzler.
Ostler, Rosemarie 2000. Disappearing languages. *Whole Earth Magazine* Spring 2000 (http://www.wholeearthmag.com/ArticleBin/325.html).
Peirce, Charles S. 1931–58. *Collected Papers of Charles Sanders Peirce*, vol. 1–8 (Charles Hartshorne, Paul Weiss & Arthur Burks, eds.). Cambridge: Harvard University Press.
Posey, Darrell Addison (ed.) 1999. *Cultural and Spiritual Values of Biodiversity: A Complementary Contribution to the Global Biodiversity Assessment*. London: Intermediate Technology Publications.
Rorty, Richard 1989. *Contingency, Irony and Solidarity*. Cambridge: Cambridge University Press.
Santaella Braga, Lucia 1999. A new causality for understanding the living. *Semiotica* 127(1/4): 497–519.
Stanley, Steven M. 1998. *Earth System History*. San Francisco: W. H. Freeman.
Thomsen, Hans Jørgen 1988. *Frihed og Kontingens: Træk af Modernitetserfaringernes Historie og Betydning*. Arhus: Modtryk [in Danish].
Thyssen, Ole 1982. *Den anden natur*. Kæbenhavn: Vindrose.
Vitousek, P. M.; D'Antonio, C. M.; Loope, L. L.; Rejmánek, M.; Westbrooks, R. 1997. Introduced species: A significant component of human-caused global change. *New Zealand Journal of Ecology* 21(1): 1–16.

Биоинвазия, глобализация и возможности культурного и биологического разнообразия — экосемиотические наблюдения

В статье рассматривается все усиливающеяся биоинвазия (характерное для местных экосистем смешивание видов, вызванное глобализацией) как проблема экосемиотики. В связи с этим вызывает беспокойство явная нехватка знаний о долгосрочных экологических и эволюционных последствиях вторжения чужих видов. Указывается на необходимость дополнения биологического понимания экологии биоинвазии экосемиотическим подходом, который бы связал эту проблему с вопросами чело-

веческой культуры, культурного многообразия. Биоинвазия, вымирание местных видов и всеобщее уменьшение биодевирзитета могут сопровождаться уменьшением культурного разнообразия так же, как исчезновение местных земледельческих традиций приводит к генетической эрозии. Между вымиранием языков и биологических видов можно провести экосемиотические параллели, оба феномена связаны с глобализацией. Пример биоинвазии позволяет различить два экосемиотических подхода: 1) эволюционно открытое и местами случайное возникновение новых видов и вымирание старых; 2) маркированность культуры, точнее историчность ощущения природы в культуре, проявляющаяся в характерных “пейзажах” какого-нибудь народа или исторического периода.

Bioinvasioon, globaliseerumine ja kultuurilise ning bioloogilise mitmekesisuse võimalikkused — ökosemiootilisi vaatlusi

Artiklis käsitletakse üha suurenevat bioinvasiooni (kohalikke ökosüsteeme iseloomustavat, globaliseerumisest tingitud liikide segunemist) kui ökosemiootika valdkonda kuuluvat probleemi. Üheks mureks on teadmiste nappus võõraste liikide sissetungi pikaajaliste ökoloogiliste ja evolutsiooniliste tagajärgede kohta. Osutatakse vajadusele täiendada loodusteaduslikku käsitlust bioinvasiooni ökoloogiast ökosemiootilise mõistmisega selle probleemi seotusest inimkultuuri kultuurilise mitmekesisuse küsimusega, sellega, mida tähendab olla pärismaine või võõras. Bioinvasioon, kohalike liikide väljasuremine ja üldine biodiversiteedi kahanemine võivad käia koos kultuurilise mitmekesisuse vähenemisega samal viisil nagu kohalike põllupidamistraditsioonide kadumine viib geneetilise erosioonini. Keelte ja liikide väljasuremise vahele on võimalik tõmmata ökosemiootilisi paralleele, mõlemad on seotud globaliseerumisega. Bioinvasiooni näide võimaldab eristada kahte ökosemiootilist interpretatsiooni: (1) evolutsiooniliselt avatud ja kohati juhuslik uute liikide tekkimine ning vanade liikide väljasuremine; (2) kultuuri või täpsemalt kultuuri loodustunnetuse ajaloolisus markeerituna mingi rahva või ajalooperioodi tunnuslikes maastikes.

Bioethics, semiotics of life, and global communication

Augusto Ponzio, Susan Petrilli

Dipartimento di Pratiche Linguistiche e Analisi di Testi,
University of Bari, Via Garruba 6, 70100 Bari, Italy
e-mail: s.petrilli@lingue.uniba.it

Abstract. Ethical problems connected with biological and medical discoveries in genetic engineering, neurobiology and pharmaceutical research, reach a unified and critical point of view in bioethics as a specific discipline. But even before reaching this stage, ethical problems already belong to two totalities: the *semiobiosphere*, and the current social form of *global communication*. Coherently with its philosophical orientation, bioethics must necessarily keep account of this double contextualisation. The semiobiosphere is the object of study of *global semiotics* or *the semiotics of life*. Global semiotics is of particular interest to bioethics not only because of the broad context it provides for the problems treated by bioethics, but also because it provides bioethics with an adequate contextualisation both in terms of extension, of quantity, as well as of quality. From this point of view, "contextualisation" also means critical reformulation. We are now alluding to the need of viewing bioethical problems in the light of today's socio-economic context, that is, in the context of *global communication-production*. These contextualisations are closely related from the viewpoint of ethics. Semiotics as global semiotics or semiotics of life must accept the responsibility of denouncing incongruencies in the global system, any threats to life over the entire planet inherent in this system.

Bioethics offers a unified and critical perspective for ethical problems connected with biological and medical discoveries in the fields of genetic engineering, neurobiology and pharmaceutical research, etc. With the introduction of bioethics such ethical problems become the object of study of a specific discipline.

However, ethical problems, even before the introduction of this new discipline, are already part of two totalities which together contribute to their characterisation: one totality is the *semiobiosphere*; the other is today's society of *global or world communication*. Bioethics, coherently with its philosophical orientation which is critical and foundational, must necessarily keep account of this double contextualisation when dealing with the problems at the centre of its attention.

The focus of *global semiotics* or what we may also call *semiotics of life* is the whole semiobiosphere.

Thomas A. Sebeok above all has contributed to the current status of this discipline or "doctrine of signs". Rather than the more ennobling terms "science" or "theory", Sebeok prefers the expression "doctrine of signs" adapted from John Locke — for whom a doctrine is a body of principles and opinions vaguely forming a field of knowledge, and with this expression Sebeok takes his place in a tradition that includes Berkeley and leads to Charles S. Peirce.

Like Kant, Peirce focusses on signifying conditions. This leads to the possibility of identifying foundations shared by the human sciences and the natural sciences. Thanks to Peirce's "doctrine of the categories" the two opposite conceptions of reality which have dominated Western philosophical thought at last meet. We are alluding to the conception of reality which originates from Aristotle, on the one hand, and recites that things exist on their own account and independently from mind, and to the opposite conception which describes reality as depending on mind, on the other. The point of encounter is the semiotic perspective which describes objects and minds as part of the common process of semiosis.

The expression "doctrine of signs" also evidences the pedagogical character of Sebeok's research — but not only. With this expression Sebeok recovers the *critical* instance of semiotics. From this point of view not only does semiotics assign itself the task of observing and describing sign processes, but even more than this it interrogates itself *à la* Kant on the conditions of possibility of sign processes, just as it interrogates the conditions of possibility of the disciplines themselves that study sign processes.

As stated above, the object of global semiotics, of semiotics of life, is the *semiosphere*. This term is taken from Lotman but is understood in a more extended sense. In fact the Lotman refers the term "semiosphere" to human culture, while in the perspective of global semiotics the *semiosphere* identifies with the *biosphere* and may be characterised as the *semiobiosphere*: in fact *semiosis* coincides with *life* and in

this sense global semiotics is "semiotics of life"). Global semiotics is in a position to evidence the extension and consistency of the sign network which obviously includes the *semiosphere* as constructed by human beings, by human culture, signs, symbols and artifacts, etc. But *global semiotics* also underlines the fact that the semiosphere is part of a *far broader semiosphere*, the *semiobiosphere* — a sign network human beings have never left, and to the extent that they are *living beings*, never will.

With reference to Sebeok's writings the most systematic exposition of global semiotics is offered by the Italian edition of his book of 1991, *A Sign is just a Sign: La semiotica globale* (1998), which in addition to the original edition includes his essay of 1994 "La semiotica globale". Another book by Sebeok is scheduled to appear in 2001 entitled *Global semiotics*.

At an international level the most systematic work in global semiotics is without a doubt *Semiotics: A Handbook on the Sign-Theoretic Foundations of Nature and Culture*, in three volumes (the third is forthcoming), edited by R. Posner, K. Robering and Thomas A. Sebeok. This volume has benefited from the participation of 175 authors from 25 different nations. It includes, among others, an article by Sebeok "The evolution of semiosis" (published in Italian translation in his volume of 1998 cited above) in which he claims that life and semiosis coincide. This *Handbook* also includes many other articles referring to different fields and interests covered by global semiotics, these include: biosemiosis (Th. von Uexküll), microsemiosis (F. E. Yates), endosemiosis (T. von Uexküll and W. Geiges), mycosemiosis (G. Kraepelin), phytosemiosis (M. Krampen), zoosemiosis (W. Schler), anthroposemiosis (F. M. Wuketits), semiosis of machines (P. B. Andersen, P. Hasle, P. A. Brandt), environmental semiosis (G. Tembrock).

Global semiotics or semiotics of life is particularly significant for bioethics because of the broad context it provides for the problems at the centre of its attention (though this is not the only reason). And in fact, given that in the perspective of global semiotics semiosis and life coincide, the context is far broader than that postulated by Saussure's semiology which studies signs in the sphere of social life.

On his part, Sebeok closely relates anthroposemiotics to zoosemiotics (the study of animal communication including nonverbal human signs) and to endosemiotics (the study, on both the ontogenetic and the phylogenetic levels, of cybernetic systems within the organic body). In Sebeok's view, biological and therefore biosemiotic founda-

tions are the epicentre for studies on communication and signification processes in the human animal. Sebeok's semiotics unites what in other fields of knowledge and praxis is generally kept apart in the effort to justify needs of a specialized order, but also for the sake of useless and even damaging sectorialisations. This tendency is not devoid of ideological implications though often masked by motivations of a scientific order, and poorly so.

However, that global semiotics can provide bioethics with an adequate contextualisation is not only true in terms of extension, of quantity; a qualitative aspect is also involved. From this point of view "contextualisation" means *critical founding*. Global semiotics contributes to a *foundational and critical approach to bioethics*, that is, to its characterisation as a theoretical-philosophical discipline.

In fact the approach adopted by global semiotics is predominantly of an *ontological* order. Global semiotics refers explicitly to both Peirce's and Morris's semiotics as signposts, and no doubt their approaches are very broad — we know that Peirce went so far as to maintain that the whole universe is perfused with signs, if not made entirely of signs. However, beyond Peirce and Morris who limit their work to the phenomenological description of the various processes that may be interpreted as semiosical, Sebeok with global semiotics contributes to the reformulation of *ontology* in semiotic terms.

Sebeok's global semiotics interrogates itself on being, and does so *from the point of view of life*, for, as says Heidegger, the question of being is inevitably the question of that particular being for whom that question is vital. Indeed, not only is it a question of the life of the human individual or of all humanity, but also of *life over the whole planet* given the social system dominant today, that of global communication, and given, therefore, not only the pervasiveness but also the destructive potential of presentday anthroposemiosis. Global semiotics answers the ontological question by identifying *life* and *semiosis*.

With his global semiotics Sebeok may be considered as the author of such an ontological perspective, and of its diffusion among semioticians and cryptosemioticians. And all the different specialized contributions offered by those scholars who have contributed with different disciplinary competencies to the monumental *Handbook* take their place, whether consciously or unconsciously, in this particular setting. From this point of view, the *Handbook* in question is an official recognition of the status of Sebeok's global semiotics and of the accomplishment of his project. On the other hand, bioethics cannot ignore the benefits it may receive for its own philosophical vocation from

global semiotics. And this is so not only because of the scientific analyses conducted by global semiotics in the different fields of biosemiosis on a phenomenological level, but *above all because the approach adopted by global semiotics as semiotics of life is primarily of an ontological order*.

Global semiotics starts from the hypothesis that semiosis and life coincide and focusses on the interconnection among signs. Its gaze moves from the protosemiosis of energy-information to the overall processes of the complexification of semiosis in the evolution of life over the planet: from prokaryotes to monocellular living beings to the eukaryotic aggregates which form the multicellular organisms belonging to the superkingdoms. The latter coexist and interact with the microcosm and together form the great semiobiosphere. All this results in an indissoluble interconnection as presented by the *network of signs*: in Sebeok's words, this network extends from the Lilliputian world of molecular genetics and virology, to the man-size world of Gulliver and finally to the world of Brobdingnag, the gigantic biogeochemical ecosystem called Gaia. At first sight this system may seem to be made of numerous separate living species, but, at a closer look, we soon realize that each one of its parts, ourselves included, is interdependently connected with all the others. This system taken wholly, so to say, is the only ecosystem which may really be considered as such (even though it too only relatively).

As mentioned at the beginning, in addition to contextualisation of the phenomenological and ontological orders provided by global semiotics, another kind of contextualisation is also necessary for an adequate treatment of problems relevant to bioethics. We are now referring to the need of viewing bioethical problems in the light of today's socio-economic context, that is, in the context of *global communication-production*.

Such contextualisations are closely related and are so from the viewpoint of ethics. In fact, if we consider the contribution made by global semiotics to bioethics in relation to presentday global communication, semiotics is faced with an enormous responsibility, that of evidencing the limits of today's communication-production society. Semiotics must now accept the responsibility of denouncing incongruencies in the global system with the same energy, instruments and social possibilities produced by the global communication-production system itself. Semioticians must now be ready to denounce the dangers inherent in this system for life over the entire planet.

Today's phase in the development of the capitalistic system is that of "global communication". This expression may be understood in at least two senses: that communication is now characterised by its *extension over the whole planet* and that it is *accomodated realistically* to *the world as it is*. Globalisation implies the *omnipresence* of communication in production and characterises the entire productive cycle: not only is globalisation present at the level of the market, of exchange, as in earlier phases in socio-economic development, but also at the level of production and consumption. Globalisation is tantamount to heavy interference by communication-production not only in human life but in life in general over the whole planet.

For an understanding of world-wide global communication-production we need a view that is just as global. While the special sciences taken separately are not in a position to provide such a global view, the general science of signs or *semiotics* as it is taking shape today on the international scene thanks to the approach fostered by Sebeok and his ongoing work for further development, is.

A full understanding of global communication today implies a full understanding of the risks involved by global communication, including the risk of the *end of communication itself*. This risk, however, is not simply that of the rather banal phenomenon known as "incommunicability", theorized and represented in film and literature. What we are alluding to, instead, is the subjective-individualistic disease provoked by the transition to communication in its current forms (and which can no longer be separated from production). When we speak of the "risk of the end of communication", we are referring above all to the recognised identification between communication and life, and therefore to the risk of the end of life on the planet, considering the enormous potential for destruction in today's society by contrast with all other earlier phases in the development of the social system.

Therefore, the expression *global* communication-production does not only refer to the expansion of communication means and of the market at a world-wide level, but also to the fact that all human life is incorporated into the communication-production system: whether in the form of development, well-being and consumerism or of underdevelopment, poverty and the impossibility to survive; health or sickness; normality or deviation; integration or emargination; employment or unemployment; transfer functional to the work-force characterising emigration or transfer of peoples in their denied request of hospitality, characteristic of migration; the traffic and use of legal commodities or of illegal goods, from drugs to human organs, to "non-conventional"

weapons. Indeed, this process of incorporation is not limited to human life alone. All of life over the entire planet is now irremediably involved (even compromised and put at risk) in the communication-production system.

Reflection on problems relevant to bioethics today in the context they in fact belong to, the context of globalisation, requires an approach therefore that is just as global. An approach which does not simply consider partial and sectorial aspects of the communication-production system according to internal perspectives functional to the system itself, an approach which is not limited on an empirical level to psychological subjects, to subjects reduced to the parameters imposed by the social sciences — subjects measurable in terms of statistics. Global communication-production calls for a methodological and theoretical perspective just as global as the phenomenon under observation, a perspective in a position to understand the logic of global communication-production and to proceed therefore to a *critique* of the system it subtends.

An adequate analysis of today's world of global communication in all its complexity calls for conceptual instruments which must be as *precise* as possible, and which a *new theory of communication* may furnish; these conceptual instruments must also be as rigorous as possible and this can only be provided through a philosophical grounding of such a theory. An attempt in this sense is made in the volume by Ponzio, *La comunicazione* (1999) as well as in the volume co-authored by Ponzio and Petrilli, *Il sentire nella comunicazione globale* (2000).

Social reproduction in the global communication-production system is destructive. Reproduction of the *productive cycle* itself is destructive. It destroys: (a) machines, which are continuously substituted with new machines — not because of wear but for reasons connected with competitivity; (b) jobs, making way for automation which leads to an increase in unemployment; (c) products on the market where new forms of consumerism are elicited, completely ruled by the logic of reproducing the productive cycle; (d) earlier products which once purchased would otherwise exhaust the demand and which in any case are designed to become immediately outdated and obsolete as new and similar products are continuously introduced on the market; (e) commodities and markets which are no longer able to resist competition in the global communication-production system.

It is no incident that the European Commission which has devoted special attention to inventiveness and innovation functional to profit,

to "immaterial investment" and "competitivity" (cf. *Green book on innovation*, 1995), should identify *"innovation*" with *"destruction*" in full respect of capitalistic ideologic. The innovative character of a product is made to consist in its capacity for destruction: this product must destroy earlier products that are similar and still present on the market. The capacity for innovation abreast of the times coincides with the capacity for destruction to the extent that the criteria for evaluating innovation are completely adjusted to the interests of the market.

The *conatus essendi* of communication-production destroys natural environments and life forms. It also destroys different economies and cultural differences which in fact tend to be eliminated by the processes of homologation operated by market logic: nowadays not only are habits of behaviour and needs rendered identical (though the possibility of satisfying such needs is never identical), but even desires and the imaginary tend to be homologated. The *conatus essendi* of communication-production also destroys traditions and cultural patrimonies that contrast with or obstacle or are simply useless, non functional to the logic of development, productivity and competition. It destroys those productive forces that tend to escape the limits of current forms of production which penalize intelligence, inventiveness and creativity by over-ruling them and subjecting them to "market reason" (and of course production cannot avoid this in the current phase of necessary investment in "human resources"). The destructive character of today's production system is also manifest in the fact that it produces growing areas of underdevelopment as *the very condition of development,* areas of human exploitation and misery to the point of nonsurvival. This logic subtends the expanding phenomenon of *migration* which so-called "developed" countries are no longer able to contain due to objective internal space limitations — no doubt greater than in earlier forms and phases in the development of the social system.

Universalisation of the market, that is, application of the status of commodities to all things and relationships, is destructive; and the more so-called commodities are illegal and prohibited — think of drugs, human organs, children, uteruses, etc. — the more they are expensive. The principle of exploiting other people's work is destructive, work obviously costs less the more it produces profit: with the help of global communication developed countries are more and more turning to low cost work in underdeveloped countries ("stay where you are, and we'll bring you work"). The disgrace of the communica-

tion-production world is particularly manifest in the spreading exploitation of child labour that is heavy and even dangerous (much needs to be said and done about children as today's victims of underdevelopment, in misery, in sickness, in war, on the streets, in the work-force, on the market).

The destructive character of world-wide communication-production is also made obvious by war which is always a scandal. Global communication-production is the communication-production of war. War requires continuously new markets for the communication-production of conventional and unconventional weapons. War also requires increasing approval acknowledging it as just and necessary, as a necessary means of defense against the growing danger of the menacing "other", as a means therefore of achieving respect for the rights of one's "own identity", "one's own difference". The truth is that identities and differences are not threatened or destroyed by the "other", but by today's social system itself which encourages and promotes identity and difference while rendering them *fictitious* and *phantasmal*. And this is precisely the reason why we cling to such values so passionately, a logic which fits the communication-production of war to perfection.

With the spread of "bio-power" (Foucault) and the controlled insertion of bodies into the production apparatus, world communication goes hand in hand with the spreading of the concept of the individual as a separate and self-sufficient entity. The body is understood and experienced as an isolated biological entity, as belonging to the individual, as a part of the individual's sphere of belonging. This has led to the quasi total extinction of cultural practices and worldviews based on intercorporeity, interdependency, exposition and opening of the body (what remains is the expression of a generalized tendency to museumification; mummified remains studied by folklore analysts, archeological remains preserved in ethnological museums and in the histories of national literatures).

The technologies of separation as applied to human bodies, to interests, to the life of individual and collective subjects are functional to production and to identification of production and consumption characteristic of present day production forms. With respect to all this and thanks to its ontological perspective, global semiotics (or semiotics of life) can, if nothing else, oppose a whole series of signs showing how each instant of individual life is wholly interrelated, even compromised with all other forms of life over the entire planet.

To acknowledge such interrelatedness, such compromise involves a form of responsibility which far exceeds all positive rights and all limited responsibilities, restricted responsibilities with alibis. Such acknowledgement is ever more urgent the more the reasons of production and of global communication functional to it impose ecological conditions which impede and distort communication between our bodies and the environment.

An ontological reformulation of bioethics on the basis of the semiotics of life and keeping account of the current socio-economic context of global communication helps single out two fundamental principles: *dispossession* and *extralocalisation*. These principles allude to the human individual as a living body interconnected with all other forms of life over the whole planet thanks to its condition of diachronic and synchronic intercorporeity: *dispossession* with respect to techniques favouring the body's subordination to the knowledge-power of *biopolitics* (Foucault); *extralocalisation* with respect to chronotopic coordinates, projects, structures and roles functional to reproduction in the economico-social form of global communication.

Dispossession and extralocalisation are manifest in the body's "escape without rest" from the techniques that wish to dominate and control it, and above all in its "persistence in dying". Dispossession and extralocalisation are principles that must be taken into account in the prolegomena for an approach to bioethics that is *critical, philosophical and theoretical*, this being the condition for acknowledgement of their moral and juridical status.[1]

References

Benjamin, Walter *et al.* 1995. *Il carattere distruttivo*. (*Millepiani* 4.) Milano: Mimesis.

Foucault, Michel 1972. *L'ordine del discorso*. Turin: Einaudi.

— 1992a. Tecnologie del sé. In: Martin, L.H.; Gutman, H.; Hutton, P.H. (eds.), *Tecnologie del sé: Un seminario con Michel Foucault*. Torino: Bollati Boringhieri, 11–47.

[1] Together with the University of Bari, Italy, we wish to thank the Director of the Istituto Italiano di Cultura in Frankfurt am Main, Germany, Dr. Luigi Volta, who financed our participation at the Conference *The Semiotic Threshold from Nature to Culture*, at the Research Centre for Cultural Studies of the University of Kassel, 16–17 February, 2001.

— 1992b. La tecnologia politica degli individui. In: Martin, L.H.; Gutman, H.; Hutton, P.H. (eds.), *Tecnologie del sé: Un seminario con Michel Foucault*. Torino: Bollati Boringhieri, 135–153.
— 1994a. *Poteri e strategie: L'assoggettamento dei corpi e l'elemento sfuggente*. Milano: Mimesis.
— 1994b. *Eterotopia: Luoghi e non luoghi metropolitani*. (*Millepiani* 2.) Milano: Mimesis.
— 1996. *Biopolitica del potere: I rapporti di potere passano attraverso i corpi*. (*Millepiani* 9.) Milan: Mimesis.
Heidegger, Martin 1976. *Essere e tempo*. Trans. by P. Chiodi. Milano: Longanesi.
Lotman, Jurji M. 1985. *La semiosfera*. Venice: Marsilio.
Morris, Charles 1998. *Lineamenti di una teoria dei segni*. Lecce: Piero Manni.
— 2000. *Significazione e significatività.* Trans. and ed. by Susan Petrilli. Bari: Graphis.
Peirce, Charles S. 1980. *Semiotica: i fondamenti della semiotica cognitiva.* Selected and introduced by M. A. Bonfantini, L. Grassi, R. Grazia. Turin: Einaudi.
Petrilli, Susan 1995a. *Materia segnica e interpretazione*. Lecce: Milella.
— 1995b. *Che cosa significa significare?* Bari: Edizioni dal Sud.
— 1998a. *Su Victoria Welby. Significs e filosofia del linguaggio*. Napoli: Edizioni Scientifiche Italiane.
— 1998b. *Teoria dei segni e del linguaggio*. Graphis: Bari.
Petrilli, Susan; Ponzio, Augusto 1998. Signs of research on signs. *Semiotische Berichte* 22(3/4): 5–173.
Petrilli, Susan; Ponzio, Augusto 1999. *Fuori campo: I segni del corpo tra rappresentazione ed eccedenza.* Milan: Mimesis.
Ponzio, Augusto 1995. *La differenza non indifferente: Comunicazione, migrazione, guerra*. Milan: Mimesis.
— 1997. *Elogio dell'infunzionale: Critica dell'ideologia della produttività.* Rome: Castelvecchi.
— 1999. *La comunicazione*. Bari: Graphis.
Ponzio, Augusto; Petrilli, Susan 2000. *Il sentire della comunicazione globale*. Rome: Meltemi.
Posner, Roland; Robering, Klaus; Sebeok, Thomas A. (eds.) 1997–1998. *Semiotics: A Handbook on the Sign-Theoretic Foundations of Nature and Culture*, vol. 1–2. Berlin: de Gruyter.
Prodi, Giorgio 1977. *Le basi materiali della significazione*. Milano: Bompiani.
Sebeok, Thomas A. 1976. *Contributi alla dottrina dei segni.* Milan: Feltrinelli.
— 1984. *Il gioco del fantasticare.* Milan: Spirali.
— 1985. *Il segno e i suoi maestri.* S. Petrilli (ed.). Bari: Adriatica,
— 1990. *Penso di essere un verbo.* S. Petrilli (ed.). Palermo: Sellerio.
— 1992. *Sguardo sulla semiotica americana*. S. Petrilli (ed.). Milano: Bompiani.
— 1998a. *Come comunicano gli animali che non parlano*. S. Petrilli (ed.). Bari: Edizioni dal Sud.
— 1998b. *The sign is just a sign. La semiotica globale*. S. Petrilli (ed.). Milano: Spirali.
— 2001. *Global semiotics.* Bloomington: Indiana University Press.

Sebeok, Thomas A.; Petrilli, Susan 1999. Women in semiotics. In: Carr, Gerald F.; Harbert, Wayne; Zhang, Lihua (eds.), *Interdigitations: Essays for Irmengard Rauch*. New York: Peter Lang, 469–478.
Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.) 1992. *Biosemiotics: The Semiotic Web 1991*. Berlin: Mouton de Gruyter.
Uexküll, Jakob von 1967. *Ambiente e comportamento*. Introduction by F. Mondella. Milano: Il Saggiatore.
Welby, Victoria 1990. Senso, significato, significatività. *Idee: Genesi del Senso* 13/15: 145–154.

Биоэтика, семиотика жизни и глобальная коммуникация

Этические проблемы, связанные с биологическими и медицинскими открытиями в сфере генной технологии, нейробиологии и фармацевтических исследований достигают стадии объединения в биоэтике как самостоятельной дисциплине. Но еще до достижения этой стадии этические проблемы принадлежат к двум целостным группам: одна из них — *семиобиосфера,* а вторая — современная социальная форма *глобальной коммуникации*. В соответствии с этим биоэтика должна учитывать двойную контекстуализацию исследуемых проблем. Семиобиосфера является объектом *глобальной семиотики* или *семиотики жизни*. Глобальная семиотика представляет особый интерес для биоэтики не только благодаря широте контекста, который та предоставляет для решения проблем, разрабатываемых в биоэтике, но и потому, что глобальная семиотика обеспечивает биоэтику адекватной контекстуализацией как в отношении экстенсивности, количества, — так и в отношении качества. С этой точки зрения “контекстуализация” означает и *критическое переосмысление*. Очевидной становится необходимость рассмотрения биоэтических проблем с учетом современного социоэкономического контекста, т.е. контекста *глобального процесса коммуникации-производства*. С точки зрения этики эти две возможности контекстуализации тесно переплетаются. Современная семиотика в качестве глобальной семиотики или семиотики жизни должна взять на себя ответственность за обнаружение несоответствий в глобальной системе, всех опасных для жизни явлений, присущих этой охватывающей планету системе.

Bioeetika, elusemiootika ja globaalne kommunikatsioon

Geenitehnoloogia, neurobioloogia ja farmaatsia vallas tehtud bioloogiliste ja arstiteaduslike avastustega seotud eetilised probleemid puutuvad kokku ühes olulises punktis — bioeetikas. Bioeetikas saavad eetilistest probleemidest iseseisva distsipliini uurimisobjektid. Aga isegi enne sellele tasemele jõudmist kuuluvad eetilised probleemid kahte tervikusse, mis koos loovad selliste probleemide alusjooned: üks neist on *semiobiosfääri* terviklikkus; ja teine *sotsiaalse kommunikatsiooni* globaalselt toimiv vorm. Vastavalt oma aluspõhisele ja kriitilisele filosoofilisele orientatsioonile peab bioeetika arvestama uuritavate probleemide kahekordse kontekstualiseeritusega. Semiobiosfäär on *globaalse semiootika* või *elusemiootika* uurimisobjekt. Bioeetikat huvitab eriti viimane, ning seda mitte üksnes konteksti avaruse tõttu, mida see pakub bioeetika poolt käsitletavatele probleemidele. Globaalsemiootika pakub bioeetikale sobivat kontekstualiseerimisvõimalust, mitte üksnes ulatuse ja kvantiteedi, vaid ka kvaliteedi osas. Sellest vaatekohast tähendab "kontekstualiseerimine" ka *kriitilist ümbersõnastamist*. Globaalsemiootika *on* bioeetikale vajalik *aluspõhise ja kriitilise lähenemise* jaoks. Lisaks globaalsemiootika pakutavale kahekordsele kontekstualiseeritusele, nii fenomenoloogilisele kui ontoloogilisele, on bioeetikale tähtsate probleemide kohaseks käsitlemiseks vajalik ka teistsugune kontekstualiseerimine. Siinkohal viitame vajadusele vaadelda bioeetilisi probleeme tänapäeva sotsiaal-majanduslikus, st *globaalse kommunikatsiooni tootmise* valguses. Eetika seisukohalt on need kaks kontekstualiseerimisvõimalust omavahel tihedalt seotud. Tegelikult peabki tänapäeva semiootika globaal- või elusemiootikana võtma endale kohustuse taunida ühtimatusi globaalses süsteemis ja kõiki elu ähvardavaid ohte, mis sellest planeeti hõlmavast süsteemist vältimatult tulenevad.

S/E ≥ 1 : A semiotic understanding of bioengineering

Jesper Hoffmeyer
Department of Biological Chemistry, University of Copenhagen
Solvgade 83, DK 1307 Copenhagen K, Denmark
e-mail: hoffmeyer@mermaid.molbio.ku.dk

Abstract. Natural (non-cultivated) systems are tuned to economize their use of energy as much as possible, and thereby to produce minimal amounts of entropy. It is suggested that this has been obtained by optimizing the evolutionary creation of semiotic controls on all processes of life. As long as biological (ultimately photosynthetic) energy sources satisfied most human needs for energy consumption, these biosemiotic controls remained largely undisturbed, with the result that production systems remained sustainable. The industrial revolution instantiated a rupture of this balanced situation. The semiotic control function (*S*) would no longer match the size of the energy flow (*E*). In the industrial production system, energy flows have dramatically been increased, while the *S* component has not been taken care of. This has created a dangerously low *S/E* ratio, and it is suggested that this low *S/E* ratio constitutes a fundamental explanation of the environmental crisis. In order to restore a sustainable production system, we will now have to develop technological means for a strong increase in the S factor of the production system. It is suggested that this can be obtained through a development of considerate, gentle, and clever forms of biosemiotic technology.

The basic idea behind this paper came to me already while I worked on my book of 1982 on ecological history, *Samfundets naturhistorie* (*Natural History of Society*; not translated into English; Hoffmeyer 1982). In the meantime, I always hoped to work it out in more satisfactory details and depth. But in order to do this, one must ideally combine a thorough understanding of history with a sure command of several very different kinds of competencies, primarily biochemistry,

ecology, technology, and semiotics. Since obviously I cannot claim such diversified skills, I am now offering the basic idea here in the hope that somebody else might find the time and power to substantiate it. It seems to me that if the idea may in fact be substantiated, it should have a decisive influence on our thinking in areas of ecology and technology. So, even though the idea is yet just a sketch, I think a presentation must be risked.

Energy and semiosis

It may be seen as a case of cultural bias that the term energy is now part of everyday language while its counterpart term in thermodynamics, entropy, is not even known to the man in the street. Abundant supplies of energy are the well-known motivating force behind the show we call the modern world, whereas production of entropy is related rather to certain negative aspects of this show such as thermal and chemical pollution or ecological disorder. That there is a necessary link between these two major players of our world is not generally acknowledged, even though physics has it as one of its most fundamental laws, the 2nd law of thermodynamics. According to the second law of thermodynamics, the amount of entropy in a system is bound to increase whenever an energy transformation takes place. And this fact may well be one of the deepest pieces of knowledge we have about our universe.

One way of describing the meaning of entropy is as "molecular disorder" and this shows us how the concept relates to pollution. For illustration, one important component of fertilizer is phosphate, which is mined from a variety of deposits. When fertilizer is spread over the open land, phosphate molecules formerly packed in the deposits become spread out not only in the fields, but also wherever rain and streams will take them. Thus, much of the phosphate ends up stimulating the growth of algae, followed by oxygen depletion in rivers, lakes, and coastal waters. In this situation, the phosphate molecules have literally become disordered, since we now know less about their localization than we did before.

The 2nd law of thermodynamics has often been seen as a law of general degradation and thus as contradictory to the existence of life and evolution. However, the apparent contradiction was solved in 1945 by the physicist Erwin Schrödinger who in his seminal book

What is life? explained how the evolution of life on Earth has proceeded without any violation of the 2nd law (Schrödinger 1945). For this to happen, the only condition is that the surplus production of entropy linked to the metabolic processes of life would somehow be exported away from the system, which is in fact exactly what happens when disorganized heat energy is irradiated away from the planet. Thus, in the overall scheme, highly organized and thus low-entropic irradiation reaches planet Earth from the sun whereas high-entropic heat energy is given off to outer space. The flow of energy through the planetary system thus carries a net export of entropy away from the earth allowing for the build up of organized low-entropy structures and behaviours associated to the processes of life.

In the 1970s, Ilya Prigogine and his co-workers found that the 2nd law, when applied to systems far from equilibrium would actually account for the occasional creation of organized states out of chaotic states (Prigogine 1980). Following this work, for which Prigogine was accorded the Nobel price, a number of more radical interpretations of the 2nd law have been suggested (see, e.g., Ulanowicz 1997 for an overview). Essentially, the organizing and degradative powers of our physical world belong together and are ultimately derived in the condition of irreversibility described by the 2nd law.

Semiosis then, as the manifestation of Nature's tendency to take habits, is rooted in the irreversible entropic dimension of our universe. Ultimately, semiosis derives from the weak kind of "future directedness" implied by irreversibility, or in other words from the possibility of "knowledge" or "memory", in the broadest sense of these concepts, which is latently implied by any form of directionality. About a reversible world you cannot know a thing, but an irreversible world necessarily opens itself to eventual anticipation.

Historians may discuss whether or not human history has progressed in the sense of our civilizations, attaining a higher quality of life or of other eventual parameters connected to human well being. However, it is an undeniable fact that the *flow of energy* which human societies have been able to canalize into productive social use has exhibited a nearly unbroken pattern of increase throughout history (Hoffmeyer 1982; 1988). Major steps were the appropriation of biological or photosynthetic energy flows through the agricultural revolution, the taming of the non-biological but natural energy flow of hydrological power during the middle ages (the water wheel) and of

course the mastering of artificial energy flows derived from coal, oil, or uranium[1].

All of this depended upon the development of highly sophisticated semiotic controls frozen into technology and into social organization and co-operation patterns (Hoffmeyer 1988). Energy *per se* is of no use; for energy to be useful it must be brought to "flow" according to human needs.

But what is true of human productive life is no less true of the millions of other species trying to cope with the thermodynamic bindings of energy metabolism. In nature as in culture, entropy production has to be kept at a minimum or exported to the surroundings, and in both cases this is obtained by semiotic means. Energy and semiosis are the two major players in the evolutionary game on Earth.

An ecohistorical perspective

According to C-14 dating, wheat production started 9,500 years ago in southeastern Europe and slowly spread along an axis from south east to northwest reaching the farthest northwestern regions appr. 5,000 years ago (Cavalli-Sforza 2000). Compared to the short span of time, a few hundred years, during which we have had industrialized societies, peasant societies had been exceedingly stable. In fact, traditional peasant economies were potentially sustainable economies, although environmental catastrophes were indeed threatening whenever land became too heavily populated.

But even 10,000 years is a short span of time as compared to the period of 100,000 or 150,000 years during which our own species has inhabited the earth, living, we must presume, in band societies based on hunting and collecting. Thus, seen from the point of view of hunter-collector societies, even agricultural production may seem to touch on the edge of sustainability.

In Hoffmeyer (1982), I dealt extensively with the ecology of early human technological history (see also Hoffmeyer 1988). Let me here summarize a few points.

Hunting and collecting is a very extensive way of life because very few resources can be extracted from nature when the most important

[1] Coal and oil are of course perfectly natural sources of energy. What is artificial is the flow, i.e., the burning up of those enormous deposits in the time span of a few centuries.

energy source is unmanipulated nature and when the energy-technique does not in general exceed the limits of muscular power — bound as that power necessarily is to the restraints of the human body. No gradual process can increase the amount of resources accessible by this strategy beyond a naturally given level.

This naturally determined threshold (reflecting the available means of food-energy per km^2 of wild nature) probably constitutes the most important natural fact in human history. The significance of this threshold was that the only way to sustain life for a population density above a certain level was to embark on the laborious practices of cultivating the earth, i.e., agriculture.

The essence of agriculture is that it surpasses the threshold set by unmanipulated natural systems and brings to productive use a radically simplified biological system, the field. Through agriculture, men and women get access to *biological energy* resources (photosynthesis) in a systematic way and thereby they can suddenly increase the absolute amount of resources extracted per areal unit enormously, allowing for the survival of much denser populations.

It should be noticed, however, that contrary to legend, people in general do not want to cultivate the soil if they don't have to. The point is, that the control of photosynthesis, i.e., systematic biological energy, is a survival strategy which changes any dimension of people's social life. This is born out by anthropological and archeological evidence as well as by theoretical considerations (Lee 1968; cf. Boserup 1965; Wilkinson 1973; Harris 1977). Hunter collectors resist the introduction of agriculture, primarily because the necessary workload is radically increased and also because social freedom and autonomy is decreased. The continued intensification of agriculture apparently leads inevitably to a doubling — or even a tripling (in irrigation-systems) — of the amount of social work. The anthropologist Marshall Sahlins even coined the term "the original affluent societies" for the hunter-collector cultures of the Stone Age (Sahlins 1972). Thus, the agricultural revolution has probably nowhere in the world been a voluntary process (Carneiro 1970).

Behind these facts lies an important ecologically based principle, namely that the flow of resources extractable from a given area can only be increased through operations which push natural systems farther away from their own balanced state (Hoffmeyer 1988). However, to do this, not only more energy (which in pre-industrial societies means work) but also a stricter organization is needed. Inevitably then, the flow of resources becomes more and more dependent on condi-

tions which are liable to social manipulation. Therefore, a connection exist between the size of a given flow of resources and the social manipulability of this same flow.

Thus, in the case of the agricultural revolution, people from now on had to organize their work in particular ways, reflecting the characteristics obtaining to the management of a harvest-surplus. Work becomes heavier and is no longer individual. Planning and co-operation become necessary for raising, storing, and distributing the harvest surplus. From those requirements, finally, the possibility for one class to monopolize the flow of resources is derived. Agriculture simply establishes for the first time in history conditions akin to the project of controlling somebody else's access to his resources, i.e., the ownership of land. And, as the British historian Richard Wilkinson has put it: "Power stems inevitably from control of people's access to their means of livelihood" (Wilkinson 1973: 110).

The capacity for resource appropriation by photosynthetic energy sources had probably been locally exhausted as early as in the old high-cultures of Egypt, Mesopotamia, or China. However, the possibility for expansion all over the globe probably worked like a valve letting out the pressure, and thousands of years had to pass before the next natural threshold was crossed.

This happened in Europe in the late Middle Ages as a totally new technical principle was introduced in a systematic way: The principle of *non-biological energy* in the form of windmills and watermills. The peasants did not profit from these mills. Quite to the contrary, they were now forced by the landlord to grind their grain on the mill for payment.

The characteristic difference between biological and nonbiological energy sources is this: while living nature — and thus earth as material substrate — is essential to the former, inanimate nature (the hydrological cycle, coal, oil etc.) is the core of the latter. Living nature immediately furnishes people with nearly all of their material requirements, food and fodder, clothes, tree for building, natural fibres, construction and warming. A water mill (or coal) does none of this. Thus, while a society dependent on biological energy is most easily organized in a locally self-sufficient way and a power-relation based on ownership of land, a society based on non-biological energy is not only indifferent to but even incompatible with this kind of economic and political organization. The social logic of non-biological energy points towards a society based on division of labour and production for a market.

The strong focus on the steam engine as the basic technological improvement behind the industrial revolution may have blinded us to the fundamental importance of these ecologically based aspects of the major transformations in history. From an ecosemiotic point of view the transformation of a production system fuelled by biological energy to a production system based on nonbiological or artificial energy sources is of prime importance.

The biosemiotics of the industrial revolution

Through billions of years of evolution, plants and animals have acquired exceedingly sophisticated endo- and exosemiotic means of controlling the flows of energy on which they depend. The endosemiotic controls are exhibited through millions of ingeniously tuned biochemical and physiological cycles and, in the case of animals, through the senso-motorically controlled settings of behavioural patterns. The exosemiotic controls exhibit a diverse and far from well-understood group of interspecific interaction patterns. Symbiotic relations (mutualism and parasitism) offer prominent examples of exosemiotic controls on energy flow (Sapp 1994; Hoffmeyer 1997c), but in general, any biotic or nonbiotic regularity in nature may serve as orientation marks for some species or other, thus diverting energy flows through natural biota in subtle and semiotically well scaffolded patterns (Hoffmeyer forthcoming).

The point I want to make here is that evolution has worked relentlessly on fitting the biosemiotics of all species to the kinds of energy flows available to them and that therefore evolution guarantees a near optimal fit of the means for semiotic control to the actual flows of energy through bodies or ecosystems. Now suppose it was possible to measure this semiotic fitness, *S*, e.g., in terms of entropic efficiency. Then, for reasons just discussed, we would expect that S in natural systems would balance the energy flows, so that for convenience, we could equal the ratio *S/E* to 1 in natural systems (where *E* measures the size of the energy flow through the system).[2]

[2] I have no intention whatsoever to claim that a true quantifiable measure of semiotic fitness (*S*) can in fact be constructed. But as a thought experiment, I think the idea of such a measure bears out the main point I am aiming at here, which is that a deeply disturbed relation between semiotic and energetic command is the key to the non-sustainability of industrial production systems.

Now, as I said, the trick behind agriculture, is to produce a simplified ecosystem, the field, through which nearly all of the energy flow is canalized into one single species, i.e., the crop species. In preindustrialized societies, this takes an enormous amount of human labour, which in industrialized agriculture is substituted by a diversity of petrochemical products, such as fertilizer, herbicides, pesticides, and gasoline for motive power etc. Also, of course, the indirect energy costs of draining and digging ditches and canals, and of distributing the agricultural input as well as output (comprising construction of roads, railroads and bridges and of transportation vehicles, including tankers transporting oil and materials around the globe etc.) should be counted here.

Clearly, already in preindustrial agriculture, the amount of exosemiotic control on energy flows is lowered as compared to the state of wild ecosystems. On the other hand, this lowering of the *S/E* ratio is at least partially compensated by human skill and ingenuity, and ultimately through the semiotic control exercised by the input of human knowledge. Thus, in healthy traditional agriculture, the yield is still low and essentially constrained by biosemiotically controlled natural nutrient cycles as well as by a whole range of non-biotic limit factors.

The industrial revolution meant that we learned how to bypass all or most of these natural constraints through an explosive increase in the use of artificial energy. In an agricultural production system based on the petrochemical service industry, an enormous homogenization of nature can be obtained, yielding unequalled amounts of crop. Or to state this in different words, industrializing agriculture meant that we learned to circumvent nature's own semiotic controls on energy flows, substituting them by few and comparatively very unsophisticated controls, such as time schedules for different kinds of operations like sowing, irrigating, spreading of fertilizer, herbicides and pesticides, and harvesting. I do not pretend here to offer a satisfactory comparison between the ecosemiotics of petrochemical agriculture and the ecosemiotics of more traditional kinds of agriculture, but I think that even in the absence of such a deep analysis, the overall picture is indisputable: the *S/E* ratio is dramatically lowered. And this dramatic decrease, I shall suggest, is the deep source of the modern environmental crisis.

When we talk about an industrialized production system, we cannot limit ourselves to analyzing the agricultural sector, for agriculture is just one indissolvably integrated component of the diversified production apparatus of industrial society. From en ecological point of

view, too, agriculture may well be the worst single factor in the deterioration of nature's capacity for sustainability, but by no means the only one. The overwhelming use of energy in all and every context of modern society (e.g., as chemicals ultimately derived from oil), inevitably end up overthrowing the semiotic controls operative inside living systems, at the organismic as well as at the ecological level (our own body included). Thus, in our estimate of the *E* component we must include all kinds of energy flows staged by our production system.

In sum, we can see that the industrial revolution was only one half of a revolution. Starting with the water wheel in the Middle Ages and continuing through the mastery of coal, oil and uranium, we gradually liberated the energy component of natural systems from their biosemiotic controls. However, we did not until very recently try to evolve techniques to compensate for this liberation of the power of energy by a corresponding mastering of the power inherent in the biosemiotic controls. As a result, we created an ecological impoverishment of the environment reflecting the uninhibited dependence of our production system on the brute force of artificial energy. As a consequence, we are now unable to reestablish a sustainable production system, essentially because we have neglected the constraints ultimately induced upon us by the 2nd law of thermodynamics. The task ahead of us now is to embark on the second half of the so-called industrial revolution, which will consist in the development of a mastery of the biosemiotic controls which can match and thus sophisticate our mastery of the gigantic energy flows which in an overpopulated world necessarily must burden nature's ecological settings. Or, to state this more directly, *we need to develop a biosemiotic technology base for our productive system,* a technology base that can substitute natural biosemiotic controls by biosemiotic controls artificially set to obey human needs.

Therefore, instead of talking about the industrial revolution we should envisage that the deeper principle at work behind this major and yet sadly unfinished historical transformation has always been something quite different, namely, the substitution of a resource base relying on naturally controlled energy flows for a resource base relying on energy flows controlled by human ingenuity and skill. In fact, what we are witnessing is one long *process of the humanization of nature*. A process which slowly took off back in Neolithic times, then acquired an enormous momentum through the so-called industrial revolution and is now reaching a final turn where the dangerously dis-

turbed tuning of the energetic and semiotic (entropic) aspects of the natural world has to be restored at a high artificial level.

Clever technologies

The American plant physiologist J. S. Boyer once calculated that the average harvest yield for a range of crops even in US agriculture was only 21.6% of a calculated maximum (Boyer 1982). Diseases, weeds and pests would account for less than 10% out of this total loss of nearly 80%, whereas the rest would be due to unfitting physico-chemical conditions such as lack of water, cold, high salt levels etc. As Boyer himself pointed out, the reason for this lack of efficiency is to be found in the current breeding strategies. Breeders typically produce a small number of "miracle" varieties, giving extremely high yields provided they are grown under favourable conditions. Now, the bad thing about the world is that conditions are rarely favourable, implying that farmers have to buy services from the petrochemical industries to artificially create a situation of "favourable conditions". However, as Boyer's numbers disclose, this strategy not only make farmers dependent on expensive and ecologically inflamed practices, it also apparently fails to deliver the true product, i.e., the favorable conditions.

The obvious solution to this problem is that instead of homogenizing the soils of the Earth so as to fit a few miracle crops, we should breed crops that fit the multitude of unfavourable conditions under which concrete farmers actually live. We need one particular kind of wheat for maximally favourable conditions, another for salty soils, yet another for soils that are too wet etc. Such a strategy, however, was not feasible within the paradigm of traditional cross-breeding where typically 10–15 years were needed for the production of each new variety. But new clever breeding technologies based on modern biotechnology, and particularly on genetic manipulation, have the potential to support a diversified breeding strategy aiming at producing varieties fitted to local conditions.[3]

[3] Whether political and economic conditions will permit the implementation of breeding for local needs is quite another question of course. Since multinational petrochemical industries are main actors on the breeding market, one should perhaps not be too confident that breeding for the purpose of uncoupling agriculture from petrochemical services will be a major priority.

We are used to talking about clever technology as information technology, and it has often enough been claimed that we are now living in an information society. I think it is urgent that two points are made clear in this context. First, so-called information techniques (among which should be included techniques dealing with biological information) are not really techniques proper but *meta-techniques*, i.e., they are not directly interacting with the world around them. Instead, they are interacting with, and controlling other techniques. And, second, so-called information techniques may well be carrying out extraordinary amounts of information processing, but that is not their real power. The real power stems from their semiotic capacities, the semiotic control they assign to their user, the power of communicating and interpreting complex and quickly changing messages or patterns of cues. In fact, we ought to talk about *semiotic techniques* and not just information techniques.

A thought provoking illustration of this fact was given by Thomas Sebeok in his talk at the Toronto Conference, *Semiosis, Energy, Evolution* in 1997, when he nominated the Gulf War to be the first semiotic war in history. The key to American war-power in this case was not the pure data processing capacity of the American war machine. The key was rather the ability of ordinary soldiers to take command of all the smart technology, which again depended on the preceding development of user-friendly interfaces. The key to victory, in other words, was not information processing as such but rather *semiotic command*. And included in this semiotic command of course also were strategies for how to play in tune with the mass communication media, particularly television.

A gene technologically based breeding strategy to produce varieties for the world's variable local conditions is fundamentally a semiotic strategy. First, because it aims at *persuading* the plant species to grow well under specified conditions rather than to oblige them to do so by the application of brute force (petrochemistry), and second, because the strategy will only succeed if developed in an actual collaborative effort with local farmers.

The goal of breeding for local conditions is just one example out of a multitude of cases where the use of biosemiotic technology instead of petrochemical technology would accommodate our production system towards the goal of sustainability. To mention just one other example let me point to the striking fact that less than 30 plant species covers 95% of our total need for provisions, and just 3 grasses, wheat, rice and corn, alone furnish 75% of total human need for food. Why

are so few of the world's estimated 300,000 species of plants in human use? The explanation seems to be historical coincidence, and this promises that unknown potentials are hiding in many other plant species, not only for production of crops for food and fodder, but also for production of crops intended as raw material for a fermentation industry, e.g., making bio-degradative plastic. Before world war two, chemical engineering was mainly based on biological raw materials, but this has all been forgotten in the petrochemical rush. Returning to biomass (semiotically tuned to our needs) as raw material will also fight the greenhouse effects because the CO_2 intake of growing biomass balances off the CO_2 contribution from using that same biomass.

Agriculture is, of course, by no means the only sector in which biosemiotic technology holds great promises for the goal of sustainability. Substituting chemical technology by biosemiotic technology wherever possible would be clearly favourable to the environment and probably less hazardous to health, too (although this need not be so and should be studied separately in each case).

My purpose here is not to offer an extensive analysis of the possibilities created by the development of biosemiotic technology. However, I hope that the discussion has substantiated my claim for the relevance of the general formula $S/E = K$ (where K is supposed to average 1 in natural undisturbed ecosystems) as a guiding metaphor for our reflections on ecosemiotic strategies. The general effect of introducing biosemiotic technology will be to decrease the necessary deployment of energy due to a far better control of its effect on desired parameters, which of course amounts to saying that S is increased in the same time as E is decreased in the system. Thus, the introduction of biosemiotic technology will contribute to our goal of approaching the situation where $S/E \geq 1$, i.e., a sustainable production system.

A natural history of society

The very idea of the existence of ecologically based determinations of human history is probably anathema to most historians. One reason for this may be the general conception of the natural world as ruled by laws with deterministic power combined with the fact that deterministic conceptions of human history are not held in high esteem by modern historians. It should be remarked, therefore, that the idea presented here is not deterministic in any strong sense of the term. The claim is

that cultural evolution has proceeded in accordance with constraints induced upon civilization by general thermodynamic and biological determinations. Nobody would object to gravity being a constraining factor for human life, and any psychological theory claiming that the attainment of unaided flight should be set as a goal for the upbringing of children, would rightly be ridiculed. Thus, our theories of society should likewise pay respect to fundamental thermodynamic constraints on human history. One cannot make perpetual mobiles and one cannot by hunting and collecting sustain population densities above appr. 2 km^2 per person. Inside these constraining bonds, however, infinitely many concrete social ways of organizing life may be practiced as solutions to the constraining factors.

For perhaps one hundred thousand years our ancestors lived as hunter-collectors in small and, for all we know, egalitarian band societies. Then 10–11,000 years ago, quite suddenly agriculture was independently introduced in three different parts of the world. One possible explanation for this is the ecological breakdown in the aftermath of the final glacial period, caused, for instance, by gradual forestation of former grasslands which had been nourished by melt water from the now retreating glaciers. Together with the grasslands also the big wild game inhabiting these areas may have disappeared thus severely damaging survival conditions for the unfortunate hunters. Such conditions might have created the hard need that might have forced people into the laborious practices of cultivating the earth.

Whatever may have happened, there can be little doubt that this was a major catastrophe[4], which catapulted our species out of its intimate or embryonic embeddedness in nature. Prehistory became history. The industrial revolution might seem to promise an end to the catastrophe of toilsome peasants' life. But this strategy of homogenizing nature by brute petrochemical force was doomed to create pollution and ecological disaster. The hope expressed in this paper is that a considerate, gentle and clever introduction of biosemiotic technology as a meta-technology to guide and control industrialized production will finally restore sustainability at a level which could nourish the high density of present populations on Earth.

[4] To give just one example: in fossil remains we can see that the neolithic revolution was accompanied by a dramatic decrease in average height, from 177 cm 30,000 b. C. to 165 cm 10,000 years b. C. (Harris 1977; Hoffmeyer 1982).

References

Boserup, E. 1965. *The Condition of Agricultural Growth.* New York: Allen & Unwin.
Boyer, John S. 1982. Plant production and environment. *Science* 218: 443–448.
Carneiro, Robert L. 1970. A theory of the origin of the state. *Science* 169: 733–738.
Cavalli-Sforza, Luigi L. 2000. *Genes, Peoples, and Languages*. New York: North Point Press and Farrar, Straus and Giroux.
Harris, Marvin 1977. *Cannibals and Kings: The Origins of Cultures*. New York: Random House.
Hoffmeyer, Jesper 1982. *Samfundets naturhistorie*. København: Rosinante.
— 1988. The historical logic of domestication. In: Thill, G.; Kemp, P. (eds.), *The Triumph of Biotechnologies: The Domestication of the Human Animal (Acte du Cours de l'Inter-University Centre, Dubrovnik, March 1986)*. Namur: Presse Universitaires de Namur, 107–115.
— 1997c. Biosemiotics: Towards a new synthesis in biology. *European Journal for Semiotic Studies* 9(2): 355–376.
— (forthcoming). Semiogenic scaffolding in nature. *Communication and Information Science Research* 1.
Lee, Richard B. 1968. What hunters do for a living. In: Lee, Richard B.; Vore, Irven de (eds.), *Man the Hunter*. Chicago: Aldine.
Prigogine, Ilya 1980. *From Being to Becoming*. San Fransisco: Freeman.
Sahlins, Marshall 1972. *Stone Age Economy*. Chicago: Aldine.
Sapp, Jan 1994. *Evolution by Association: A History of Symbiosis*. New York: Oxford University Press.
Schrödinger, Erwin 1945. *What is Life?* London: Cambridge University Press.
Ulanowicz, Robert E. 1997. *Ecology, the Ascendent Perspective*. New York: Columbia University Press.
Wilkinson, Richard G. 1973. *Poverty and Progress: An Ecological Model of Economic Development*. London: Methuen.

S/E ≥ 1: семиотическое понимание биотехнологии

Природные (некультивированные) системы в максимально возможной степени ориентированы на экономизацию потребления энергии и поэтому производят минимальное количество энтропии. В статье говорится о том, что такое положение достигнуто эволюционно, путем создания оптимальных семиотических контрольных механизмов для всех жизненных процессов. До тех пор, пока источники биологической (в конечном итоге фотосинтетической) энергии обеспечивали большую часть энергетических нужд человека, эти биосемиотические системы

контроля оставались преимущественно нетронутыми, в результате чего и производственные системы оставались стабильными. Индустриальная революция резко нарушила это равновесие. Функция семиотического контроля (S) не соответствовала уже величине энергетического потока (E). В индустриальной производственной системе энергетические потоки заметно возросли, в то время как компонент *S* остался в тени. Это привело к опасно низкой величине пропорции *S*/*E*, и в статье предполагается, что эта низкая величина и является основным объяснением экологического кризиса. Для восстановления устойчивой системы производства теперь необходимо развивать технические средства, чтоб заметно увеличить фактор *S*. Этого можно достичь, развивая гибкие, мягкие и разумные формы биосемиотической технологии.

S/E ≥ 1: semiootiline arusaam biotehnoloogiast

Looduslikud (mittekultiveeritud) süsteemid on nii suures osas kui võimalik häälestatud energia kasutamise ökonomiseerimisele ja toodavad seetõttu minimaalsel hulgal entroopiat. Artiklis pakutakse välja, et see on saavutatud evolutsiooniliselt, luues optimaalsed semiootilised kontrollmehhanismid kõigile eluprotsessidele. Senikaua kui bioloogilise (lõppkokkuvõttes fotosünteetilise) energia allikad rahuldasid enamiku inimese energiavajadusest, jäid need biosemiootilised kontrollmehhanismid valdavalt häirimata, mille tulemusena olid ka tootmissüsteemid jätkusuutlikud. Tööstusrevolutsioon lõpetas järsult selle tasakaalustatud olukorra. Semiootilise kontrolli funktsioon (*S*) ei vastanud enam energiavoo suurusele (*E*). Industriaalses tootmissüsteemis on energiavood tunduvalt kasvanud, samas kui *S*-komponendi eest pole hoolt kantud. See on tinginud ohtlikult madala *S*/*E* suhte ja artiklis arvatakse, et see madal *S*/*E* suhe moodustabki põhilise seletuse ökokriisile. Jätkusuutliku tootmissüsteemi taastamiseks tuleb nüüd arendada tehnilisi vahendeid suurendamaks märkimisväärselt tootmissüsteemi *S*-faktorit. Pakutakse, et see on saavutatav, arendades välja biosemiootilise tehnoloogia paindlikud, mahedad ja targad vormid.

Biosemiotics and ecological monitoring

Luis Emilio Bruni
Institute of Molecular Biology, University of Copenhagen
Sølvgade 83, DK 1307 København K, Denmark
e-mail: bruni@mermaid.molbio.ku.dk

Abstract. During the recent decades, a global cultural-institutional network has gradually grown up to project, implement, and use an enormous technological web that is supposed to observe, monitor, communicate, inventory, and assess our environment and its biodiversity in order to implement sustainable management models. The majority of "knowledge tools" that have been incorporated in the mainstream of this "techno-web" are amply based on a combination of mechanistic biology, genetic reductionism, economical determinism and neo-Darwinian cultural and biological perspectives. These approaches leave aside many of the qualitative and relational aspects that can only be grasped by considering the semiotic networks operative in complex ecological and cultural systems. In this paper, it is suggested that a biosemiotic approach to ecology may prove useful for the modelling process which in turn will allow the construction of meaningful monitoring systems. It is also advanced that it may as well serve to better integrate our understanding and monitoring of ecosystems into the cultural process of searching for (human) sustainability.

A short note on the *eco* prefix

To the extent that ecosemiotics deals with the semiotic ways in which organisms interact with their natural environment (Nöth 1999) it may be seen as a branch of a general biosemiotics: the analysis of semiotic networks operative in ecosystems (Hoffmeyer 1997a), or the horizontal aspects of semiosis in the ontogeny of organisms and ecosystems (Emmeche 1992).

Ecology, originally a branch of biology, has had an enormous transdisciplinary influence on other fields of study as scholars have become aware of the world-wide ecological crisis and as the *eco* prefix has spread into philosophy, aesthetics, anthropology, literature, history, linguistics, psychology and ethology (Nöth 1999). This development may seem to corroborate Gregory Bateson's observation that if there is a crisis, it is not just ecological but also epistemological. It is not only the ecosystem that is in crisis (although it manifests the consequences of such a crisis) but deep-rooted cultural values, some of which are also operative inside science itself:

> Epistemological error is often reinforced and therefore self-validating. You can get along all right in spite of the fact that you entertain at rather deep levels of the mind premises which are simply false ... circuits and balances of nature can only too easily get out of kilter, and they inevitably get out of kilter when certain basic errors of our thought become reinforced by thousands of cultural details. (Bateson 1972: 480–485)

The spreading (and often the banalization) of the *eco* prefix has not done a good service to the epistemological grounds of the science of ecology. If anything it has encouraged the discipline to rigidly retreat to its physicalist-positivist origin. So the ideologies and contra-ideologies that have risen from the cognition of an "ecological crisis" have tended to deviate our attention from where the real crisis lies. The crisis is in reality a cultural crisis. This is why it is important that we delineate fields of study that deal with the nature-culture interface, or the ecological-anthropological realm, and semiotics looks like a privileged tool in this endeavour.

Nöth (1999: 80) refers to the semiotics of the "interior Umwelt" of the organism (endosemiotics) and states that at this level ecosemiotics begins with the processes of cognition and recognition between genes, other genes, and antigens in their molecular biological environment. Interestingly, the American biologist Leo Buss introduced the term "somatic ecology" to describe the bodily dynamics that continuously regulates potential conflicts between the cell and the individual (Buss, 1987: 139). The immune system plays a central role in this dynamic and at this level there would be no distinction between biosemiotics and ecosemiotics apart perhaps from the implicit goal of "sustainability" sometimes implied by the *eco* prefix.

In accordance with this, Kalevi Kull (1998) has observed that Nöth's definition of ecosemiotics looks like a synonym for biosemiotics, and he places ecosemiotics (and also ecology in general) somehow

out of the range of biosemiotics, more towards human ecology and cultural semiotics applied to the study of the culture-nature interface (both, historically in different cultures, and in relation to the contemporary "ecological crisis"). The existence of these two definitions may require some clarification when elaborating a research agenda to apply biosemiotics to the ecosystem-ecological level.

Thus, summing up the above contributions, we can distinguish between (1) ecosemiotics proper — biosemiotics at the ecosystem level, synchronic exo-biosemiotics, and (2) ecosemiotics as a second order notion that reflects on the way we relate to nature through our culture (our knowledge, science, technology, art, etc.), i.e., culture-nature relations, including epistemological considerations on the knowledge tools we use in ecology and environmental sciences.

Notice that "ecosemiotics proper" could be a subject of study for this "second order" ecosemiotics which would then look like "system-observer semiotics"[1] applied to the basic knowledge tools that allow us to relate to nature and to simply be part of it.

In this paper, I will be referring to both levels of analysis in order to (a) identify what is the mainstream trend in ecosystem modelling and monitoring from a system-observer semiotics point of view, and (b) suggest a direction for how biosemiotics research at ecosystem level could be of help in ecological monitoring.

According to the standard definition, "monitoring" consists in the observation, recording or detection of an operation or condition in a system with instruments that have no effect upon the operation or condition of the system. Modelling, on the other hand, is basically a process of understanding, and it is my assumption in this paper that the design of any monitoring device or system (conceptually or mechanically) implies a previous understanding of the process to be monitored, but then again, the "understanding" requires also some observation, which is in turn a sort of monitoring. Given this circularity, I will often be referring to "modelling and monitoring" as one single process (however it is possible to conceive modelling without monitoring, but the contrary seems not possible to me).

Modelling of complex ecological systems may incorporate rigorous assumptions of functional relationships or empirically determined

[1] "System-observer semiotics" (Emmeche 1992: 78): "the critical inquiry into the nature of the modeling relation to the various systems we can observe, describe, conceptualise and construct theories about. It is a semiotic of scientific experiment, observation, interpretation, operation upon and measurement of various systems".

relationships. "The purpose of these models may be to test particular assumptions about system dynamics, give insight into relationships difficult to measure or test under actual conditions, or *indicate the specific kinds of data needed for a more complete understanding of system function"* (Collier et al., 1974: 14, my italics). It is precisely in this last purpose of a model that I think biosemiotics can be of help to ecological monitoring.

Sensory apparatuses and "fine-tuned internal impressions"

Epistemologically, ecology as science, like many other knowledge tools is a specific case of nature-culture communication. It involves our conception of explicative models that simulate nature and yield (and make necessary) further artifacts to monitor and manage (i.e. make decisions about) nature. Ecological modelling and monitoring is a clear example of such a technological interface, i.e., a direct and explicit search for a human dialogue with nature.

In this sense, our empirical data can be seen like "words" with which nature speaks to us. Data is good for monitoring and decision making. But these are not words invented by nature but by ourselves (or us as nature), thanks to the explicative models that we previously constructed.

Biosemiotics sees organic evolution as a gradual build-up of semiotic networks of organisms covering the totality of the surface of the Earth and thus giving rise to an autonomous sphere of communication: the semiosphere (Hoffmeyer 1994). The term *semiosphere* was originally suggested by Yuri Lotman (1990), but here I shall use the concept in the broader conception developed by Hoffmeyer that includes both biosemiosis and anthroposemiosis. In Hoffmeyer's (1997a) perspective, the semiosphere is a sphere like the atmosphere, the hydrosphere or the biosphere. It penetrates these spheres and consists in communication: sounds, odours, movements, colours, electric fields, waves of any kind, chemical signals, touches etc.

Once higher complexity was achieved it became possible to develop a more "sophisticated sensory apparatus and corresponding nervous system which would enable animals to form fine-tuned internal impressions of what lay round about them (the subjective experience of the world, the Umwelt)" (Hoffmeyer 1996: 33).

When we consider the keen sensorial capacity of many animal species it becomes clear that the human sensorial mechanisms are not at the top of the sophistication scale. Instead of sensorial keenness *Homo sapiens* has evolved a well developed "cultural keenness" through which human beings have ingeniously managed to create technological extensions in order to increase their sensorial resolution. Most certainly this fact has played an important role in the evolution of the "technosphere".

One might draw an analogy between the evolution of biological sensorial apparatus in species and the evolution of the "environmental monitoring techno-web" that we have been constructing throughout the past century. This "techno-web" allows us to acquire, store and manipulate an enormous quantity of data. However, it is probable that our capacity to "form fine-tuned internal impressions" of the quality of what lay round about us may have not evolved *pari passu*, or may even have involved.

Through recent decades a global cultural-institutional network has gradually grown up to project, implement and use the enormous technological web that is supposed to observe, monitor, communicate, inventory and assess our environment and its biodiversity in order to implement sustainable management models. This web has been growing through the proliferation of structures that include a great variety of artifacts, hardware, software and implementable conceptual tools of diverse typologies and degrees of sophistication. This "structure" includes networks of monitoring and communication satellites and a great variety of remote-sensing techniques, aerial reconnaissance, groundtruthing techniques, data acquisition, manipulation and display through large-scale computing and modelling (such as the popular multilayer Geographical Information Systems), *in situ* sensors for advanced site characterization and monitoring, complex systems dynamics modelling, ecosystem analysis models, expert systems and artificial intelligence decision making technology, information-sharing technology and the like. We can refer to this structure in general as "information and monitoring systems".[2]

The technological mutation implicit in these global monitoring systems is the consequence of the development and integration of various technologies such as: remote sensing, data telecommunication, technology for the manipulation and "intelligent" management of data, aerospace and military technology. This technological integration is

[2] See World Conservation Monitoring Centre 1996a, 1996b.

being used as a source of information and automated interpretation of local/global processes to conform natural, military, economic, social, agricultural and infrastructure databases.

It is important to understand how this grand technological web is itself generated by, and in the same time lodges, a mental process inherent to the theoretical developments. There is an inescapable circularity between the design of technology and the kind of theory that can "flow" within it. This in spite of the claims made by many empiricists who may be lead to believe that they do not need theory or that their science does not presuppose any ontological positions.

As Hoffmeyer has observed:

> In actual fact, what biologists work with is not living things but *data* ... one could easily be misled into believing that data is something hidden within the natural world, something which the good experimentalist goes out and most cunningly coaxes out of it [...] To the scientist, reality amounts to data plus those theories which make sense of the gathered data. [...] Despite the impressive volume of data which biology and medicine can produce, it is impossible to rid oneself of the suspicion that there is a chronic gap in all the information they keep churning out. (Hoffmeyer 1996: 90–92)

Considering the alleged amplitude of the "biodiversity" concept (genes, species, ecosystems and cultures), one realizes that it is almost equivalent to the concept of "living nature". The difference between the biodiversity and the biosphere concepts lies in the fact that the former puts its emphasis in taxonomic quantification, while the latter concentrates on the process of interdependent relations between such diversity of taxa. The mainstream approach in the study of biodiversity has been that of making species inventories and taxonomic quantification, while the one that predominates in the study of the biosphere have been the quantification of mass-energy conversions in ecosystems.

The majority of "knowledge tools" that have been incorporated in the mainstream of the cultural-institutional-technological web that is supposed to "manage" the sustainable use of biodiversity and ecosystems world-wide, are amply based on a combination of mechanistic biology, genetic reductionism, economical determinism and neo-Darwinian cultural and biological perspectives. These epistemological stands may each have their theoretical merits, but taken in combination and determining "thousands of cultural details" it may be suspected that they have a counterproductive effect on common sense and everyday management. At the very best, this combination may provide only a partial picture of what is going on in ecosystems, and in

the worst case it may give rise to misleading guiding principles if we want the goal to be "sustainability".

We can thus conclude that Modernity has produced some cultural premises which have determined an ecological crisis. Among these premises figures the environmentalist's myth of an external environment that we have to save without questioning the cultural aspects that have compromised it. This is how we end up developing a cultural-institutional-technological web for the sustainable management of global biodiversity based almost exclusively on the epistemological scaffolding born from the very process of modernity that in the first place has determined the cultural-ecological crisis.

The goals of ecological monitoring

Since the international community became aware of the ecological crisis in the early 1970's (particularly since the Stockholm Conference in 1972) different concepts have been implemented to characterize the kind of interdisciplinary effort needed for a healthy social-ecological management. Among these "sustainability" is probably most widely accepted at the international level, and the goals of ecological monitoring should therefore coincide with those of "sustainable development". However, even its supporters acknowledge that the concept still remains vague and elusive, and this of course affects its practical implications. There appears to be consensus on the need to emphasize ecological, economic and social indicators of sustainability. A definition considered as one of the most comprehensive and insightful says that sustainability is a state in which human life can continue indefinitely, human individuals can flourish (economic), human cultures can develop (social), but in which the effects of human activities remain within bounds, so as not to destroy the diversity, complexity, and function of the ecological life support system (ecological) (Herkert et al. 1996). At present, "sustainability" studies seem to have trouble in moving ahead from this initial definition, which risks becoming an inoperative cliché.

Almost three decades ago Bateson gave us some hints as to how to proceed along a sustainable path (without ever using the word "sustainability"), and how to define a healthy ecology of human civilization:

> It would be convenient to have an abstract idea of what we might mean by ecological health. Such a general notion should both guide the collection of data and guide the evaluation of observed trends. [...] A single system of *environment combined with high human civilization* in which the flexibility of the civilization shall match that of the environment to create an ongoing complex system, open-ended for slow change of even basic (hard-programmed) characteristics. (Bateson 1972: 494)

Among the different characteristics listed by Bateson in his attempt to work towards a definition of "high" we have: "A 'high' civilization should therefore be presumed to have, on the technological side, whatever gadgets are necessary to promote, maintain (an even increase) wisdom of this general sort. This may well include computers and complex communication devices" (Bateson 1972: 495).

More recently, Hoffmeyer adds further hints in order to move on from operative definitions:

> Sustainable resource utilization presupposes that natural systems are allowed to follow their own complex and diverse regulatory mechanisms. And this is where information techniques enter the scene. So far we have simplified nature to match our heavy technical system. With the information techniques we would be able to fit our technical system to match the complexity and refinement of living nature. [...] Basically two kinds of information techniques should be distinguished. Techniques for manipulating, transferring and storing culturally derived informations, i.e. microelectronic techniques, and techniques for manipulating, transferring and storing biologically derived informations, i.e. bio-information techniques (e.g., gene splicing). (Hoffmeyer 1993a)

But even though new information techniques (both types) may constitute the technological basis for a production system which could better match the complexity of ecosystems we should bear in mind that "... several of the premises which are deeply ingrained in our way of life are simply untrue and become pathogenic when implemented with modern technology" (Bateson 1972: 502).

System-observer semiotics

Environmental sciences and engineering (extended to sustainability studies) deal with the attenuation and balance of anthropogenic impacts on the "natural life-support systems" (i.e., ecosystems). They act in the interface between culture and nature. This means that the design and choice of technology should include considerations about such an interface.

At present, major approaches dealing with this interface, particularly with monitoring, tend to preserve the discontinuity between the two realms which the interface should bring into interactive play, nature and culture. This is the reason why it might be useful to introduce an approach that can cope equally well with the semiotic aspects of both realms and specially the semiotic aspects of the interface. Such an approach would seem to make the "knowledge transfer" from the natural to the cultural — "capturing data" (i.e., monitoring) — smoother, since it would not reduce the analogical-digital communication, i.e. the code-duality that characterizes all living systems and human cognition (see below), to digital, quantitative data, which then paradoxically must in a later stage be "re-analogised" for the human mind to capture its meaning.

The processes of interest are not linear, and the variables are so many and so entangled that the broader balance may easily be lost out of sight. Thus, for instance, people doing work on ecosystem network analysis, attempting to trace and quantify the trophic connections among the populations (who eats who and how much carbon, nitrogen and phosphorus is transferred from one place to another), often complain that even in the simplest ecosystems the emerging picture soon comes to resemble a hopeless jumble, sometimes referred to as a "bird's nest" or "spaghetti diagram".

When the technology designer sets out a goal of sustainability in his design, he immediately bumps into the "cultural issue" since the design of "environmental friendly" technology necessarily involves cultural aspects. Thus we find different approaches in the literature such as "design for the environment", "life cycle design", "green engineering", "industrial ecology" "sustainable development and technology" or "environmentally conscious design" (Coulter et al. 1995) where the "conscious" part seems to be related to the "sustainability" notion.

The general trend of globalization has implied that also the spatio-temporal scope of environmental planning and technology design has expanded its range of action, creating a massive techno-web to manage biodiversity resources and anthropogenic impacts on ecosystems. It is in this technological sphere — right at the interface between the natural system and our cultural "planning" — that we encounter monitoring technology.

But monitoring implies a previous step, which is sensing, and sensing in turn implies a range of semiotic processes of different sorts: sensing data and sensing a difference that has to make a difference to

whoever designed and implemented the sensing device and its data codification and manipulation procedure. The empirical ecologist might therefore ask himself two different questions implying two different epistemological attitudes:

(1) what can I sense with all this technology that I have available and that keeps arriving to me?

(2) what kind of technology (i.e. knowledge tools) do I really need to sense what is supposed to be important?

Obviously the design of "sensing" has to precede the actual activity of "sensing". And the design of "sensing" consists not only in structuring and codifying the data but also in the design of all the procedures to manipulate those data in order to grasp their significance.

Many research programs recognize that complex systems exhibit chaotic and non-linear behaviour, recognize the complexity of feedback loops that make it difficult to distinguish cause from effect, and recognize the existence of thresholds and emergent qualities that make difficult the aggregation of small scale behaviour to arrive at large-scale results. However, many of these approaches seem to put excessive confidence in large scale computing (such as parallel super computers or advanced numerical computation algorithms) hoping thereby to obtain integrated models of systems that independently and on their own would be extremely complex. An example of this could be the integration of computerized models for ecosystems dynamics with economic system simulation and climatic systems in order to compound an unitary model of incredible complexity. To move towards this goal, it is claimed that it is necessary to mobilize the academic community in a global collaborative effort based on the new information sharing technology in order to reunite the leaders of advanced computing and software development with the leaders in global biological, ecological and socioeconomic modelling and data collection.

These approaches risk transforming complexity into complication. They leave aside many of the qualitative and relational aspects that can only be grasped by considering the semiotic networks operative in the complex systems constituted by the ecological and the cultural processes. As Hoffmeyer has warned:

> Environmentalists have generally considered ecological complexity to be a positive value and logically, at least, complexity would seem to be the opposite of simplicity. But the problem with this concept (complexity) may well be that our scientific tradition has tended to treat it in a simplifying way, i.e., through definition in quantitative terms. (Hoffmeyer 1993b: 162)

Thus in most of mainstream monitoring networks information is perceived through a filter of "cultural structuring", that converts it into a digital form amenable to sophisticated computational treatment even before it reaches the retina of the "someone" to whom it was supposed to make a difference. It follows from this that the kind of information we will get by the monitoring procedure is buried in the computational setting of the situation and thus in our prefigured notions of "sustainability" and "conscious". Therefore it is important that decisions on what direction we want to take when defining terms such as "sustainability" or "conscious" precede the designing of parameters (the differences!) to be sensed.

A view from biosemiotics

There are at least two ways in which the information techniques could help us to fit our technical systems to match the complexity and refinement of living nature. And these two ways correspond to the two basic kinds of information techniques distinguished by Hoffmeyer (1993a), namely techniques for manipulating, transferring and storing culturally derived information, as in the case of ecological monitoring, and techniques for manipulating, transferring and storing biologically derived information as in the case of biotechnology (while in this paper I'm concentrating on the former, I will take on the latter in a separate work). In both these applications of information techniques biosemiotics is involved.

Moreover, as biotechnology advances, the genetic (and thus also the evolutionary) level will increasingly be included in the ecological monitoring. Here the challenge to biosemiotics is to assist in creating an explanatory sphere that will allow for the passage from the "one gene-one enzyme" approach to approaches based on the multifarious developmental trajectories in organisms and ecosystems. Both molecular biology and biotechnology might profit from this (Emmeche 1999; Sarkar 1996).

Besides being potentially able to help to refine our mapping techniques of biological processes, a biosemiotic approach to ecology, if carried out further, may serve to better integrate our understanding and monitoring of ecosystems into the cultural process of searching for (human) sustainability.

Several different concepts have been used during the 20th century to represent the totality of living nature: from the biosphere to biodiversity to the more comprehensive semiosphere. These constitute different approaches to biological complexity, but they all have in common the fact that they focus our attention upon a network that includes everything from genes to ecosystems. While biodiversity has been understood in terms of its "components", ignoring the relations between them, the biospheric approach has surrendered to the strategy of explaining life as "nothing-but-interacting-molecules" resulting in an explanation of life as trophic chains and mass-energy exchanges at ecosystem level. And so once again the reductionist research strategy leaves out a whole dimension of life that it has itself helped digging out: the dimension of semiosis. "Surprisingly then", writes Hoffmeyer, "from a biosemiotic point of view the biosphere appears as a reductionist category which will have to be understood in the light of the yet more comprehensive category of the semiosphere" (Hoffmeyer 1997a: 934). The biosphere is bio-sphere because from it emanates a semiosphere in which it is itself immersed and by which it is permeated, Life is an ancient semiotic web.

A few years before presenting the new concept, biosphere, Vernadsky himself apparently already spoke in terms of the Biosphere's "mental process", in which the human "mental process" is immersed, as is evident in the following quote made by Lotman, who tells us that Vernadsky, in his notes dating from 1892, described human intellectual activity as a continuation of the cosmic conflict between life and inert matter:

> The seeming laws of mental activity in people's lives has led many to deny the influence of the personality on history, although, throughout history, we can in fact see a constant struggle of conscious (i.e. not natural) life-formations with the unconscious order of the dead laws of nature, and in this effort of consciousness lies all the beauty of historical manifestations, the originality of their position among the other natural processes. A historical epoch can be judged by this effort of consciousness. (Lotman 1990: 125)

It is evident that Vernadsky is referring to the semiotic process inherent to the living world and its relation to the "dead nature" that serves as a substrate through which it manifests itself.

Bateson used the notions of *pleroma* and *creatura* to describe how the "mental process" in nature unfolds in a historical perspective. For him the word *pleroma* describes "the material world, characterized by the kinds of regularities described in the physical sciences". Whereas

creatura refers to "all processes in which the analog of cause is information or difference [...], the entire biological and social realm, necessarily embodied in material forms subject to physical laws of causation as well as the distinctive processes of life", i.e. the world of communication. The distinction between *pleroma* and *creatura* "is blurred by the fact that human knowledge of Pleroma is entirely mediated by Creatural processes of response to difference" (Bateson, Bateson 1989: 207–211). So for Bateson, "there is an underlying notion of a dividing line between the world of the living (where *distinctions* are drawn and *difference* can be a cause) and the world of nonliving billiard balls and galaxies (where forces and impacts are the 'causes' of events)" (Bateson 1979: 7).

The revolutionizing effect of Bateson's innovative notion of "information" in life sciences as opposed to the physicalist and mechanistic, or computabilistic, philosophies that cannot encompass the semantic aspect of information and cognition has been discussed by Brier (1998: 185). For Bateson, the smallest unit of mental process, is a difference or distinction, or news of a difference. So information means a difference that makes a difference to somebody. But for there to be a "difference", news of a distinction, there has to be "somebody" to perceive it. It has to be in relation with "a system with interpretative power, or a subject to whom these ostensible signs could make a difference (if we say that sign, or information, is a 'difference that makes a difference for some interpretant', to cross ideas of C. S. Peirce and Gregory Bateson)" (Emmeche 1994: 12).

In a biosemiotic understanding biological information is inseparable from its context, it has to be interpreted in order to work, and Bateson's approach to information, context and analog/digital communication has been recognized as highly relevant to a more fully developed semiotic approach to biology (Hoffmeyer, Emmeche 1991).

Views like those of Vernadsky (the "consciousness" of historical manifestations), Bateson (nature's "mental process" in a historical perspective) or those of Lotman and Hoffmeyer (the semiosphere), have in common the necessity of maintaining synchronicity and diachronicity together. The interplay of what Hoffmeyer has termed horizontal and vertical semiosis in evolution. From a biosemiotics point of view, this dynamic can be grasped through the concept of "code-duality" which allows the consideration of historical and evolutionary aspects in the semiotic networks "horizontally" operative in ecosystems.

Thus "code-duality" (Hoffmeyer, Emmeche 1991) becomes a key concept in biosemiotics: life exhibits a semiotic interaction between two states, the analog coded state of the organism itself and its redescription in the digital code of DNA. As analog code the organisms recognize and interact with each other in the ecological space giving rise to a horizontal semiotic system (or ecological hierarchy), while as digital codes (after eventual recombination through meiosis and fertilization in sexually reproducing species) they are passively carried forward in time between generations, the vertical semiotic system (or genealogical hierarchy).

This leads Hoffmeyer to say that the necessary but sufficient condition for a system to have the ability to transform the differences in its environment into distinctions is that it has developed self-reference based on code-duality, i.e. the continued chain of digital-analogue (i.e. DNA-cell) re-interpretations guiding the genealogical descent (Hoffmeyer 1993b, 1997a, 1995, 1996; Hoffmeyer, Emmeche 1991).

The notion of "code-duality", like other biosemiotic terms, such as "semiotic freedom", "Umwelt", "swarm semiotics" and "semiogenic scaffolding" may have fruitful explanatory potential at the ecosystem level. This is not the place, however, to engage in a more systematic analysis of these concepts in relation to ecosemiotics.

The most important step for the conservation and sustainable use of biodiversity is often assumed to be the identification and elaboration of exhaustive taxonomic inventories. Many scientists are worried about the extinction of thousands of species yearly before anybody even had a chance to classify them! It has been estimated that about 1 million species have been taxonomically labelled and frequently it is repeated that there may exist five, thirty or even eighty millions of species yet to be "discovered". But while taxonomy is of course necessary and useful, the understated goal of exhaustibility seems a bit awkward. Most of the resources spent on species conservation are being allocated to this immense work of identification.

Also much effort goes to the mapping and quantifying of trophic networks and biomass. According to Emmeche (1998), ecology addresses the specificity of individual species in terms of niches, where the niche is the mode of functioning of the individual species in the ecosystem, its special contribution to the network of energy and matter. Emmeche claims that, after all, biomass is organized in other far more ingenious ways than the simple dyadic-ecological relations of the type illustrated by the figure "tiny fish is eaten by little fish is eaten by fish is eaten by large fish is eaten by". The fact that food

chains are not just simple and dyadic actions[3] but complex relations dependent on constant communication among organisms (of different or the same species), represents the semiotic dimension. So it becomes hard to imagine that (bio) mass phenomena are exclusively governed by the laws for the particles of which they are composed. Thus mass "becomes a macroscopic phantom with no meaning, for it is the dynamics at the micro level that have been the causal moving force for the system as a whole" (Emmeche 1998: 76).

Quantification of biomass production has been used to monitor the "vigor" of large ecosystems, like for example the transnational effort launched by UNESCO at the beginning of the 1980s to monitor ecosystem "vigour" and "function" of the main ecosystems of the Caribbean Sea. A project like this consists in setting up a certain number of measuring stations (23 in 19 countries), establishing a standard measuring protocol for consistency and over the years create a historical-statistical data-base for comparison purposes (UNESCO-CSI, 1997).

But seen as an ecological indicator mass growth may not be good enough. Thus even though it may be a good indicator of "vigour" it does not necessarily reflect "health" or "balance", as may for instance be observed in an eutrophic mangrove lagoon where sturdy marine birds activity on the expanding mangroves does not guarantee that fishery, reptiles and water freshness are not at risk.

This is where biodiversity enters into ecological monitoring. Measurements of biodiversity comprises the identification and quantification of species and the recording of population dynamics. In large, complex and diverse ecosystems, as for instance a tropical rainforest, such measurements take on enormous proportions. Therefore modelers try to design monitoring systems that rely on what are considered "indicator species", a notion which obviously already has an explicit semiotic connotation.

The mere number of specimens of an indicator species will probably not in general give a truly reliable idea of what is going on in a larger dynamic. Or to put it in another way, the selection of a "sensible" species as an indicator cannot be based solely on the easiness of observation of the specimens but must also rely on knowledge that we can obtain about its Umwelt and its semiotic niche, and on an under-

[3] Emmeche (1998: 75): "There are two kinds of actions in our universe, dyadic and triadic. Dyadic action is mechanical or dynamic, and is concerned with efficient causation as described for example in ecology in connection with the biomass. The triadic action type is semiotic, or intelligent; it concerns final causation as described in biosemiotics. The two kinds of action are irreducible, but inseparable and superimposed".

standing of how that borderless-sphere relates to the network of semiotic relations that include other "indicator" species or events.

For illustration let us consider the eventual monitoring of the effects of gaps produced by forest clearance in large tropical rainforest extensions. The gaps are known to disrupt the "normal" pattern of species dissemination in the forest surrounding the gap. The main question here will be how small patches of forest can possibly be if retainment of its primary diversity, vigour, function or health shall be assured. What are the signs that disorient birds in their disseminating of tree seeds? Why should we care?

A strategy like this would more truly vindicate the role of the so-called "parataxonomist" in western globalized culture, that is, the role of native people that in their everyday life are used to handle a great amount of data relative to the species, their trails, their utterances, their habits and their relations with other habits, other utterances and other trails in the ecosystem.

Here, if a tree needs to rely on certain bird's airmail service for success in reproduction, where would that information be found? In the tree's DNA? or in the bird's? would it be foolish to talk about the ecosystem's DNA?

Semiotics, trophic chains and biomass growth and decay are not mutually exclusive explanatory tools:

> To the extent evolution favors the establishment of refined semiotic interaction patterns between species, it will also tend to open the way for a multitude of physical interactions between species... In this perspective symbiotic relations are not to be considered just funny accidents, rather they constitute a systematically occurring phenomenon in the semiosphere. (Hoffmeyer 1997b: 367)

Any primitive biological organism already interacts semiotically with its environment when it selects or avoids energetic or material objects in its environment (Nöth 1999: 78). But the semiotic interactions of organisms are by no means limited to physical dependence modes. There are other possibilities for semiotic mutualism in which one organism uses regularities exhibited by other organisms as cues (e.g., for orientation, play, safety and even sexual intercourse) just in the same way it may use perceived regularities from the abiotic world for similar purposes (as, e.g., when migratory birds find their way by reading the configuration of stars) (Hoffmeyer 1997b: 367–368).

Semiotic interactions will tend to combine different species into integrated functional networks which cannot be analysed in terms of

two-species interaction models. Hoffmeyer has claimed that semiotic interactions between species very likely, when analyzed in more detail, "will produce an explosive change in our conceptions of symbiosis and thereby put the symbiotic theory of evolution to the forefront of evolutionary theory" (Hoffmeyer 1995: 377).

In conclusion then, we shall suggest that an understanding of nature's semiotic ways of controlling the interactive behaviour of individuals, populations and species may prove useful or even necessary for the modelling process, which in turn will allow the construction of meaningful monitoring systems.

References

Acock, B.; Reynolds, J. F. 1990. *Model Structure and Data Base Development: Process Modelling of Forest Growth Responses to Environmental Stress*. Portland: Timber Press.

Bateson, Gregory 1972. *Steps to an Ecology of Mind.* New York: Chandler Publishing Company.

— 1979. *Mind and Nature: A Necessary Unity.* New York: Bentam Books.

Bateson, Gregory; Bateson, Mary Catherine 1989 [1987]. *Dove gli angeli esitano. Verso un'epistemologia del sacro.* Milano: Adelphi Edizioni.

Brier, Søren 1998. Cybersemiotics: A transdisciplinary framework for information studies. *Biosystems* 46: 185–191.

Buss, Leo 1987. *The Evolution of Individuality.* Princeton: Princeton University Press.

Collier, Boyd D.; Cox, George W.; Johnson, Albert W.; Miller, Philip C. 1974. *Dynamic Ecology.* London: Prentice/Hall International editions.

Costanza, Robert; Wainger, L.; Folke, C.; Mäler, K.-G. 1993. Modeling complex ecological economic systems: Toward an evolutionary, dynamic understanding of people and nature. *Bioscience* 43(8): 545–555.

Coulter, Steward; Brass, Bert; Foley, Carol 1995. A lexicon of green engineering terms. In: Hubka, V. (ed.), *International Conference on Engineering Design, ICED 95*. Praha: Heurista, 1033–1039.

Eichler, Arturo 1987. *S.O.S. Planeta Tierra.* Caracas: Fuerzas Armadas de Cooperación de Venezuela.

Emmeche, Claus 1992. Modelling life: A note on the semiotics of emergence and computation in artifitial and natural living systems. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.), *Biosemotics. The Semiotic Web 1991.* Berlin-New York: Mouton de Gruyter Publishers, 77–99.

— 1994. The computational notion of life. *Theoria-Segunda, Epoca* 9(21): 1–30.

— 1998. The agents of biomass. In: Jurgensen, Andreas; Ohrt, Carsten (eds.), *The Mass Ornament: The Mass Phenomenon at the Turn of the Millennium*. Odense: Kunsthallen Brandts Klaedefabrik, 64–79.

— 1999. The Sarkar challenge to biosemiotics: is there any information in a cell? *Semiotica* 127(1/4): 273–293.

Emmeche, Claus; Hoffmeyer, Jesper 1991. From language to nature: The semiotic metaphor in biology. *Semiotica* 84(1/2): 1–42.

Herkert, Joseph; Farrell, Alex; Winebrake, James 1996. Technology choice for sustainable development. *Institute of Electrical and Electronics Engineers' Technology and Society Magazine* 15(2): 11–20.

Hoffmeyer, Jesper 1993a. The changing concept of information in the study of life. Paper presented in the Symposium *Nature and Culture in the Development of Knowledge. A Quest for Missing Links*. Uppsala, 8–11 September 1993 (http://www.molbio.ku.dk/MolBioPages/abk/PersonalPages/Jesper/ History.html).

— 1993b. Biosemiotics and ethics. In: Witoszek, Nina; Gulbrandsen, Elisabeth (eds.), *Culture and Environment: Interdisciplinary Approaches*. Oslo: Centre for Development and the Environment, University of Oslo, 152–176.

— 1995. The semiotic body-mind. In: Tasca, Norma (ed.), *Essays in Honour of Thomas Sebeok*. Porto: Cruzeiro Semiótico No. 22/25, 367–383.

— 1996. *Signs of Meaning in the Universe: The Natural History of Signification*. Bloomington: Indiana University Press.

— 1997a. The global semiosphere. In: Rauch, Irmengard (ed.), *Proceedings of 5th Congress of The International Association for Semiotic Studies, Berkeley, 1994*. Mouton Gruyter, 933–936.

— 1997b. Biosemiotics: Towards a new synthesis in biology. *European Journal for Semiotic Studies* 9(2): 355–376.

— 1998. The unfolding semiosphere. In: Vijver, Gertrudis van de; Salthe, Stanley; Delpos, Manuela (eds.), *Evolutionary Systems: Biological and Epistemological Perspectives on Selection and Self-Organization*. Dordrecht: Kluwer, 281–294.

Hoffmeyer, Jesper; Emmeche, Claus 1991. Code-duality and the semiotics of nature. In: Anderson, Myrdene; Merrell, Floyd (eds.), *On Semiotic Modelling*. New York: Mouton de Gruyter, 117–166.

Kull, Kalevi 1993. Semiotic paradigm in theoretical biology. In: Kull, Kalevi; Tiivel, Toomas (eds.), *Lectures in Theoretical Biology: The Second Stage.* Tallinn: Estonian Academy of Sciences, 52–62.

— 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–369.

— 1999. Umwelt and evolution: From Uexküll to post-Darwinism. In: Taborsky, Edwina (ed.), *Semiosis, Evolution, Energy: Towards a Reconceptualization of the Sign.* Aachen: Shaker Verlag, 53–70.

Lotman, Yuri 1990. *Universe of the Mind: A semiotic Theory of Culture*. Bloomington: Indiana University Press.

May, Robert (ed.) 1976. *Theoretical Ecology: Principles and Applications.* Oxford: Blackwell Scientific Publications.

Nöth, Winfried 1999. Ecosemiotics and the semiotics of nature. In: Taborsky, Edwina (ed.), *Semiosis, Evolution, Energy: Towards a Reconceptualization of the Sign.* Aachen: Shaker Verlag, 73–87.

UNESCO-CSI 1997. Coastal Ecosystem Productivity Network in the Caribbean (http://www.unesco.org/csi/act/caricomp/projec15.htm)

World Conservation Monitoring Centre 1996a. *Assessing Biodiversity Status and Sustainability.* Cambridge: World Conservation Press.

World Conservation Monitoring Centre 1996b. *The Biodiversity Information Clearing House: Concept and Challenges.* Cambridge: World Conservation Press.

Биосемиотика и экологический мониторинг

В последние десятилетия глобальная культурно-институциональная сеть постепенно развилась до того, чтобы начать проектировать, оборудовать и вводить громадную технологическую сеть, которая призвана наблюдать, контролировать, инвентаризировать и оценивать нашу окружающую среду и ее биологическое разнообразие, чтобы обеспечить создание модели экономичного хозяйствования. Большинство "инструментов знания", применяемых в главном направлении этой "техносети", основывается на комбинации механистической биологии, генетического редукционизма, экономического детерминизма и неодарвинистских культурных и биологических перспектив. Такие подходы игнорируют многие качественные и реляционные аспекты, которые можно понять, лишь учитывая действие семиотических сетевых структур в комплексных экологических и культурных системах. Автор статьи считает, что биосемиотический подход к экологии может оказаться полезным при моделировании процессов, что, в свою очередь, позволит конструировать оптимальные системы мониторинга. В статье утверждается, что биосемиотический подход может способствовать интегрированию нашего понимания экосистем и наблюдения за ними в общекультурный процесс поиска (человеческой) стабильности.

Biosemiootika ja ökoloogiline seire

Viimastel kümnenditel on globaalne kultuurilis-institutsionaalne võrgustik hakanud kavandama, seadmestama ja rakendama tohutut tehnoloogilist võrku, mis peaks tegelema meie keskkonna ja selle bioloogilise mitmekesisuse vaatlemise, järelevalve, vahendamise, inventeerimise ja hindamisega, et kasutusele võtta säästliku majandamise mudelit. Valdav osa sellesse "tehnovõrku" kaasatud "teadmise tööriistadest" põhineb suuresti mehhanitsistliku bioloogia, geneetilise reduktsionismi, majadusliku determinismi ning neodarvinlike kultuuriliste ja bioloogiliste väljavaadete kombinatsioonil. Need

lähenemised eiravad aga mitmeid kvalitatiivseid ja suhtumuslikke aspekte, millest võib aru saada üksnes arvestades semiootiliste võrgustike toimimist komplekssetes ökoloogilistes ja kultuurilistes süsteemides. Artikli autor arvab, et biosemiootiline lähenemine ökoloogiale võib osutuda kasulikuks protsesside modelleerimisel, mis omakorda võimaldab konstrueerida mõttekaid monitooringusüsteeme. Veel väidetakse artiklis, et biosemiootiline lähenemine võib soodustada meie ökosüsteemidest arusaamise ja nende järelvalve integreerimist kultuuriprotsessidesse, milles toimub jätkusuutlike võimaluste otsing.

Towards a semiotic definition of trash

Riste Keskpaik
Department of Semiotics, University of Tartu
Tiigi St. 78, 50410 Tartu, Estonia
e-mail: riste@ut.ee

Abstract. The phenomenon of trash has rarely been addressed in the cultural theoretical literature. However, its structural similarity with the concept of taboo as well as its role in the dynamics of culture has been stated. Current paper aims to summarize the partial contributions that have been made so far, localize them in a larger semiotic framework, and deriving from Lotman's approach to culture suggest a few further ideas for a semiotic definition of trash. It is proposed to define trash as a phenomenon marking the boundary between culture and non-culture/nature. In the context of the deepening environmental crisis (to which accumulation of trash contributes) a semiotic approach opens a new perspective for identifying the origin of the problem in our mind/culture rather than in nature.

Human discards[1] can tell about the habits and belief systems of those who have left them behind and may even give evidence of the whole of a human culture. Nevertheless, the study of this domain has so far remained rather undiscovered by semioticians. Have we been blinded by cultural norms that prescribe the rejection of the phenomenon, or has the topic simply gone unnoticed because of a lack of relevant theory? Only recently, scholars of culture have begun to give some attention to the creative potential inherent in trash.

[1] The English language offers synonyms such as 'rubbish', 'refuse', 'garbage', 'trash' etc. to designate human discards. The terminology of the scholars in this field of study varies. Douglas (1984) deals with 'dirt', Rathje and Murphy (1993) prefer the term 'garbage', while Artigiani (1994) uses 'trash' as the topic of his paper. I have chosen to employ 'trash' since it refers to human discards most generally and can be used in both the literal and a metaphoric sense.

In 1973, a research project was launched by the University of Arizona to obtain practical information and data concerning human behaviour in relation to garbage (Rathje, Murphy 1993). The scholars proceeded by archaeological methods, sorting out people's discards and doing excavation in landfills with the aim to find out whether "it would be possible to investigate human behaviour 'from the back end'" (Rathje, Murphy 1993: 14). The approach proved to be fruitful and led to valuable insights concerning several patterns of cultural behaviour well supported by empirical results. The Arizona Garbage Project has provided detailed data concerning consumer habits, landfill situations, biodegradation, and the recycling of trash.

Unlike the Arizona garbologists who believe that "to understand garbage you have to touch it, to feel it, to sort it, to smell it" (Rathje, Murphy 1993: 9), other scholars have attempted to "sift through the trash" without getting their hands dirty. A collection of such approaches can be found in a special issue of the *American Journal of Semiotics* (vol. 11(1/2), 1994) on the semiotics of trash. According to Adams (1994: 64), the volume is an assortment of the authors' "residues of intellectual endeavours". These semioticians of trash have investigated various examples and aspects of (d)evaluative processes in culture and society and have focused on the metaphorical usage of the concept of trash (Afable 1994, Anderson 1994, Bogumil 1994, Schofield 1994). Several theoretical frameworks have been adopted. Dickson (1994), Miller and Sotirin (1994), and Passariello (1994) follow the structural approach to trash elaborated by the anthropologist Mary Douglas (1984). From quite different perspectives, Artigiani (1994) departs from information theory and the theory of open systems (as developed by I. Prigogine) to describe some positive aspects of trash in the life and development of culture. Both structural and dynamic aspects are in the focus of the contribution by Adams (1994), who defines trash above all as a semiotic phenomenon and states that the problems associated with it require semiotic solutions.[2]

Our brief review of semiotic approaches to trash focuses on the following questions: In what context does trash become an object for semiotic analysis? How is the theoretical construct of trash connected to our everyday understanding of it? What is the role of trash in and for culture? Does trash belong to nature or to culture? Based on Lotman's theory of the semiosphere (Lotman 1990, 1992), a broader

[2] In addition to the studies discussed in this paper, other papers dealing with some semiotic aspects of trash are Bock and Zafirov (1992) or Posner (2000).

theoretical framework will be proposed and its potential for ecosemiotics will be investigated.

Trash in the framework of structural anthropology

According to Lévi-Strauss (1963), human beings structure their world in the same way in which they categorize their language. The categories of the human mind are based on the principles of binary opposition. Human culture constitutes an integrated system that symbolically represents the order of the world. This symbolic system is also a practical tool for the orientation of humans in their world and for their operation in society.

However, as Leach (1966) and Douglas (1984) have shown, no matter how elaborated or differentiated the system of categories may be, there are always phenomena that defy categorization, and such phenomena acquire special status in culture. According to Leach, in our cultural perception of the world, we distinguish between "things" and "non-things":

> I postulate that the physical and social environment of a young child is perceived as a continuum. It does not contain any intrinsically separate 'things'. The child, in due course, is taught to impose upon this environment a kind of discriminating grid which serves to distinguish the world as being composed of a large number of separate things, each labeled with a name. [...]
>
> Now if each individual has to learn to construct his own environment in this way, it is crucially important that the basic discriminations should be clear-cut and unambiguous. There must be absolutely no doubt between *me* and *it*, or between *we* and *they*. [...] We achieve this [...] kind of perception by means of simultaneous use of language and taboo. Language gives us the names to distinguish the things; taboo inhibits the recognition of those parts of the continuum which separate the things. (Leach 1966: 34–35)

An example of a "non-thing", according to Leach, is bodily excrement. Excrements threaten the fundamental distinction between *me* and *not me* and this is why they are tabooed in all cultures (see also Dickson 1994). However, in spite of their status of non-things, these substances are not only "felt to be dirty — they are powerful; throughout the world it is precisely such substances that are the prime ingredients of magical 'medicines'" (Leach 1966: 38; on power and sacredness of bodily remnants see further: Passariello 1994). Hence, ambiguous elements are not only culturally suppressed, they are also vested with supernatural powers.

Rituals, prohibitions, and detailed cultural rules concerning religious pollution and purification have been investigated by Mary Douglas. Douglas has shown that cleanliness is a matter of serious concern in culture. She argues that there is no essential difference between the traditional conception of religious pollution and contemporary ideas about trash: both aim at creating and maintaining order in human experience. Her conclusion is that there is a conceptual continuity between reactions to dirt and reactions to ambiguity or anomaly (Douglas 1984: 5). As these phenomena testify to the artificial nature of the system of categorization established by culture and pose a constant threat to its (symbolic) order, the question of trash is intimately tied to the origin of culture.

According to Douglas (1984: 35), "dirt is the by-product of a systematic ordering and classification of matter, in so far as ordering involves rejecting inappropriate elements". Trash is hence conceived of as a "residual category" of "rejected" things that do not conform to other categories. Furthermore, it also consists of dangerous things that are better to be avoided if not totally eliminated. Although trash is always determined by specific cultural order, it is as such a universal category.

The cultural categories of trash and pollution are hence genuinely linked to creating order, as Douglas (1984) has shown, and since order is always subject to corruption, the elimination or even total ignorance of trash is impossible. We are constantly faced with trash, as we are incessantly engaged in creating order out of chaos. Creating order means creating trash at the same time, so that trash and order are like two sides of one and the same coin. This conveys trash a positive function in culture. Trash establishes boundaries and confirms the categories that it does not conform to. Trash evinces a dynamics that does not lead to destruction, but also to creativity. It can even become a mediator between humans and supernatural powers (Passariello 1994). Trash is a resource out of which something new can be created. Its merit as an "apt symbol of creative formlessness" (Douglas 1984: 161) has most authentically been expressed in creation myths that interpret the origin of the world from dirt, mud, or even from "primordial defecation" (Dickson 1994: 165).

Role of trash in the dynamics of culture

Although Mary Douglas has emphasized that trash plays an important role in the dynamics of culture, her model of structural anthropology cannot adequately cope with the dynamical aspects of the phenomenon. Models to cope with these aspects have been derived from the theory of complex dynamical systems, especially Prigogine's theory of dissipative structures.

In terms of the theory of entropy, Artigiani interprets trash as having "both thermodynamic and informational meanings".[3] With reference to the Second Law of thermodynamics, the author argues that there are both negative and positive connotations if trash is accounted for in terms of entropy. Using the American Constitutional history as a test case, he tries to establish a link between trash and social evolution (Artigiani 1994: 249–250). Based on Prigogine's theory of dissipative structures, Artigiani describes society as an open system that unlike closed systems freely exploits resources from the external environment and manages to keep the local level of entropy low by expelling its waste to its environment. As Prigogine has demonstrated, there is a close relation between entropy and evolution, since "systems can evolve to greater levels of complexity by increasing their rates of external entropy production" (Artigiani 1994: 251). In information theoretical terms, it can be said that "one way in which open systems can become more complex, i.e., communicate more information about an expanded fraction of the world, is by incorporating "noise" from outside the system" (*ibid*.).

Open systems and their environments are in a relationship of reciprocal influence. The viability and development of a *social* system depend on the ability of this system to adapt to changes in its environment, to extend its frontiers, and to incorporate elements from its environment, which transform its inner structure. Such incorporation of elements from the environment lead to an increase in the level of the entropy produced by the social system. This model of social dynamics can be applied to interpret the social evolution of the United States of America: Artigiani describes the role of the US Constitution as its or-

[3] "In thermodynamic terms, entropy refers to degraded energy, to energy which can no longer be accessed by a system. In informational terms, entropy refers to 'noise', to some flow across a boundary that cannot be processed by a system" (Artigiani 1994: 249).

ganizing principle. Instead of prescribing all possible violations and specifying all necessary countermeasures, the Founders of the Constitution set up very general procedural rules. Their strategy was successful in maintaining the social system adaptable to changes and innovations in the social environment which the Founders themselves were still unable to foresee:

> Societal perturbations are 'noise' communicated by individuals or groups an established politico-economic structure ignored and/or mistreated. They were people — like Blacks, women, or the urban poor — that were 'trash' from the perspective of existing society. For them to force their way into conventionally constituted social structures would have meant the destruction of those systems. But the new procedures for organizing societies introduced by the U.S. Constitution have the unexpected benefit of preserving order amidst the entropy bursts of societal transitions. Thus, the society can generate out of its internal fluctuations arrangements that represent more complex forms of self-organization by turning noise into information. (Artigiani 1994: 254–255)

This interpretation is not concerned with what trash as such is, but with how trash may become an integral part of a social system in the course of its evolution. However, Artigiani fails to distinguish between trash as something produced and considered to be external to the system and trash as a resource that may be incorporated or assimilated by the system. If everything that is external to the system is accounted for as "trash", the essential difference between trash as "refuse" and trash as a "resource" cannot be understood.

Artigiani's systems theoretical approach to trash has affinities with Lotman's theory of the semiosphere (Lotman 1990, 1992).[4] This model gives a better account of the process of the incorporation of elements from the environment within a semiotic system. Culture in general as well as any specific culture can be considered as an independent semiosphere. The inside of this semiosphere is so organized that the texts considered to be more important from the point of view of the culture's self-description comprise the centre, while the less important texts remain at its periphery. The principles of organizing

[4] The semiosphere, according to Lotman (1990; 1992) is the model of a dynamic view of cultural processes: "By analogy with the biosphere (Vernadsky's concept) we could talk of a semiosphere, which we shall define as the semiotic space necessary for the existence and functioning of languages..." (Lotman 1990: 123). The semiosphere can be compared with an individual subject defined by its external boundary which separates its "inside" from its "outside" having its own subjective "sense of self". Although it can be described as a hierarchically organized system, the semiosphere resembles more to a living organism than a stable structure.

the internal space of a semiosphere remain stable, while the structures themselves are in constant motion: marginal structures gain prestige and attract supporters until they are recognized as central to the culture and finally become, in their turn, replaced by other peripheral structures (cf. Lotman 1990: 123–142; 1992: 16–18). In addition to the permanent flux of structures within the semiosphere there is a constant twofold flow over the external boundaries of the semiosphere:

> The boundary is a mechanism for translating texts of an alien semiotics into 'our' language. It is the place where what is 'external' is transformed into what is 'internal', it is a filtering membrane which so transforms foreign texts that they become part of the semiosphere's internal semiotics while still retaining their own characteristics. (Lotman 1990: 136–137)

Cultural borders are "the hottest spots for semioticizing processes", since they are the place of "constant invasions from outside" (Lotman 1990: 136, 141). The dynamics in culture is achieved by two processes, structural drift within the semiosphere and permanent translation from without into the semiosphere. The concept of "translation" suggests that something previously considered as external, is then included in the cultural repertoire and related to the other elements of this culture. Translation also occurs between different codes within the semiosphere.

From this perspective, the production of trash can be considered as a translation mechanism. By calling certain cultural objects "trash" these objects attain the meaning of "things that are displaced and need to be removed". The objects lose their identities and become reduced to the category of trash (Douglas 1984: 160–161). Deprived of their "meanings", they are pushed towards cultural periphery. Such a "translation" is a dynamic process since it brings "trash" to the periphery of culture. From the centre of the culture the periphery and the exterior appear as "trash", at least on an evaluative level.

A further original semiotic definition of trash has been proposed by Adams (1994). The author describes three successive phases in dealing with trash. In every new phase, expenditure of additional energy and time is required. In the first phase, "people discard, ignore, or otherwise suppress trash" (Adams 1994: 66). In getting rid of worthless things as little energy as possible should be spent.

The second phase occurs when the cumulation of trash makes it a source of confusion. "People want to continue ignoring 'it', but they cannot because they *must* do something about 'it'" (Adams 1994: 66). The cultural resolution of this predicament is in the development of

rituals, such as the ones dealing with social minority groups or the practices of sacralizing or tabooing certain phenomena of trash (like human excrements). In this context, it would also be interesting to examine to which extent our routine practices of cleaning and getting rid of refuse are rituals, and to see how such rituals have strengthened our belief that we are keeping trash under control. Of course, ritualization cannot be a definitive solution to the problem of the accumulation of trash, but

> these rituals compel us to acknowledge that we create refuse; concurrently, they allow us to ignore this fact. Thus, trash becomes a part of culture, but continues to be an ephemeral part of culture […] The ritualization of trash disposal will work until another externality makes this course of action no longer possible. People then make trash an integral part of their culture. To do so they have to refer to the higher frame of reference (Adams 1994: 66).

According to Adams, the solution of the problem of trash is a semiotic one. To cope with trash, a new sign has to be created and promulgated. This is an effort requiring expenditure of large amounts of time, energy, and money. Since people are always reluctant to change their habits and ways of thinking, they will be even more so if the proposed new ways cost time and energy. This is the key to the problem. From the systems theoretical perspective, culture, like any other living system, is unable to grow or even exist without continuously adapting to its internal and environmental changes, without integrating and translating "noise", and without time and energy.

A semiotic definition of trash

Most theories of trash have appeared as by-products of other theories. Meanwhile, however, the issue requires a definition of its own. Analyses of trash have so far remained incomplete since they have been restricted to only some features of the phenomenon. The definitions are much indebted to the theoretical framework in which they have been developed. Since no comprehensive theory of trash can be discerned as yet, it must suffice to summarize the partial contributions that have been made so far, localize them in a larger semiotic framework, and suggest a few further ideas for a better understanding of the phenomenon.

The models discussed so far do not sufficiently take into consideration how we perceive trash in our daily life. Trash is a cultural univer-

sal. It is due to the fact that cultures, either as homeostatic systems or symbolic structures, need to get rid of the residues that endanger their existence. The kinds of objects discarded are culture specific.[5] Discarding things is a process in the course of which things are physically relocated. By calling something "trash", its semiotic status is changed. The object becomes semiotically "relocated". When discarded, things cease to exist for the members of a culture. They are purposefully forgotten and are believed to have been pushed beyond the "outer edge" of culture. According to Lotman, objects which are considered as belonging to the non-semiotic world from the centre of a culture may, from outside of this culture, appear as belonging to the periphery of the same culture. So, the border of a given culture is determined by the position of the observer (Lotman 1992). Concurrently, whether trash is treated as a part of culture or not depends on who is judging. The garbologists, for example, treat trash as a part of culture. To them, landfills appear as "valuable lodes of information that may [...] produce valuable insights [...] into the nature of our own [society]" (Rathje, Murphy 1993: 4). Quite the same intuition comes to our mind when we run into trash in a naturally wild environment.

It is most appropriate to treat trash as a phenomenon marking the external boundary of culture. As the boundary "belongs to both contiguous semiospheres" (Lotman 1990: 136), it is possible to treat trash as belonging both to culture and to non-culture at the same time. It has also been shown that the boundary of the semiosphere functions as a translation filter: what is beyond has to be "translated" into the "language" of the semiosphere. Anything that crosses that boundary in either direction will be perceived as trash. On the one hand, by calling things "trash", they are (symbolically) excluded from culture, on the other hand, that what lies beyond has in general no positive value in this culture and appears just as "trash". It is interesting to notice that not only symbolically, but also physically, trash tends to be deposited at the periphery of the inhabited territory in uninhabitable areas where it appears as the last boundary post of culture, gradually fusing with nature.

Trash is a phenomenon blurring the boundaries between both culture and nature. For centuries people have expelled their waste into nature, and a considerable amount of it has vanished. This has sup-

[5] Moreover, trash is not simply a cultural universal, but all living organisms need to get rid of the remainders of their metabolism. This aspect, however is not discussed in the present paper.

ported the idea of trash as a phenomenon opposed to culture. However, the problems that our culture faces today in connection with the accumulation of trash, hazardous waste, and the pollution of natural resources are overruling such an attitude. "Ecological knowledge is not sufficient to understand or solve the ecological problems which humans face, since these are consequences of certain deeply semiotic and cultural processes, intertwined with ecological and biological ones" (Kull 1998: 366). Consequently, the semiotic definition of trash as a border phenomenon of culture is a step towards the ecosemiotics,[6] which "seems to be the possibility for facing these most important, and most difficult challenges of the contemporary world" (Kull 1998: 366).

Conclusions

From the point of view of cultural theory, approaches to the study of trash derive from two major theoretical traditions, structural anthropology and dynamical systems theory. In the structural anthropological perspective, trash appears as a category of things which threaten the culture and are therefore tabooed, but also the positive aspects of trash have been recognized in this framework, in particular its role as a source of cultural innovation. From the perspective of dynamical systems theory, it has been argued that trash is a phenomenon of the dynamics of culture. Treating trash in terms of entropy Artigiani has argued that the development and existence of a social system depends on its ability to get rid of its waste material as well as on its ability of incorporating it. The definition of trash in the framework of Lotman's theory of the semiosphere takes both structural and dynamical aspects of trash into consideration. Trash in this context can be defined as a phenomenon marking the boundary between culture and non-culture (nature). Such a definition of trash opens an ecosemiotic perspective. It may be a step towards a practical solution of the environmental problems connected with trash and pollution.

[6] The field and subject of ecosemiotics have been discussed in Nöth 1998, Kull 1998, Nöth and Kull 2000.

References

Adams, Walter Randolph 1994. Sifting through the trash. *The American Journal of Semiotics* 11(1/2): 63–87.

Afable, Andy 1994. The cost of scavenging — A cautionary ethnographic tale. *American Journal of Semiotics* 11(1/2): 89–96.

Anderson, Myrdene 1994. Trashing and hoarding in words, deeds, and memory: A sampler from the Fourth World Saami. *American Journal of Semiotics* 11(1/2): 277–289.

Artigiani, Robert 1994. Send me your refuse: The U.S. Constitution as trash collector. *American Journal of Semiotics* 11(1/2): 249–276.

Bock, Herbert; Zafirov, Boge 1992. Der sprachliche Umgang mit Müll und Abfall: Eine zeichenbezogene Untersuchung von Presseberichten. *Zeitschrift für Semiotik* 14(3): 271–286.

Bogumil, Mary L. 1994. Voice, dialogue, and community: In search of the 'Other' in African American texts. *American Journal of Semiotics* 11(1/2): 181–196.

Dickson, Keith M. 1994. Ritual semiosis — Mumbojumbo: Magic, language, semiotic dirt. *American Journal of Semiotics* 11(1/2): 151–172.

Douglas, Mary 1984. *Purity and Danger: An Analysis of the Concepts of Pollution and Taboo*. London: ARK Paperbacks.

Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–369.

Leach, Edmund 1966. Anthropological aspects of language: Animal categories and verbal abuse. In: Lenneberg, Eric H. (ed.), *New Directions in the Study of Language* Cambridge, Mass.: The M.I.T. Press, 23–63.

Lévi-Strauss, Claude 1963. *Structural Anthropology*. New York: Basic Books.

Lotman, Yuri M. 1990. *Universe of the Mind: A Semiotic Theory of Culture*. London: Tauris.

— 1992. O semiosfere. In: Lotman, Y., *Izbrannye stati: Stati po semiotike i tipologii kultury,* vol. 1. Tallinn: Aleksandra, 11–24.

Nöth, Winfried 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–343.

Nöth, Winfried; Kull, Kalevi 2000. Discovering ecosemiotics. *Sign Systems Studies* 28: 421–424.

Passariello, Phyllis 1994. Sacred waste: Human body parts as universal sacraments. *American Journal of Semiotics* 11(1/2): 109–127.

Posner, Roland 2000. Semiotic pollution: Deliberations towards an ecology of signs. *Sign Systems Studies* 28: 290–308.

Rathje, William; Murphy, Cullen 1993. *Rubbish! The Archaeology of Garbage*. New York: Harper Perennial.

Schofield, Mary Ann 1994. 'Rubble women': The clean-up crew of World War II. *American Journal of Semiotics* 11(1/2): 129–149.

Sotirin, Patricia J.; Miller, David J. 1994. Pink-collar trash: A critical semiotic analysis of the secretarial position. *American Journal of Semiotics* 11(1/2): 215–235.

О семиотической дефиниции мусора

В литературе по теории культуры редко рассматривается такое явление как “мусор”. В структуральной антропологии подчеркивается связь мусора и табу, мимоходом говорится и о роли мусора в динамике культуры. В данной статье дается обзор имеющихся культурологических взглядов на мусор в контексте семиотики. Исходя из теоретических положений Ю.Лотмана предлагется возможность рассматривать мусор как явление, маркирующее границу между культурой и некультурой. На фоне усугубляющегося экологического кризиса (одним аспектом которого является и аккумуляция мусора) существенной оказывается возможность показать сквозь призму семиотики, что проблема заключается не в природе, а в нашем сознании/культуре.

Prügi semiootilisest defineerimisest

Kultuuriteoreetilises kirjanduses on harva põhjalikumalt käsitletud sellist nähtust nagu prügi. Strukturaalantropoloogias on välja toodud prügi sarnasus tabuga. Põgusalt on juttu olnud ka prügi rollist kultuuri dünaamikas. Käesolevas artiklis antakse ülevaade olemasolevatest kultuuriteoreetilistest lähenemistest prügile semiootika kontekstis. J. Lotmani teoreetilistest seisukohtadest lähtuvalt pakutakse välja võimalus käsitleda prügi kultuuri ja mittekultuuri/looduse piiri markeeriva nähtusena. Süveneva ökoloogilise kriisi taustal (mille üheks aspektiks on ka prügi akumuleerumine) osutub oluliseks võimalus semiootilise lähenemise kaudu näidata, et probleem ei peitu mitte looduses vaid meie teadvuses/kultuuris.

Mimicry: Towards a semiotic understanding of nature

Timo Maran
Department of Semiotics, University of Tartu,
Tiigi 78, 50410 Tartu, Estonia
e-mail: timo_m@ut.ee

Abstract. Mimicry has been an important topic for biology since the rise of the Darwinian theory of evolution. However, by its very nature mimicry is a sign process and the quest for understanding mimicry in biology has intrinsically always been a semiotic quest. In this paper various theories since Henry W. Bates will be examined to show how the concept of mimicry has been shifted from perceptual resemblance to a particular communicative structure. A concept of mimicry will then be formulated which emphasizes its dynamic properties, and finally, mimicry will be considered in the framework of ecosemiotics.

In 1861, after returning from his eleventh year of study in the Amazon valley, the British entomologist Henry William Bates was the first to discuss the phenomenon of mimicry in a paper addressed to the Linnean Society (Bates 1862). Bates observed that certain similarities between the butterfly species of the two different families of the *Heliconidae* and the *Pieridae* might be due to a coevolution of palatable and unpalatable species under variation and natural selection. As a perfect example for the Darwinian theory of evolution, this hypothesis became well-known, and the phenomenon of mimicry has been a "hot topic" in biology ever since.[1]

[1] Bates's paper was published three years after Darwin's *Origin of Species*, i.e., in the middle of the heated debate about the theory of natural selection. Later, in *The Descent of Man, and Selection in Relation to Sex*, Darwin adopted Bates's hypotheses

Bates's hypothesis was soon checked and further elaborated by naturalists such as Wallace (1870) and Müller (1878), who were both in correspondence with Charles Darwin. Further pioneers in the study of mimicry are Peckham (1889), Poulton (1890) and Shelford (1902, 1912). Important later studies include Heikertinger's (1933, 1954) critique of the Darwinian account of mimicry and the studies of mimicry and camouflage in the frame of ethology (e.g., Blest 1957; Ruiter 1952, 1958; Tinbergen 1960). Other highly relevant contributions to the topic are the evolutional studies by Browers and their school (e.g., Brower 1960; Brower & Brower 1962, 1964; Brower ed. 1988). The communicational aspects of mimicry were further emphasized in the studies by Wickler (1965, 1968), Vane-Wright (1976, 1980), Pasteur (1982), and Howse & Allen (1994). During the last decades, the theory of mimicry has been extended in several directions. Among the more recent topics are: polymorphism of mimicries (Mallet & Gilbert 1995; Winhard 1996; Joron & Mallet 1998), influences of predator behavior (Bowers et al. 1985; Turner & Speed 1996; Uesugi 1996), community structure (Burd 1994) and mimicry in plants (Wiens 1978; Johnson 1994; Roy & Widmer 1999). According to estimates by Wickler (1968: 13) more than three decades ago, the number of papers arguing for or against the concept of mimicry was about 1,500. Today, this number probably exceeds 2,000.[2]

In several papers, Sebeok has argued that biological mimicry should quite naturally belong to the field of semiotics (Sebeok 1979: 116; 1986: 77; 1990: 96–97). Meanwhile, a note about mimicry can be found in all major semiotic textbooks (Ford 1989: 552–553; Nöth 1990: 163; 2000: 269). The topic is mostly discussed as an example of iconicity in animal communication.

This paper develops the argument that mimicry by its very nature is a sign process and that the quest for understanding mimicry in biology has always been a semiotic quest, even if no explicitly semiotic terminology was used. Various theories since Bates will be examined to show how the concept of mimicry has been shifted from perceptual resemblance to a particular communicative function. An outline of

---

in his own argumentation (Darwin 1874: 278–280). Because of the intellectual atmosphere of the time, mimicry was hereafter mostly described in the frame of Darwinian theory, and for decades it became almost conventional to quote to Darwin in any paper on mimicry.

[2] My estimation does not include papers concerning molecular mimicry (cf. Damian 1963). There has been a considerable increase in the study of imitations between viruses and macromolecular tissue structures.

mimicry will then be given which emphasizes its dynamic properties, and finally, mimicry will be considered in the framework of ecosemiotics.[3]

Mimicry as imitative resemblance

Similarities between different objects in the natural world have inspired humans throughout the history of culture. Guthrie interprets the principle of cognitive analogy as one of the main causes of animistic religions and as the root of anthropomorphic descriptions of nature in general (1993: 43–47). The Middle Ages and Renaissance were highly inspired by the phenomenon of analogies between nature and culture. Nöth (1998: 335), e.g., describes the Renaissance doctrine of signatures which postulated that the world was perfused with significant homologies between various domains of nature, such as minerals, plants, or the lines of the human body. According to Paracelsius, such iconic signs of natural similarity in nature were believed to be *indexical* traces of divine sign emitters (*signatores*). For iconicity in early ethnic art, see Voigt (1986).

Bates and other 19th century naturalists focussed on the immediately visible similarities between organisms of different descendent. According to Bates's definition, the basis of mimicry is visible "resemblance in external appearance, shapes and colors between members of widely distinct families" (Bates 1862: 502). Other definitions of mimicry are based on visual criteria, such as "imitative resemblance", "deceptive resemblance", "mimetic resemblance", or "mimetic analogy" (Bates 1862). Similar notions have been used by Wickler, who emphasized that the term "pattern", or more specifically, "warning pattern", "camouflage pattern", and "protective pattern" had been commonly used in the description of mimicry. Similarities based on other senses were usually excluded from the study of mimicry (Wickler 1968: 8). Wallace went so far as to claim that mimicry according to Bates was restricted to forms of resemblance between animals (cf. Pasteur 1982: 171).

However, in several early field studies (Atkinson 1888; Shelford 1902) the concept of mimicry was first based on the naturalists' experience of surprising analogies between animals in their natural envi-

[3] For preliminary notes concerning the classification of mimicry and further semiotic aspects of mimicry, see Maran (1999).

ronment, and these early concepts of mimicry were attempts at giving causal explanations of these similarities.[4] As a comment to Bates's discovery, Darwin wrote: "It had previously been observed that certain butterflies in S. America belonging to quite distinct families, resembled the *Heliconidae* so closely in every stripe and shade of colour, that they could not be distinguished save by experienced entomologist" (1874: 278).

The definition of mimicry on the basis of the criterion of perceptual similarity has been adopted in standard textbooks of biology. According to *The Oxford Companion to Animal Behavior*, e.g., mimicry is "the resemblance of one animal (the *mimic*) to another animal (the *model*) such, that the two animals are confused" (Malcolm 1987: 387). However this definition leads to empirical problems because it fails to specify the role of the perceiver as the agent in natural selection.[5] Can the similarities perceived by human minds serve as the empirical basis to determine mimicry? Must not also discrimination errors of predators be taken into account? Furthermore, the resemblance between different biological organisms may have other reasons. Even when we eliminate similarities attributed to the organisms only by human observers, still other evolutionary causes of resemblance between different species must be taken into consideration: evolutionary convergence, physio-morphological or the so-called orthogenetic limitations (cf. Eimer 1897), and even actual phylogenetic proximity.[6] It is rather

[4] Among the naturalists who did not account for mimicry in terms of causality was Francé (1908), who defended the extreme position that most forms of resemblance in nature, however functionless they may be, constitute mimicry, including, e.g., sea-anemones mimicking plants and spurges (*Euphorbiaceae*) mimicking cacti. Thayer (1909) stated that *all* patterns and colours of all animals which prey or are preyed upon are obliterative under certain circumstances. His example, red flamingos, which are supposedly concealed against a red sunset sky, has became well-known as an example of over-interpretation (Thayer 1909).

[5] In my opinion, one of the reasons for the neglect of the important role of the receiver as the actual agent of selection was a too abstract interpretation of Darwin's theory of natural selection.

[6] However, some serious attempts were made to distinguish mimicry from another forms of similarity. Wallace provided five criteria to define mimicry: (1) the imitative species lives in the same area and shares its environment with the imitated; (2) the imitators are always less defended than those who are imitated; (3) the imitators are always less numerous in groups; (4) the imitators differ from the bulk of their allies; (5) the imitation, however minute, is always external and only visual, never extending to internal characteristics or to features that do not affect the external appearance (cf. Poulton 1890). One can notice that none of these criteria are based on actual communicative relationships between imitators and perceivers of the resemblance. Wickler (1968: 46–48) has shown that there are still other cases of mimicry.

questionable to assume mimicry between closely related species, as Gingerich (1975), e.g., does when he considers the aardwolf *Proteles* as a mimic whose model is supposed to be the striped hyena *Hyaena hyena*. Even resemblances between evolutionarily quite distinct species may have not have their cause in mimicry, but in convergence, i.e., in an evolution under similar environmental conditions. For instance, morphological similarities between the eels *Anguillidae* and the sea snakes *Hydrophiidae* have most probably been developed because of evolutionary convergence.

Mimicry as threefold communication

Although there have been descriptions of the reactions of predators in face of their prey animals, including aposematic prey and mimics, since the end of 19th century (Poulton 1887; Finn 1897), a thorough analysis of the perceiver's role in deceptive resemblance only began with studies in the framework of ethology. The long break in the continuity of research was partly due to the progress of Mendelian genetics and the recession of the classical Darwinism (Bowler 1983: 214). Since the 1920's, the interest in the study of protective adaptation including animal coloration and mimicry decreased rapidly.[7]

In the late 1930's and 1940's, the Lorenz-Tinbergen school of ethology created new research interest in the field. Comparative research in animal behaviour brought new insights into mimicry because of its studies in the learning abilities and search behaviour of predators. The concept of the *searching image* popularized by Tinbergen (1960), which accounted for the properties remembered by the predator in his search for the prey became especially useful. Although this concept is usually attributed to Tinbergen, it was actually first proposed by Jakob von Uexküll (cf. 1957: 62–64).[8]

The first who systematically included the perceiver in his account of protective resemblance was Wickler (1965: 519), who introduced the concept of *signal receiver* and distinguished different types of perceivers. At the time, it became clear that mimicry is not always exclu-

[7] A reason for the diminished interest in mimicry may also be doubts expressed as to its adaptational value. As a result of his study of 237,399 prey identifications from 80,000 bird stomachs of more than 300 bird species, L. McAtee stated that there is no correlation whatsoever between protective resemblance and occurrence of the species in the predators diet (Malcolm 1990: 57).

[8] For the influence of Uexküll's works on ethology see Brier (2001).

sively directed against possible predators. Instead, there is a wide variety of different mimicry functions, in particular, aggressive, reproductive, intraspecific, i.e., social mimicry (*ibid.*; see also Pasteur 1982).[9] Wickler developed the theory of the mimicry system as a triadic structure of three participants in co-evolution: the *mimic*, the imitating organism or constructed agent, the *model*, the (animate or inanimate) entity being imitated, and the *signal receiver* or *operator*, the organism that fails to discriminate between model and mimic.[10] Despite certain similarities with semiotic concepts, Wickler made no reference to semiotics and probably derived his terminology from the behaviourist tradition of ethology.[11] Another renewal adapted by Wickler, was the use of "*mimicry system*" instead of "mimicry", indicating so the complex nature of the phenomena:

> One condition of mimicry is the existence of two different signal transmitters, S_1 and S_2, which transmit the same signal and have at least one signal-receiver, E, in common which reacts similarly to both. One signal-transmitter is called the model and the other the mimic, the entire set-up being a mimicry system. (Wickler 1968: 239)[12]

By using plus and minus signs to indicate whether the mimicry situation is advantageous or disadvantageous to the participants, Wickler formalizes mimicry systems and other biological communication structures by means of formulas. For instance, $S_1 + E - + S_2$ describes Bates's protective mimicry: a palatable species S_2 profits as a mimic from a situation in which it is mistaken by the predator for the less palatable one, the model S_1. In similar manner, Müller's protective mimicry, i.e., according to which unpalatable species converge in evolution by sharing more similarities in their warning coloration so that the signal receiver learns specific color patterns more quickly, is transcribed by the formula $S_1 + + E + + S_2$. As one may notice, Müller's mimicry is beneficial to every participant. No agent is deceived and

[9] The conceptual distinction between protective (Batesian) and aggressive mimicry — in which the mimic itself is a predator mimicking object or organism harmless to its prey — was made already by Poulton (1890).

[10] Although one may find some similarities between Wickler's threefold mimicry systems and Morris's three dimensions of semiotics, I would caution against any superficial equation. Even if the positions of the "signal receiver" and the "sign interpreter" are alike, it would not be adequate to match the "sign vehicle" or "designatum" with the "model" and "mimic".

[11] For parallels between Wickler's advantage patterns of mimicry and Odum's six basic types of ecological interaction between species see Vane-Wright (1976: 51) .

[12] Wickler (1965) used *S* instead of *E* to mark the signal to a receiver.

therefore it is usually no longer considered to be mimicry (Wickler 1968; Wiens 1978; Pasteur 1982).

Wickler's triadic concept of mimicry was developed further by Vane-Wright (1976), who used the affiliations of mimicry agents as his basis of classification. The author distinguishes between disjunct, conjunct and bipolar mimicry systems. In a disjunct system, all protagonists belong to the different species, in a conjunct system all three belong to the same species, and in a bipolar system two species are in interaction. Utilizing Wickler's patterns of advantages as a further element of classification, Vane-Wright distinguishes forty types of possible mimicry systems. His model was improved by Pasteur (1982) who classifies different mimicry systems in case studies. Pasteur distinguishes 18 types of mimicry, 2 types of mimesis, as well as the cases of eucrypsis (homocromy) and nondeceitful homotypy.

In a much debated paper, Vane-Wright (1980) characterizes mimicry systems further by differentiating between mimicry and crypsis on the basis of the signal receiver's experience.[13] According to his definition, whenever the mimic resembles an organism that belongs to a general "cognitive model" of the signal receiver, there is mimicry (*ibid*.: 2–3). In crypsis, by contrast, the animal tries to avoid producing signals that might be detected by the signal receiver. Hence, Vane-Wright define crypsis as a "nonsignal" and place it between the actual communication of signals and situations in which animals avoid producing any signal at all, e.g., by trying hide.

The difference between mimicry and crypsis becomes even clearer when we consider Uexküll's concept of Umwelt. When the model of resemblance plays an important part in the receiver's Umwelt, there is mimicry, but when the mimic tries to dislocate its perceivable properties to a world outside of the receiver's Umwelt by resembling some object that does not belong to this receiver's Umwelt, thus making its message meaningless to the signal receiver, there is crypsis (Maran 2000: 57–59).

With the signal receiver as the third participant in mimicry, the analysis of mimicry emphasizes its systemic properties. The diversity of mimicry gives empirical evidence that features of mimicry develop from all three participants and their specific interplay. Hence, the triadic model of mimicry is a good theoretical basis for observing mimicry signals not directly accessible to human perception. Pasteur has criticized research in mimicry for focussing too much on visual sys-

[13] For further discussions, see Robinson (1981) and Cloudsley-Thompson (1981).

tems and for showing too little interest in signals that remain invisible to humans (1982: 173–175). Nevertheless, there have been studies of extensions of mimicry beyond the visual in recent years: e.g., chemical mimicry of parasitic ants (Lenoir *et al*. 1997) and of fungi (Roy & Raguso 1997; Raguso & Roy 1998), tactile mimicry of spiders (Jackson & Wilcox 1993), reproductive mimicry of bell-flowers (*Campanula*) by the red helleborine orchid (*Cephalanthera rubra*) invisible to the human eye, but not to the signal receivers, the solitary bees (Nilsson 1983).

Thus, the triadic concept of mimicry implies a kind of Uexküllian approach to nature by raising the threefold question, what resembles what to whom? It gives evidence that there are infinite possibilities of similarity because of the plurality of perceptual worlds of different organisms. The only remaining general criterion of mimicry is the one of similar perceptions in the cognitive world of the signal receivers: "Common to all examples of mimicry [...] is the deception of a signal receiver by the counterfeit signal, that carries a quite specific meaning for the receiver" (Wickler 1968: 241).

The semiotic dynamics of mimicry systems

Mimicry has been found in most of classes of higher animals and plants inhabiting many ecological communities on land, in the air, and the water. All channels of communication, optical, acoustical, chemical, and tactile ones, occur in mimicry systems. Furthermore, signals sent and received by participants differ according to the factor of noise and other distractions in the environment. To explain such high variability among mimicry systems it is not enough to consider mimicry systems only as static situation. They must rather be interpreted as dynamically changing and evolving systems.

The systemic dynamics of the triadic sign-process of mimicry, may be studied with profit according to a cyclical communication model (cf. Nöth 1990: 177, 178). Mimicry is the result of a long sequence of semioses taking place between mimics and models as senders and signal receivers. Feedback mechanisms may be assumed to account for the stability and heterogeneity of the mimicry systems.

Mimicry arises from a signal receiver's permanent cognitive confusion between objects (mimics, models) between which perceptual distinctions must be made. There is a mimicry system when a selec-

tive feedback loop occurs: a compensatory system allows signal receivers, by means of natural reproduction or artificial recreation, create features for future generations. Thus, a mimicry system is not just an individual resemblance, but a continuous and dynamic process of creating similarities via regulation.

According to these premises, semiosis in mimicry systems is a kind of filtering system, filtering signs accordingly to receivers' response. In most semiotic systems operating in situations of cyclical communication, signs correctly recognized by a receiver are passed on to the next generation. The mimicry system is characterized by the reverse situation: mimetic signs not recognized correctly by the receiver are transmitted, recognized signs are inhibited by a semiotic "filter" on the way to their receiver. For the description of this fundamental difference between mimicry and other sign systems, I propose the term "reverse feedback": in normal situations of communicative feedback, the signs may be recognized correctly by the receiver and pass the filter of semiosis, carrying the message on to the next generation. In reverse feedback, signs succeed which are recognized incorrectly by the receiver.

As mimetic signs evolve via exclusion, there should be several possibilities for these signs to evolve in the perception of the sign receivers. Studies of the diversity in biological mimicry show that for mimics there are many possibilities not to be recognized (Mallet & Gilbert 1995; Joron & Mallet 1998). Furthermore, at least in some cases, these different possibilities of not being recognized are mutually conditioned, e.g., in satyric mimicry, where mimics combine similar appearance with different escape strategies, thus using unexpected behaviour to escape from the predator (Howse & Allen 1994).

Two opposed feedback cycles are at work in mimicry systems: a reverse feedback cycle that determines the similarity of the mimic to the model and a normal feedback cycle that determines the further effectiveness of the receiver via learning and memory. As similarities of mimics with their models and the receivers' potential to recognize objects will develop simultaneously, mimics and models are always confused by the signal receiver, even if their actual properties change. As shown by computer modelling, the mutual conditioning between the participants of the mimicry system is the source of a great stability (Holmgren & Enquist 1999).

Thus, the factors required for the evolution of a mimicry system are: similarity of objects in the perceptual world of the signal receiver, patterns of advantage and disadvantage, and feedback cycles, i.e., se-

lective reproduction or recreation of participants of the mimicry system. The concurrence of these factors may happen anywhere and under many environmental circumstances, provided there is communication between organisms and a common perceptual world. Once that common structure of a mimicry system has developed, the system is able maintain itself through random changes of surrounding structures and contexts (e.g., influences of noise and channel properties).

Furthermore, if it is in the receiver's interest to distinguish between mimics and models, the signal receiver should also develop better cognitive and semiotic capabilities to recognize these deceptive resemblances. Thus, mimicry systems in the bio-semiosphere may also be seen as sources of the development of potential, vortex-like structures which are able to maintain themselves and transform the biological potential of developing into a semiotic one.

Mimicry systems in the ecosemiotic frame

Ecosemiotics, as first defined by Nöth (1996) and further specified by Kull (1998), is the semiotics of relationships between culture and nature. Thus, from the biosemiotic viewpoint ecosemiotics deals with *Umwelt* and *Innenwelt* of one species, *Homo sapiens*. Theoretically mimicry systems as phenomena of biosemiotics may occur in any organism, including humans. Potentially, humans can fulfil any of three roles of the triadic nature of a mimicry system, i.e., being a mimic, a model, or a signal receiver. According to Vane-Wright's theory of mimicry types there might also be *conjunct* mimicry systems in human culture. Humans have developed many deceptive strategies and devices based on imitation. A simple example is the production of inexpensive products by companies (mimic) imitating the production of high quality products (model) in order to deceive the customers (receiver). Another example of a human mimicry system is false money (mimic) imitating real money (model) to deceive traders (receiver).

It is also possible to find mimicry systems which connect humans with the rest of the nature and which have shaped our cultural consciousness and understanding of nature in general. An example of such a mimicry system are secondary crops like rye and flax (mimics) which have developed from weeds by mimicking man's first crop (model), which was wheat (cf. Pasteur 1982: 187). In this mimicry

system, the signal receivers were first Neolithic humans and much later agricultural machines. Another case of ecosemiotic mimicry from prehistorical times is the ancient strategy of humans to get better hunting results by concealing themselves or by mimicking prey-species. Modern methods of concealment as a strategy in military action may be regarded as continuation of this mimicry system.

Contemporary examples of mimicry relations between culture and nature are plastic flowers (mimics) which resemble real ones (models) to ordinary people (signal receivers) or artificial animals invented as mimics of real pets for infants (more recently Tamagotchis, cf. Schmauks 2000).

Although ecosemiotic mimicry systems developed by humans have quite often some cultural connotations and values, making them thus also objects of cultural semiotics, the approach proposed here suggests that they may be a valuable source for further research in the eco- and biosemiotic frames. [14]

References

Atkinson, George F. 1888. New instances of protective resemblance in spiders. *American Naturalist* 22: 545–546.

Bates, Henry Walter 1862. Contributions to the insect fauna of the Amazon valley: *Lepidoptera: Heliconidae*. *Transactions of the Linnean Society* 23: 495–566.

Blest, A. David 1957. The function of eyespot patterns in the *Lepidoptera*. *Behaviour* 11: 209–256.

Bowers, Deane M.; Brown, Irene L.; Wheye, Darryl 1985. Bird predation as a selective agent in a butterfly population. *Evolution* 39(1): 93–103.

Bowler, Peter J. 1983. *The Eclipse of Darwinism: Anti-Darwinian Evolution Theories in the Decades around 1900*. Baltimore: The John Hopkins University Press.

Brier, Søren 2001. Cybersemiotics and *Umweltlehre*. *Semiotica* 134(1/4).

Brower, Jane van Zandt 1960. Experimental studies of mimicry IV: The reactions of Starlings to different proportions of models and mimics. *American Naturalist* 94: 271–282.

Brower, Jane van Zandt; Brower, Lincoln Pierson 1962. Experimental studies of mimicry 6: The reaction of toads (*Bufo terrestris*) to honeybees (*Apis mel-*

[14] For contributions to this paper in personal discussions or correspondence I am grateful to K. Lagerspetz, V. Mikita, W. Nöth, I. Pilt, I. Puura, P. Torop, and A. Turovski. I express my especial gratitude to Kalevi Kull for his long-lasting guidance to the depths of biology and biosemiotics.

lifera) and their dronefly mimics (*Eristalis vinetorum*). *American Naturalist* 96: 297–307.
Brower, Lincoln Pierson; Brower, Jane van Zandt 1964. Birds, butterflies and plant poisons: A study in ecological chemistry. *Zoologica* 49: 137–159.
Brower, Lincoln Pierson (ed.) 1988. *Mimicry and the Evolutionary Process*. Chicago: University of Chicago Press.
Burd, Martin 1994. Butterfly wing colour patterns and flying heights in the seasonally wet forest of Barro Colorado Island, Panama. *Journal of Tropical Ecology* 10(4): 601–610.
Cloudsley-Thompson, J. L. 1981. Comments on the nature of deception. *Biological Journal of the Linnean Society* 16: 11–14.
Damian, Raimond T. 1963. Molecular mimicry: Antigen sharing by parasite and its host and its consequences. *American Naturalist* 98: 129–149.
Darwin, Charles 1859. *On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle of Life.* London: John Murray.
— 1874. *The Descent of Man, and Selection in Relation to Sex* [2nd ed.]. London: John Murray (1st ed. 1871).
Eimer, Theodor G. 1897. *Orthogenesis der Schmetterlinge*. Leipzig: Engelmann.
Finn, Frank 1897. Contributions to the theory of warning colorations and mimicry. No III. Experiments with a Tupaia and a Frog. *Journal of the Asiatic Society of Bengal* 66: 528–533.
Ford, Edmund Brisco 1989. Mimicry. In: Sebeok, T.A. (ed.), *Encyclopedic Dictionary of Semiotics*, Berlin: Mouton de Gruyter, 552–553.
Francé, Raoul Heinrich 1908. *Das Leben der Pflanze*. Stuttgart: Kosmos.
Gingerich, Philip Derstine 1975. Is the aardwolf a mimic of the hyaena? *Nature* 153(5488): 191–192.
Guthrie, Steward Elliott 1993. *Faces in the Clouds: A New Theory of Religion*. New York: Oxford University Press.
Heikertinger, Franz 1933. Kritisches zum Mimikryproblem: Über Schmetterlingsmimikry. In: *5th International Congress of Entomology.* Paris, 119–130.
— 1954. *Das Rätsel der Mimicry und seine Lösung*. Jena: Gustav Fisher Verlag.
Holmgren, Noél. N. M.; Enquist, Magnus 1999. Dynamics of mimicry evolution. *Biological Journal of the Linnean Society* 66(2): 145.
Howse, P. E.; Allen, John A. 1994. Satyric mimicry: The evolution of apparent imperfection. *Proceedings of Royal Society London B*, 111–114.
Jackson, Robert R.; Wilcox, Stimson R. 1993. Spider flexibly chooses aggressive mimicry signals for different prey by trial and error. *Behaviour* 127(1–2): 21–36.
Johnson, S. D. 1994. Evidence for Batesian mimicry in a butterfly-pollinated orchid. *Biological Journal of the Linnean Society* 53: 91–104.
Joron, Mathieu; Mallet, James L. B. 1998. Diversity in mimicry: Paradox or paradigm? *Trends in Ecology and Evolution* 13(11): 461–466.
Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26: 344–371.

Lenoir, A.; Malosse, C.; Yamaoka, R. 1997. Chemical mimicry between parasitic ants of the genus *Formicoxenus* and their host *Myrmica* (*Hymenoptera*, *Formicidae*). *Biochemical Systematics and Ecology* 25: 379–389.

Malcolm, Edmunds 1987. Mimicry. In: *The Oxford Companion to Animal Behaviour*. Oxford: Oxford University Press, 387–389.

Malcolm, Stephen B. 1990. Mimicry: Status of a classical evolutional paradigm. *Trends in Ecology and Evolution* 5(2): 57–62.

Mallet, James; Gilbert, Lawrence E. Jr. 1995. Why are there so many mimicry rings? Correlation between habitat, behavior and mimicry in *Heliconus* butterflies. *Biological Journal of the Linnean Society* 55: 159–180.

Maran, Timo 1999. A note on the semiotics of biological mimicry. *Sign Systems Studies* 27: 139–146.

— 2000. *Bioloogiliste mimikrinähtuste semiootika.* [Semiotics of biological mimicry] MA thesis. Tartu: Tartu University, Department of Semiotics.

Morell, Virginia 1996. Staring species with third parties and sex wars. *Science* 273(5281): 1499–1503.

Müller, Fritz von 1878. Über die Vortheile der Mimikri bei Schmetterlingen. *Zoologischer Anzeiger* 1: 54–55.

Nilsson, Anders L. 1983. Mimesis of bellflower (*Campanula*) by the red helleborine orchid *Cephalanthera rubra*. *Nature* 305(5937): 799–800.

Nöth, Winfried 1990. *Handbook of Semiotics.* Bloomington: Indiana University Press.

— 1996. Ökosemiotik. *Zeitschrift für Semiotik* 18(1): 7–18.

— 1998. Ecosemiotics. *Sign Systems Studies* 26: 332–343.

— 2000. *Handbuch der Semiotik*. 2. Aufl. Stuttgart: Metzler.

Pasteur, George 1982. A classificatory review of mimicry systems. *Annual Review of Ecological Systems* 13: 169–99.

Peckham, E. G. 1889. Protective resemblances of spiders. *Occasional Papers of the Natural History Society of Wisconsin* 1: 61–113.

Poulton, Edward B. 1887. The experimental proof of the protective value of color and markings in insects in reference to their vertebrate enemies. *Proceedings of the Zoological Society of London* 16: 191–274.

— 1890. *The Colours of Animals, Their Meaning and Use*. New York: Appleton.

Raguso, Robert A.; Roy, Barbara A. 1998. 'Floral' scent production by *Puccinia* rust fungi that mimic flowers. *Molecular Ecology* 7(9): 1127.

Robinson, Michael H. 1981. A stick is a stick and not worth eating: On the definition of mimicry. *Biological Journal of the Linnean Society* 16: 15–20.

Roy, Barbara A.; Raguso, Robert A. 1997. Olfactory versus visual cues in a floral mimicry system. *Oecologia* 109(3): 414–426.

Roy, Barbara A.; Widmer, Alex 1999. Floral mimicry: A fascinating yet poorly understood phenomenon. *Trends in Ecology and Evolution* 4(8): 325–330.

Ruiter, Leendert de 1952. Some experiments on the camouflage of stick-caterpillars. *Behaviour*, 4: 222–232.

— 1958. Some remarks on problems of the ecology and evolution of mimicry. *Archives Neerlandaises de Zoologie* 13: 351–68.

Schmauks, Dagmar 2000. Teddy bears, Tamagotchis, transgenic mise: A semiotic typology of artificial animals. *Sign Systems Studies* 28: 309–325.

Sebeok, Thomas A. 1979. *The Sign and its Masters*. Lanham: University Press of America.
— 1986 "Talking" with animals: Zoosemiotics explained. In: Deely, J.; Williams, B.; Kruse, F.E. (eds.), *Frontiers in Semiotics*. Bloomington: Indiana Univ. Press, 76–82.
— 1990. *Essays in Zoosemiotics*. Toronto: University of Toronto.
Shelford, R. 1902. Observations on some mimetic insects and spiders from Borneo and Singapore. *Proceedings of Zoological Society.* London, 240–274.
— 1912. Mimicry amongst the *Blattidae*; with a revision of the genus *Prosoplecta* Sauss. and the description of a new genus. *Proceedings of Zoological Society, London*, 358–376.
Thayer, Gerald H. 1909. *Concealing-coloration in the Animal Kingdom: An Exposition of the Laws of Disguise through Color and Pattern.* New York: Macmillan.
Tinbergen, Niko 1960. The natural control of insects in pine woods. *Archives Neerlandaises de Zoologie* 13: 265–343.
Turner, John R. G.; Speed, M. P. 1996. Learning and memory in mimicry. 1. Simulations of laboratory experiments. *Philosophical Transactions of the Royal Society of London — Series B: Biological Sciences* 351(1134): 1157–1170.
Uesugi, K. 1996. The adaptive significance of Batesian mimicry in the swallowtail butterfly, *Papilio polytes* (*Insecta, Papilionidae*): Associative learning in a predator. *Ethology* 102(9): 762–775.
Uexküll, Jakob von 1957. A scroll through the world of animals and men: A picture book of invisible worlds. In: Schiller, Claire H. (ed.), *Instinctive behavior: The development of a modern concept*. New York: International Universities Press, 5–80.
Vane-Wright, Richard I. 1976. A unified classification of mimetic resemblances. *Biological Journal of the Linnean Society* 8: 25–56.
— 1980. On the definition of mimicry. *Biological Journal of the Linnean Society* 13: 1–6.
Voigt, Vilmos 1986. Early forms of iconicity in ethnic and folk art. In: Bouissac, P.; Herzfeld, M.; Posner, R. (eds.), *Iconicity: Essays on the Nature of Culture*. Tübingen: Stauffenburg, 385–408.
Wallace, Alfred Russel 1870. *Mimicry, and other protective resemblance among animals.* In: Alfred Russel Wallace. *Contributions to the Theory of Natural Selections: A Series of Essays.* London: Macmillan, 45–129.
Wickler, Wolfgang 1965. Mimicry and the evolution of animal communication. *Nature* 208: 519–21.
— 1968. *Mimicry in plants and animals.* Trans. R. D. Martin. London: George Weidenfeld & Nicolson.
Wiens, Derbert 1978. Mimicry in plants. *Evolutionary Biology* 11: 364–403.
Winhard W. 1996. Convergent development of color patterns in butterflies: Field studies in Asia, Africa and South America. *Spixiana Supplement* 0(21): 1–192.

Мимикрия: к семиотическому пониманию природы

Мимикрия оставалась в центре внимания биологии начиная с возникновения теории эволюции Дарвина. Но по своему характеру мимикрия является знаковым процессом, а поэтому и стремление биологии понять явления мимикрии отличалось имплицитной семиотичностью. В данной статье рассматриваются различные теории, начиная с работ Генри У. Бейтса, для демонстрации того, как первичное понимание мимикрии в качестве воспринимаемых подобий развилось в теорию о мимикрии как структурах коммуникации. Очерчивают концепцию мимикрии, которая подчеркивает динамические свойства этого явления и прослеживают явления мимикрии в рамках экосемиотической парадигмы.

Mimikri: looduse semiootilise mõistmise poole

Mimikri on olnud bioloogia tähelepanukeskmes alates Darwini evolutsiooniteooria tekkest. Ent oma loomult on mimikri siiski märgiprotsess ja nii on ka bioloogia püüd mõista mimikrinähtusi olnud varjatult semiootiline. Käesolevas artiklis vaadeldakse erinevaid teooriaid alates Henry W. Bates'i töödest näitamaks, kuidas algne arusaam mimikrist kui tajutavatest sarnasustest on arenenud teooriaks mimikrist kui kommunikatsiooni struktuuridest. Seejärel esitatakse mimikrikontseptsioon, mis rõhutab nähtuse dünaamilisi omadusi ning viimaks vaadeldakse mimikrinähtusi ökosemiootika paradigma raames.

Methodologies and problems in zoomusicology

Dario Martinelli
Department of Musicology, University of Helsinki
Vironkatu 1, 00014 Helsinki, Finland
e-mail: dario.martinelli@helsinki.fi

Abstract. The article sketches an introductory outline of zoomusicology as a discipline closely related to zoosemiotics, focusing on the existing results and formulating few further problems. The analysis addresses the limitations and potentials of zoomusicological research, problematic topics, a basic framework of possible methodologies, and an attempt to situate the discipline in relation to other fields, ethnomusicology in particular.

The role of zoomusicology

Zoomusicology is a very young discipline. If the first appearance of the word *ornithomusicology* is dated 1963, thanks to Peter Szöke, *zoomusicology* is a much younger term, coined in F. B. Mâche's *Music, Myth, Nature* in 1992. It seems clear that most approaches to the discipline, and to others concerning animals, show strong signs of anthropocentrism. If science aspires to impartiality and exactitude, then these fields of science should try to avoid such a tendency. More properly, any study concerning animals should lean toward "biocentrism".

This does not mean that humans should turn into salmon. When geocentric theories were replaced by heliocentrism, scholars did not move from the earth to the sun in order to observe the motion of our planet. They just considered it as a part of something much bigger, stressing the similiarites earth shared with other planets, and seeing causes, effects, side effects and so on. The same should be done in the

study of the animal kingdom: the point is no longer to consider humans as an autonomous category, but as a "planet" in the natural system. This does not mean restricting humans to an improper and uncomfortable cage. It is simply that every human characteristic should be considered as result of a wider process. In zoomusicology, nobody would ever say that electric guitars are played also by frogs, or that penguins buy CDs. But if we consider the biological dimension of what we call music, taking account of causes (anatomy, physiology, psychology, ethology, etc.), effects (timbres, intervals, form, organisation of the sounds, etc.) and side effects (rituals, movements, exchange of information, etc.), then the work becomes realistic and useful. Any interesting step forward in the study of animals can be done only through such a mentality, i.e., by turning from an anthropocentric outlook to a biocentric one. This implies the following.

(1) Nature is divided into levels that are organised as follows. Beyond a general common basis, here called *ecological*, whose constraints — such as being subject to gravity — are shared by everything on Earth, we have a second, *biological* level, in which every living being is included. Eating and reproducing, for instance, typify humans and birds, insects and flowers, and so on. Things become more interesting on the third level, called the *zoological* or the *transpecific*, which concerns aspects held in common within the whole animal kingdom. At this point, more than one human conception should be revised. It has been shown, for instance, that culture is not an exclusively human peculiarity. It is just a matter of complexity. In turn, complexity is a relative concept, since it should be proportioned to the respective needs of each species, what Uexküll called Umwelt. Fourthly, we come to the level of characteristics that concern a single species (*species specific*). Activities such as making a presentation with the use of transparencies must be considered exclusively human skills, just as giving the exact position of a flower by a figure-eight dance is a skill specific to bees. From the next level on, the course is quite clear for humans, but is yet to be well defined for other species. This is because the categories are now species-specific, and each species has developed a unique process. For most animals, including humans, this level is mainly social, but many species are not organised into societies at all. And so we should stop here.

(2) In this research, the transpecific level must be considered the first meaningful category. Zoomusicology is concerned with all those musical features that are not exclusive to humans, but are shared with at least some other species, specifically, among those provided with

vocal apparatuses. It can be said that, as a zoological phenomenon, music can no longer be analysed from an anthropocentric point of view, just decades ago ethnomusicologists said that, as an anthropological phenomenon, music should not be analysed from a Eurocentric point of view.

(3) The species-specific level is so capacious that nobody should take this kind of research as being too zoomorphic. *Homo sapiens* retans its incredibly large number of exclusive aspects. The problem here is to arrange categories in the right position and proportions, and to create a more appropriate "cosmology".

(4) As Nils Wallin (1991) and other biomusicologists maintain, the study of music in its biological dimension can be very useful for the comprehension of its real essence and development.

First problematic topic: Aesthetics

To define zoomusicology in a few words, we can say that this discipline studies the "aesthetic use of sounds among animals". This definition would have the following consequences: (1) we would avoid the use of that really dangerous word, "music"; (2) we would include another dangerous word, "aesthetic", a concept that non-experts would hardly extend to non-human animals; (3) by simply saying "animals", and not "non-human" ones, we would leave open the possibility of including those not made

The preference for the word "aesthetic", at this very generic stage, is motivated by the fact that this expression represents a methodological presupposition, whereas the expression "music" constitutes the real theoretical goal. In fact, whereas ethology, especially recently, tends to acknowledge the existence of an aesthetic sense in animals, concepts like musicality and musical culture still have too strong an anthropological connotation to be applied to the rest of the animal kingdom as well. Space does not permit a philosophical discussion of the essence of aesthetics and its evolution through the centuries. But five main aspects can be pointed out.

(1) We agree with Charles Hartshorne (1973: ch. 2) that, at a very biological level, aesthetic does not stand for something merely utilitarian. This does not mean that an aesthetic act is totally useless — too many people say that without music they couldn't survive! Rather, it means that the "biological effects" cannot be seen immediately, as

happens, for instance, with coupling. This notion of aesthetics may be rather incomplete, but it points out a fundamental presupposition: aesthetics is what makes the difference between a "sentence" and a "verse", or between "speaking" and "singing", and so on. At the same time, such a concept collides with the general non expert opinion that only humans are able to do non utilitarian things. Fortunately, however, since the times of Darwin and especially in the latest decades, many studies on animal behaviour have proved that this is not true.

(2) The word "aesthetic" has a clear connection with a certain sense of "beauty", a sensation that gives the individual who feels it a particular pleasure, be it emotional, intellectual, or cultural. This matter, too, has received much attention over the centuries, and in a way is similar to the previous point: "beauty" is what makes the difference between two non utilitarian forms of behaviour, such as painting as opposed to turning over the pages of a book.

(3) In semiotic terms, the definition of "aesthetics" provided by Roman Jakobson constitutes the perfection of simplicity: to Jakobson, language has an aesthetic function when it is more concerned with signifiers rather than with signifieds. As zoosemiotician Felice Cimatti (1998: 99) puts it: "The signified does not have an explicit function, and the organisation of the signifier is led by processes and rules intentionally 'blind', i.e., they have no aim but to match the various parts of the message".

(4) As Aristotle pointed out about tragedy (see *Poetics*), aesthetic messages have to be at the same time *parà tèn dóxan* (i.e. unexpected, contrary to common beliefs) and *katà tò eikòs* (i.e., likely, believable). In Eco's (1968) words, aesthetic messages must be ambiguous.

(5) Still, according to Eco (1968), aesthetic ambiguous information may be decoded in consequence of three factors: (a) signifiers acquire signifies only from contextual interaction; (b) the matter of signifiers is not totally arbitrary as regards the signifies (e.g., onomatopoeic words); (c) the message involves many levels of reality (e.g., physical matter of the signifiers, denotation meanings, connotation and so on).

A good illustration of these five concepts is the behaviour of the male *Ptilonorhynchus violaceus* during the preparation of his nest.[1] This bird decorates the outside and inside of the place with colourful flow-

[1] In fact, "nest" is not the right word, because it is not the place where the eggs are laid. The ethological term is "pergola", but the ideal one would be *garçonnière*, since this is where the coupling occurs.

ers, pebbles, twigs, and several human objects (such as bottle caps), and then applies a special paint he has obtained by chewing some berries. As Mainardi reports (1992: 226), the bird chooses carefully the position of the decorations. He can be seen putting a flower atop the nest, taking a couple of steps backwards to assess his work, then deciding that the flower does not look nice in that place and changing its position until he's satisfied. Note that, once a flower withers, the bird replaces it with a new one. As a conclusion, the male invites the female to his nest by holding another flower in his beak, in a very flamenco fashion! The bird displays modes of behaviour that:

(1) are definitely not straightly utilitarian, since the bird could easily adopt more economic strategies of courtship;

(2) reveal certain sense of beauty, and not only in a human criteria, otherwise the bird wouldn't change position to that flower at the top of the pergola;

(3) are much more concerned with signifiers than usually, since a withered flower — functionally speaking — would contribute to the contents (the pergola's construction) in the same way as the newer one;

(4) are unexpected (at least to our eyes, but surely also to the female, since she's said to choose her partner according to how much he's able to impress her) and likely at the same time (the female must recognise the pergola as such);

(5) are decoded according to the above mentioned three factors as pointed out by Eco (1968), e.g., involving many levels of *that* reality.

Theodosius Dobzhansky observes: "It is undeniable that a well-decorated pergola gives the bird a pleasure that can only be defined as aesthetic" (1962: 215). A final remark leads the discussion to the next topic: when the pergolas were first discovered,[2] it was thought that they were dollhouses built by young girls.

Second problematic topic: Etic or emic?

Methodologically, the main problem is how to approach such peculiar musical cultures. How can we be so bold as to use the word "music"? And in what sense? Ethologists have attempted to define the word "song" in terms of structure (for instance, Busnel 1963: Ch. 1), but to

[2] Pergolas were first noticed in the nineteenth century in Australia by the Italian naturalist Ottaviano Beccari.

analyse music in and of itself is a little misleading.[3] As Gino Stefani has demonstrated, the connection between a musical object and an individual person, who is able to think and to feel, cannot be disregarded. The point is not only our disposition, as humans, to consider animal sounds as music, but to see if such a conception exists within the animals group we are observing. In Nattiez's words, an emic approach is preferable to an etic one.[4]

Such an attitude is not easy even when studying a human community. How would this be possible as concerns animals? Everything we say is based on human criteria, which we would be arbitrarily applying to animals, since nobody could ever say if animals really think in the ways we think they do. This is, more or less, the position expressed in Thomas Nagel's famous article, "What is it like to be a bat?" (1974), which emphasises the basic incapacity of an objective and impersonal scientific approach to the description of subjective and private phenomena. Felice Cimatti's *Mente e linguaggio negli animali* aims to clarify this issue:

> I believe that such a distinction is incorrect. Basically because it presupposes a dualism which is exactly what should be demonstrated, i.e. the dualism between mind and body, and between personal and impersonal perspective. I perceive my mind, from the inside, only through external ways: that is the thesis I am defending (as far as I know, the idea comes from Peirce and from the Soviet psychologist Vygotskij). (Cimatti 2000, personal communication)

Such a problem is common to most human sciences. Even with human cultures, and especially with so-called primitive societies, to take an emic approach is not easy. Ethnomusicology is very representative in this sense. Ethnomusicologists find sound structures, correlated behaviours, and emotional experiences that together look more or less like what we call music. Sometimes those cultures have a word (a content-form) that corresponds to our "music"; sometimes not. Some-

---

[3] In ethology, there are some conditions to respect before using that word for an animal vocalisation. It was Broughton who laid down these conditions. By using human indicators, he found in animal sounds three application levels of the term 'song': *sensu latissimo*, *sensu stricto*, and *sensu strictissimo*.

[4] The terms etic and emic come from linguistics: *etic* is borrowed from phonetics (the study of linguistic sounds without regard to their significance within a language), and *emic* comes from phonemics (the study of speech sounds that are meaningful within a language). For more details about ethnomusicological application of these terms, see Nattiez (1977: 92–104) and Nettl 1956. In brief, if we judge a musical element of a different civilisation with our criteria, we are taking an etic approach; if we try to get inside that culture's own point of view, that would be an emic attitude.

times there is one word for two or more different concepts (typically, music and dance or singing and speaking), and so on. In each case, however, we trust that those elements, attitudes and feelings belong to the same sense of the whole that we call "music". This is so not only because of their mutual likeness; it is also the case because they come from someone who has thoughts, feelings, an aesthetic sense, social attitudes, customs, and whatever we construe as related to the production of music. In a way, these features are used as indexical signs for music, and, in Peircean terms, very similar to "abduction".[5]

Hence, there is little reason to deny such a skill to other animals. The contributions of ethologists and psychologists have nearly confirmed that animal behaviour is drastically far from Descartes's views.[6] We are no longer shocked when someone uses the terms "culture", "emotions", and "reasoning" in reference to animals, and we should approach animals as if they were an "early tribal" society quite different from, but in no way inferior to, that of western civilisation. In that case, a totally etic attitude wouldn't be fair, and a totally emic one would hardly be possible. The compromise is what we would cautiously suppose to be an emic approach, based on similarity in rules, rituals, structures and so on. In more than one case, humans and other animals share plenty of musical traits and paramusical forms of behaviour: non humanity is not a good justification for musical anthropocentrism.

Third problematic topic: Music

Before further discussion about any kind of musical culture, we should establish what we mean by "music", in order to share the same conception of it. And this is a difficult question, as Giannattasio points out:

> The absence of synonyms and the consequent polysemy of the term show how, to the majority of people, the whole of "musical" behaviours is like an endless, indefinite and much fascinating nebulosity, especially to who feels ignorant about it ("Lucky you expert! I do not know anything about music!").

[5] As Umberto Eco puts it, in abduction, "we find a very peculiar circumstance that could be explained by supposing that it is the specific case of a general rule, and consequently we adopt this supposition" (Eco 1975: 185).

[6] For more on the anti-Cartesian view of animals, see Masson and McCarthy (1996), Mortenson (1987), Darwin (1871, 1872), Ditadi (1994), Soriau (1965), and Mâche (1992).

> To the self-styled expert ones, "music" is something open to the smallest ("Nice performance, but there wasn't any musical expression in it") and the largest changes ("You can't call music that vulgar and noisy mess"). (Giannattasio 1992: 30)

As a proof of the difficulty, we note that most musical dictionaries do not include the term; just general dictionaries do, and their definitions tend to be overly generic.[7]

Of course, if such a definition is not shared within a so-called musical culture, we can turn to an inter-cultural context:

> […] a second difficulty encountered in an attempt to provide a universal definition [is] the absence of the concept of "music" in many cultures, and, more to the point, the fact that various cultures of the world classify the world of sound in many different ways. What may be singing to us in Europe and North America may be "reciting" or "reading" in an Islamic culture; what is birdsong to us may be "music" in an African culture; what is a composition to us may be a non-musical exercise model elsewhere; and so on. (Nettl 1977: 3)

Once more, we wonder if it is possible to define a concept like "music" in itself, which concerns only the musical object.[8] Luca Marconi is undoubtedly right when he says: "What makes us recognise the presence of music are not only traits connected to some *qualities of the sounds*, but also traits connected to visible *forms of behaviour* and consequent *experiences*" (Marconi 1996: 89).

In sum, to formulate a "precise" definition of music is not possible. Such a definition would be identified by so-called necessary and sufficient features, and it would be characterised by one closed category of the term, as in a dictionary: we call "music" always and only something which has features a, b, and c. Just b and c would not be enough, and a, b, c and d would be too much. More realistic is what Wittgenstein would call a prototypical category definition: the more we have the a, b, etc. features, the more we have good examples of music.[9] The main characteristic of this definition is centrality: some examples "work" better than others. Eleanor Rosch has shown that, to most people, a sparrow is a better example of a "bird" than a penguin is

---

[7] Typical dictionary definitions of music are inevitably partial and too restrictive; for example, "sounds organised to have melody, rhythm, harmony, and dynamics", or "an art of sounds in time that expresses ideas and emotions in significant through the elements of melody, rhythm, harmony, and dynamics".

[8] It should be recalled that the ancient Greek term *mousiké*, which is the supposed origin of the modern word *music*, is a concept that includes both music and poetry.

[9] This distinction already exists in most recent studies about categorisation. See, for instance, Rosch and Lloyd (1978), Kleiber (1990).

(Rosch, Lloyd 1978). Zoologically, however, that view would be incorrect. Yet we intuitively see the sense in it. Likewise, Mozart's *Eine Kleine Nachtmusik* is surely a better example of music than are some of Berio's *Sequenzas*, but this does not mean that the former piece is music and the latter ones are not. Only Giannattasio's "self-styled experts" claim to set the limits, and, fatally, these limits tend to include the features "classical", "western", "academic", "operatic", and to exclude the features "popular", "non western", "light", "oral" (Giannattasio 1992: 31). Thus, this prototypical category definition of music should be meant when one uses the word "music" in zoomusicological contexts. This is not because that is the definition that best fits animals, but because it is the only one that allows us to share the same concept when we pronounce the word "music".

Transpecific and species specific features

If we assume that the word music, according to the characteristics mentioned above, can be easily used in a zoomusicological context (thus justifying the name of the discipline itself), the next step is to define the areas of analysis that zoomusicology can investigate. First of all, as mentioned above, a distinction should be made between transpecific and species specific features. "Transpecific" refers to those elements that can be found in more than one species, even if they are just a few. This level is important to show the biological common bases of musicality, and is definitely less problematic than the second level, since in most cases the analysis reveals great familiarity between the species observed and the human musical culture. The most trivial example is of course singing, but other, more particularized aspects — such as putting sounds in a graduated scale (Mâche 1992; Schafer 1985; Martinelli 1999) — can also be put into evidence.

Elements are called species specific when they present characteristics that are typical of the species observed. This level shows how musicality, notwithstanding the above-mentioned biological basis, has taken quite varied courses, according to the evolution of each species. Of course, the less a species exhibits human musical traits, the more difficult musicological analysis becomes. This is because zoomusicology is just taking its first steps, such that human musicality, for the moment represents the only complete point of reference. When musical cultures of other animals have been studied more closely, we will

probably be able — through the process of abduction — to create new musical parameters to apply to the most peculiar cases. A typical example of a species-specific trait is the number and quality of pertinent sounds and intervals during a performance. The perception and use of these pertinences varies from species to species, so that a sound that is catchy and pleasant to a dolphin's ear might sound totally out of tune to a seagull.

Conclusion: Structures, processes, experiences

In closing, allow me to point out one further similarity between zoomusicology and ethnomusicological research. It is an analytical grid that is very common in the study of musical universals, and that might prove useful in zoomusicological research as well.

(1) *Structures*: the musical traits in themselves, what Nattiez would call the neutral level. Analysis of this level implies a large use of sound material, such as recordings and spectrograms, and aims to define the organisation of sounds in the species observed; e.g., range of sounds covered, recurrent intervals, timbres, and so on. Mâche (1992) proposes exactly this kind of typological research.

(2) *Processes*: acts and behaviours related with the structures, in the fields of emission and reception. We could call this the world of the paramusical, and it includes the whole cultural dimension of making music, with its rituals, social rules and so on. This level constitutes the best-known part of zoomusicological research, with many of its aspects already investigated by ethology. The same kind of analysis can be found in Sebeok's *Play of Musement* (1981), in the section entitled "Musical Signs".

(3) *Experience*: this is the level that scholars like Stefani, Delalande and Tagg have proposed in the discussion about musical universals. Since musical experiences may be considered as a general human experience taking place between a subject (man or woman) and an object (musical event), they advanced the idea that a universal feature in each experience is the restatement of particular conducts and competencies. With similar presuppositions, this view may be used for zoomusicological purposes. If the first level was that of the objective, and the second was that of the cultural, this one is surely the level of subjectivity, the investigation of music as an experience lived by an individual (although it is clear that many of these experiences follow

general rules). Tagg's (1987) bioacoustic relations, for instance, were a very interesting application of this level in my work on humpback whales (Martinelli 1999). Finally, let me say that I hope my introduction to zoomusicology has been convincing enough to prompt further study — at least by the would-be pioneers among us.

References

Busnel, Renae Guy (ed.) 1963. *Acoustic Behavior of Animals*. London: Elsevier.

Cimatti, Felice 1998. *Mente e linguaggio negli animali*. Roma: Carrocci.

Darwin, Charles 1871. *The Descent of Man and Selection in Relation to Sex*. London: Murray.

— 1872. *The Expression of Emotions in Man and Animals*. London: Murray.

Delalande, François 1991. *Le condotte musicali*. Bologna: CLUEB.

Ditadi, Gino (ed.) 1994. *I filosofi e gli animali*. Este: Isonomia.

Dobzhansky, Theodor 1962. *Mankind Evolving: The Evolution of the Human Species*. New Haven: Yale University Press.

Eco, Umberto 1968. *La struttura assente*. Milano: Bompiani.

— 1975. *Trattato di semiotica generale*. Milano: Bompiani.

Giannatasio, Francesco 1992. *Il concetto di musica*. Roma: La Nuova Italia Scientifica.

Hartshorne, Charles 1973. *Born to sing*. Bloomington: Indiana University Press.

Jakobson, Roman 1963. *Essais de linguistique générale*. Paris: Minuit.

Kleiber, Georges 1990. *La sémantique du prototype*. Paris: Presses Universitaires de France.

Mâche, François-Bernard 1992. *Music, Myth and Nature*. New York: Harwood Academic Publishers.

Mainardi, Danilo (ed.) 1992. *Dizionario di etologia*. Torino: Einaudi.

Marconi, Luca 1996. Gli universali e il concetto di musica. *Progetto Uomo Musica* 9: 87–95.

Martinelli, Dario 1999. Il canto della megattera: Una musica bestiale. *Musica/Realtà* 60: 37–55.

Masson, Jeffrey M.; McCarthy, Susan 1996. *Quando gli elefanti piangono: Sentimenti ed emozioni nella vita degli animali*. Milano: Baldini & Castoldi.

Mortenson, Joseph 1987. *Whale Songs and Wasp Maps*. New York: Duttons.

Nagel, Thomas 1974. What is it like to be a bat? *Philosophical Review* 83: 435–450.

Nattiez, Jean-Jacques 1977. Under what conditions can one speak of the universality of music? *World of Music* 19(1/2): 92–105.

Nettl, Bruno 1956. *Music in primitive culture*. Cambridge: Harvard University Press.

— 1977. On the question of universals. *World of Music* 19(1/2): 2–7.

Rosch, Eleanor; Barbara B. (eds.) 1978. *Cognition and categorisation*. Hillsdale: Lawrence Erlbaum Associates.

Schafer, Robert Murray 1985. *Il paesaggio sonoro*. Milano: Ricordi.

Sebeok, Thomas 1981. *The play of musement*. Bloomington: Indiana University Press.

Soriau, Eduard 1965. *Le sens artistique des animaux*. Parigi: Hachette.
Stefani, Gino 1985. *Competenza musicale e cultura della pace*. Bologna: CLUEB.
— 1997. *Musica: Dall'esperienza alla teoria*. Milano**:** Ricordi.
Szöke, Peter 1963. Ornitomuzikológia. *Magyar Tudomány* 9: 592–607.
Tagg, Philip 1987. Universal music and the case of the death. In: Pozzi, R. (ed.), *La musica come linguaggio universale*. Firenze: Olschki, 227–266.
Wallin, Nils 1991. *Biomusicology*. Stuyvesant: Pendragon

Методологии и проблемы в зоомузыкологии

Статья представляет собой эскиз введения в зоомузыкологию как дисциплину, близко связанную с зоосемиотикой, сосредотачиваясь на имеющихся результатах и формулируя нуждающиеся в дальнейшей разработке проблемы. Анализ посвящен обнаружению границ и возможностей зоомузыкального исследования, выявлению проблемных тем и возможных методологий. Автор пытается определить и позицию данной дисциплины по отношению к другим областям исследования, особенно к этномузикологии.

Metodoloogiad ja probleemid zoomusikoloogias

Artikkel visandab esialgse sissejuhatuse zoomusikoloogiasse kui distsipliini, mis on lähedalt seotud zoosemiootikaga, keskendudes olemasolevatele tulemustele ja formuleerides edasist uurimist vajavaid probleeme. Analüüs on suunatud zoomusikoloogilise uurimise piirangutele ja potentsiaalile, problemaatilistele teemadele, võimalike metodoloogiate ringile ning autor püüab ka määratleda distsipliini positsiooni teiste uurimisvaldkondade, eriti etnomusikoloogia suhtes.

Biosemiotics and the problem of intrinsic value of nature

Kalevi Kull
Department of Semiotics, University of Tartu
Tiigi St. 78, 50410 Tartu, Estonia
e-mail: kalevi@zbi.ee

Abstract. This article poses the hypothesis that the problem of the intrinsic value of nature that stems from the work of G. E. Moore and is widely discussed in environmental philosophy, has a parallel in a contemporary discussion in semiotics on the existence of semiosis in nature. From a semiotic point of view, value can be defined as an intentional dimension of sign. This is concordant with a biological interpretation of value that relates to biological needs. Thus, a semiotic approach in biology may provide a useful tool for further analysis of the intrinsic value problem in the biological realm. From an ecosemiotic point of view, the problem is also related to the concepts of bioart and ecoart. Ecoart *viz* environmental art is that which encompasses the human ambience, e.g., landscape or its components. Bioart can be defined as the art whose material ("clay") is a living body, living matter or communication of organisms (which may include, e.g., genetic engineering). It is concluded that the acceptance of biosemiotic view has implications for a large area of ecological philosophy.

It is remarkable to notice how three very different areas of nature-related studies are intertwined in contemporary semiotics:
(a) discussion on the semiotic threshold (protosemiotics),
(b) research on semiosic communication of non-human organisms (biosemiotics),
(c) analysis of cultural representations of nature (ecosemiotics).

The biological turn in semiotics, which was initiated by the work of T. A. Sebeok (1976, 1987), incorporates these three areas. The demonstration of sign communication in and among non-conscious

organisms logically implies the conclusion about the lowering of semiotic threshold. The latter creates a possibility to view nature in terms unusual for the large part of recent natural-scientific biology, and also for contemporary culture, which has learned from science ways to deal with nature. Therefore, semiotic biology — as developed along Sebeok's tradition — can be viewed as central for the other areas — for the threshold problem, and for ecosemiotic studies.

Parallel to these developments in semiotic research, the cultural applications of ecology and the environmental or ecological turns in philosophy show similar tendencies, although environmental philosophy, despite its very diverse methodology, usually applies simple biological ideas and rarely embraces the more profound results of theoretical biology.

Thus, the development of biosemiotics — as related to fundamental problems of both semiotics and biology — may directly influence the entire realm of questions listed above, and accordingly may become a central source for environmental philosophy.

In this paper, without going into the depths of the value concept, I attempt to give a brief comparison between some uses of one of the central concepts that may well provide a bridge between biology and its cultural applications.

The hypothesis: biological turn in semiotics and ecological turn in philosophy are related

The concept of intrinsic value of nature as formulated, e.g., by G. E. Moore and widely discussed in the fields of deep ecology, ethics of nature and environmental philosophy, concerns the applicability of the notion of value for non-human systems (for a review, see Vilkka 1997). Traditionally, these discussions (e.g., Callicott 1989, Norton 2000, Rolston III 2000, Zimmerman 1988) are in no way related to semiotics, rather they stem from the writings of Aldo Leopold (1989) and a few other early ecophilosophers. The central topic in these works concerns the origins of the natural values and the applicability of the concept of value to non-humans, either to other animals, or to all living beings, or to ecosystems, or even to all of nature.

Although not directly related, this can be seen as at the very least analogous to another discussion in biosemiotics that addresses the problems of the origin of semiosis and the applicability of the notion

of sign in non-human living world. The discussion on the existence of the intrinsic value is to a large extent parallel to the discussion on the placement of semiotic threshold. In both cases, i.e. for concepts of value and of sign, the initially anthropomorphic terms are applied to animals and extended to all other living beings.

I raise the hypothesis that the apparent parallelism between the problem of intrinsic value of nature in environmental philosophy and the whole set of questions on biosemiosis are intimately related and therefore, some results of biosemiotic analysis may be applicable to the analysis of the intrinsic value problem.

The entire problem of the origin of sign can be treated in the scope of theoretical biology, or as of a branch of it, biosemiotics (Emmeche 1992). Thus, in addition, we may also ask whether, in a similar way, the concept of value and the problem of the origin of value can be seen as a problem of theoretical biology and biosemiotics.

Thus, the statement is that the problem of intrinsic value of nature, which may primarily be attributed to ecosemiotics because it concerns cultural views on nature (Kull 1998), can be seen from the point of view of biosemiotics, i.e., as dealing with the sign processes in living nature. This will be the point of departure of this study. We may also hypothesise that the concept of intrinsic value of living systems may coincide with any of already existing concepts in biology or biosemiotics.

The concept of intrinsic value of nature in environmental philosophy

For a great part of contemporary environmental philosophy, the basic problem converges in the acceptance and interpretation of the intrinsic value of nature. For instance, the *Deep Ecology Platform* as formulated in eight basic principles starts with the claim on that:

> The well-being and flourishing of human and non-human life on Earth have value in themselves (synonyms: intrinsic value, inherent worth). These values are independent of the usefulness of the non-human world for human purposes. (Naess 1993: 197).

Naess gives the following comment on this point:

> This formulation refers to the biosphere, or more professonally, to the eco-sphere as a whole (this is also referred to as ‘ecocentrism’). This includes individuals, species, populations, habitat, as well as human and non-human

> cultures. Given our current knowledge of all-pervasive intimate relationships, this implies a fundamental concern and respect.
>
> The term 'life' is used here in a more comprehensive non-technical way also to refer to what biologists classify as 'non-living': rivers (watersheds), landscapes, ecosystems. For supporters of deep ecology, slogans such as 'let rivers live' illustrate this broader useage so common in many cultures. (Naess 1993: 197–198)

In this regard, Holmes Rolston III (2000) speaks of the environmental turn in ethics. Despite the wide acceptance of the intrinsic value concept and the understanding of its important implications for law, medicine, arts, etc., its limits and biological foundations remain unclear.

O'Neill (1992: 119–120) distinguishes between three different basic meanings of the term: (a) intrinsic value is used as a synonym for non-instrumental value; (b) intrinsic value is used to refer to the value an object has in virtue of its 'intrinsic properties'; (c) intrinsic value is used as a synonym for 'objective value'.

Weston (1996) proposes a pragmatist critique of the notion. He shows that intrinsic values are also operational, although in a more esoteric manner, implying that intrinsic value defined as independent and self-sufficient, may still be possible to interpret as not completely isolated from an appraiser, or a valuing subject. In this respect Callicott (1989) says that 'value' is a verb, not a noun (cf. Norton 2000: 1037–1038).

A considerable part of interpretations of the intrinsic value concept concerns the necessary turn to a biocentric view (Vilkka 1995), as opposed to the anthropocentric view. This may mean that the valuing process is extended so that the experiential world of any living being is included. However, likewise the pansemiotic version of approach in semiotics, there also exists an approach in the analysis of intrinsic value that assigns it to all nature, including the abiotic portion (Zimmerman 1988).

Three ways of defining 'value' in biology

Biology maintains several versions of value. Among these, three main types of approaches can be distinguished. Depending on context, these can be interpreted as either alternative views or different subtypes of the same concept.

(1) Reproductive value — the notion of value as something that measures reproductive success. Reproductive success is usually characterised quantitatively via fitness measures, which is a complement of natural selection.

(2) Meronomic value — value stemming from functional differentiation. This means that a part (e.g., of an organism) always requires an additional part. Each natural part obtains its value with respect to its relationship to other natural parts.

(3) Functional value — value related to or stemming from biological needs. Valuable for an organism is what is functionally required or necessary. Needs and values mutually define one another.

Meronomic value can be called also a differential value. However, considering the use of this term in economics since the work of William Stanley Jevons, it is quantitatively expressed more analogically to the reproductive value in biology (see also Sharov 2001), on the other hand still meaning that the problem of value is that of the mind.

These three types are not entirely independent, because all are related to the concept (and possibly, a mechanism) of biological adaptation. While the reproductive value is responsible for evolutionary adaptation, the meronomic value is basically ontogenetic, and the functional value can be viewed as that upon which all organismic behaviour is based.

Integration of these three types of value is thus equivalent to finding an integral definition for the concept of adaptation. This is evidently impossible when confined to the framework of the measure of evolutionary fitness. Moreover, emphasis on biological needs results in the exclusion of some of the reproductive value phenomena, because not all differences in reproduction result from the differences in the active behaviour of organisms.

Perhaps the only integration of these concepts in the contemporary biological literature is the replacement of an organismic view by one of lineage. However, these two are associated by ontogenetic trajectory, and accordingly, if we accept that *ontogeny* (defined as organismic process) is a more fundamental concept than either organism or lineage, a general viewpoint can be reached that enables us to view biological values as the counterparts of generalised developmental process, including both reversible and irreversible changes.

On the concept of value in semiotics

Value (*valeur*) is a technical term used by Saussure, devoting to it an entire chapter in his *Cours de linguistique générale*. Saussure (1983) distinguishes between the value of a sign and all its other properties. The value of a sign is determined by the network of contrasts it enters into with all other signs in the system (Harris 1998). This notion plays a key role in the whole theory of Saussurean structuralism, and sets it apart from the several later versions of structuralism. According to Saussure, the value of a term is not its 'meaning'.

According to Morris (1971: 418), a value is 'a property of an object or situation relative to an interest'. Thus, he sees in value an intentional aspect of a system.

Peirce says that analysis of meaning implies reference to a purpose (CP 5.175) and that meaning and value are intimately connected. 'Meaning is something allied in its nature to value. [...] Value is the measure of desirability; and desire always refers to the future. This leads us to inquire whether meaning does not always refer to the future' (MS 599, 1902: 24).

J. D. Johansen, when discussing the concept of value in Saussure and Hjelmslev, concludes (Johansen 1993: 50): 'the concept of value is not independent of the concept of signification; on the contrary, it depends on it'.

Reading a text, or receiving a message is always an active process. Signs are developed and distinctions drawn for that which the users find important, or which have particular significance in their Umwelt or culture.

Thus, stating that value can be defined as an intentional dimension of meaning, we will not depart far from the most of traditional usage of the term in semiotics.

A biosemiotic approach

The main types of the value concept in biology can be placed into accordance with the interpretations of value in a semiotic sense. For instance, the meronomic value as defined above is similar or possibly related to the concept of *valeur* of Saussure, whereas both the reproductive value and the functional value (in their biological sense)

may have a pragmatic interpretation. However, if the reproductive value corresponds well to a strictly pragmatic interpretation of the term, then the concept of functional value can be better interpreted as being concordant with Peirce's pragmaticism.

Assuming that all values are nothing more than an intentional dimension of meaning that is counterpart to any sign, the whole problem of the existence of the intrinsic values converges into a problem of the existence of such signs in nature. According to a fundamental biosemiotic statement, semiosis starts with living cells. The intentional dimension of biosemiosis has received less attention, however, it is reasonable to assume that biosemiosis is primarily associated with the biological needs that characterise all living beings and that also represent the simplest type of intentionality.[1]

All biological needs seemingly stem from an organic homeostatic mechanism, although, in another formulation, any homeostatic system in organic turns out to be a pacemaker for a biological need. These have built upon themselves a hierarchy of multilevel processes (e.g., via a mechanism of metasystem transition), representing all possible forms of biological and ultimately non-biological (human) intentionality.

The developmental process of any living being, including a single cell, is either in whole or in part also an interpretant for its sign processes. Thus, as much as a living being can be independent and self-sufficient, the same can be assigned for values.

An excursus to ecosemiotics: Bioart and ecoart

Any approach to the problem of values has to be testable on aesthetic values, and the problem is whether this is also the case for intrinsic biological values.[2]

All organisms transform their ambience, designing paths, building nests, dramatically changing the structure, appearance or character of surface soil and subsoil by their consumption patterns and waste. Part of this designing process clearly conveys the sign function related to search and recognition.

---

[1] On the definition of biological need, see, e.g., Kull 2000.

[2] Recently, some interesting work on biosemiotic interpretation of aesthetic phenomena has been carried out by A. Weber (2001) and D. Martinelli (2001). See also Corrington (1994), Ferré (1996), Jonas (1997). Concerning the relationship between biosemiotics and ethics, see also Hoffmeyer (1994, 1996).

Environmental problems arise when a massive amount of something resisting biodegradation develops, when the impact on the environment becomes irreversible, when the system is thrown out of balance, or when something is introduced to or removed from the closed cycle of an ecosystem. These are all too familiar problems, related basically to the technical skills of humanity to employ alien, hostile-to-life materials and extra-cycle resources.

However, in addition to conflicts triggered by disturbing substance cycles, there is another major transformation of natural habitat, stemming from the overpowering drive to embellish the surroundings. This is related to the disparity between the human habitat — humanity's self-created environment or home space — and the habitat of animals, even when humanity appears to practice sound ecological principles. This disparity is compounded people extending their home space to embrace all of nature.

The aesthetic aspect plays a major role in home space. It is quite natural that humanity makes recourse to all conceivable means to make his environment more appealing and interesting, particularly by conscious use of skill and creative imagination in the production of aesthetic objects.

Nature art is fairly multifaceted. Clearly distinguishable within this concept are *bioart* and *ecoart*, when defined through semiosis, through a sign process rather than through denotation — like is done in other areas of art. Hence, with art conceived as an aesthetically manipulated sign process, bioart is not regarded as drawing of butterflies and flowers, nor is ecoart tantamount to painting a landscape.

The difference may be elucidated as follows. *Ecoart viz* environmental art is that which encompasses our ambience — e.g. landscape or its components, soil, communities and habitats etc. *Bioart* would then be the art whose material ("clay") is a living body, living matter or communication of organisms (as it is, the living body can not be actually severed from the life process *viz* the biocommunication).

Living matter is unique in that it is itself the creator, in particular the creator of meanings unto itself. Umberto Eco, when defining the concept of semiotic threshold, placed that in the node where language starts (and culture, for that matter). The biological turn in semiotics, shifting the boundary to where life begins, heralded the understanding that awareness is not a premise of sign process, that it does not underlie it. Icons can be detected also in the ant's world, indexes with slugs, semiosphere reaching into our body, to embrace the communication between our cells.

Supposing the semiosphere is larger, enveloping all living beings, then it must be meaningful also for art. Sign processes in living organisms are capable of creating harmony. Biology should then be partly the science of arts, education of the development of living nature being a fragment of the history of arts.

The convolution of nature art is constituted by co-operation of creators. Naturally, the inorganic matter is important for the evolution of a work of art, however the meaningfulness is the outcome of artist's craft, in the first place. Moreover, living matter is an active creator of meanings, because it entertains its own needs. Therefore, in artful transformation of the world there are certain demarcation lines where needs are concerned. This is so because needs are a vehicle for shuttling between disharmony and harmony. The needs frame the art, on the one hand, ubiquitously attending the process of vesting something with a meaning (or divesting something of the same). On the other hand, the transformation may affect the formation of the very needs — dwarfing them or inflating them irreversibly, however also eradicating them or creating new ones.

Everything alive has needs *per se*, not so the lifeless nor the dead. This borderline was emphasised and referred to by Albert Schweitzer. Whenever classical art changes the needs themselves, it almost exclusively affects only people — the creators and listeners-observers — not other living creatures. Modern art is not shackled by this restraint. There are ample examples of cases when the needs of animals and other oxygen breathing things are modified.

The Pekingese and many other pedigree lapdogs have been bred, largely on the basis of aesthetics, likewise multicoloured fish in aquariums and supposedly many varieties of garden flowers. The most recent example to the point is a mouse, in whose genome there was transplanted a chunk of DNA of the medusa glowing in UV radiation. Whereupon the transferred gene activated in the mouse's tissues and fur, making the mouse shine like a lantern. This was just a genetically modified organism (GMO), made for an art exhibition. It can be considered as an extension of aquarium art or cultivated plants in flowerpot, "surrounded by a frame". However in that game on biological level — unlike painting, furniture and non-biological art — the art is sustainable without humanity. Once the communication in the living organism has been turned on, the organism continues to play it.

Any ostentatious mix on the level of inter-species communication represent bioart — transplanting a birch in Australia, or letting the ostrich loose on an alvar. There are unlimited aspects to games with

biocommunication, the gene technology having ushered in a new era in that area — the art technique for combining in the sphere of endocommunication.

The best-known bioart is related to the human body, cf. body art. Make up and tattoos, and also plastic surgery — a long list of techniques capped by chemical, physiological and genetic changes, modifying behaviour.

The fundamental objection to bioart stems from the fact that a living body has at its disposal an operative harmonising process, thence its inner drive to aestheticism. Almost every interference tends to disrupt that harmony. (Healing may be regarded as an exception, but with reservations only. Suppose all pathogens and parasites should be eliminated and suppressed in wild nature — the outcome would be perilous to communities.) In this meaning, bioart is quite similar to modification of a perfect and consummate work of art. Whence the conclusion that bioart is always co-operation of at least two artists.

The concept of ecoart is characterised by the magnificence of scale, related to setting boundaries on the concept of environment (including the communication of organisms etc.). There is a wide expanse of phenomena, ranging from skin-deep to sky-high: habiliments, living room, house, garden, landscape, and correspondingly, art of fashion, interior decoration, urban architecture, art of planting trees and shrubs, landscape architecture and design.

All those are predominantly industrial arts, i.e., directly linked to human needs for living or functions of living. Therefore, unlike bioart, ecoart is indispensable. Of course, in all those areas non-industrial art is possible. Nature has a whole culture on offer, in this respect.

Conclusion

To take biosemiotics seriously implies not only a paradigmatic turn for at least some part of biology, but also infers important and interesting changes in the views of various aspects in the theory of culture and semiotics of culture. In addition, this approach may be helpful in order to comprehend some puzzles of environmental philosophy. Defining value as an intentional dimension of sign, it becomes possible to trace a line from biological needs to the cultural representations of value, approaching with this a biosemiotic interpretation of the intrinsic value of nature.

References

Callicott, J. Baird 1989. *In Defense of the Land Ethic*. Albany: State University of New York Press.

Corrington, Robert S. 1994. *Ecstatic Naturalism: Signs of the World*. Bloomington: Indiana University Press.

Emmeche, Claus 1992. Modeling life: A note on the semiotics of emergence and computation in artificial and natural living systems. In: Sebeok, Thomas A.; Umiker-Sebeok, Jean (eds.). *Biosemiotics: The Semiotic Web 1991*. Berlin: Mouton de Gruyter, 77–99.

Ferré, Frederick 1996. *Being and Value: Toward a Constructive Postmodern Metaphysics*. Albany: State University of New York Press.

Harris, Roy 1998. *Introduction to Integrational Linguistics*. Oxford: Pergamon Press.

Hoffmeyer, Jesper 1993. Biosemiotics and ethics. In: Witoszek, Nina; Guldbrandsen, Elisabeth (eds.), *Culture and Environment: Interdisciplinary Approaches*. Oslo: Centre for Development and the Environment, 152–176.

— 1996. *Signs of Meaning in the Universe*. Bloomington: Indiana University Press.

Johansen, Jørgen Dines 1993. *Dialogic Semiosis: An Essay on Signs and Meaning*. Bloomington: Indiana University Press.

Jonas, Hans 1997 [1973]. *Das Prinzip Leben: Ansätze zu einer philosophischen Biologie*. Frankfurt: Suhrkamp.

Kull, Kalevi 1998. Semiotic ecology: Different natures in the semiosphere. *Sign Systems Studies* 26, 344–371.

— 2000. An introduction to phytosemiotics: Semiotic botany and vegetative sign systems. *Sign Systems Studies* 28: 326–350.

Leopold, Aldo 1989 [1949]. *A Sand County Almanac and Sketches Here and There*. New York: Oxford University Press.

Martinelli, Dario 2001. Methodologies and problems in zoomusicology. *Sign Systems Studies* 29(1): 341–352.

Morris, Charles W. 1971. *Writings on the General Theory of Signs*. The Hague: Mouton.

Naess, Arne 1993. The deep ecological movement: Some philosophical aspects. In: Zimmerman (ed.) 1993, 193–212.

Norton, Bryan G. 2000. Biodiversity and environmental values: In search of a universal earth ethic. *Biodiversity and Conservation* 9(8): 1029–1044.

Nöth, Winfried 1990. *Handbook of Semiotics*. Bloomington: Indiana University Press.

O'Neill, John 1992. The varieties of intrinsic value. *The Monist* 75(2): 119–137.

Rolston III, Holmes 2000. The land ethic at the turn of the millennium. *Biodiversity and Conservation* 9(8): 1045–1058.

Saussure, Ferdinand de 1983 [1916]. *Course in General Linguistics*. London: Duckworth.

Sebeok, Thomas A. 1976. *Contributions to the Doctrine of Signs*. Bloomington: Indiana University Press.

— 1989. *The Sign and its Masters*. Lanham: University Press of America.
Sharov, Alexei 2001. Umwelt-theory and pragmatism. *Semiotica* 134(1/4).
Vilkka, Leena 1995. *The Varieties of Intrinsic Value in Nature: A Naturistic Approach to Environmental Philosophy*. Helsinki: University of Helsinki.
— 1997. *The Intrinsic Value of Nature*. Amsterdam: Rodopi.
Weston, Anthony 1996 [1985]. Beyond intrinsic value: Pragmatism in environmental ethics. In: Light, Andrew; Katz, Eric (eds.), *Environmental Pragmatism*. London: Routledge, 285–306.
Weber, Andreas 2001. Cognition as expression: On the autopoietic foundations of an aesthetic theory of nature. *Sign Systems Studies* 29(1): 153–168.
Zimmerman, Michael E. 1988. Quantum theory, intrinsic value, and panentheism. *Environmental Ethics* 10(1): 3–30.
— (ed.) 1993. *Environmental Philosophy: From Animal Rights to Radical Ecology*. Englewood Cliffs: Prentice Hall.

Биосемиотика и проблема внутренней ценности природы

В статье выдвигается гипотеза, что сформулированная Дж. Э. Муром и широко дискутируемая в философии окружающей среды проблема внутренней ценности природы сопоставима с дискуссией в современной семиотике о семиозисе в природе. С точки зрения семиотики ценность можно дефинировать как интенциональное измерение. Это соответствует биологической трактовке ценности, если рассматривать ее, исходя из биологических нужд. Таким образом, семиотический подход в биологии может послужить и при анализе проблемы внутренней ценности природы. В экосемиотическом аспекте это проблема связана и с био- и экоискусством. Экоискусство — это искусство, занимающееся средой человека, например пейзажем. Биоискусство можно определить как искусство, материалом которого является живое тело или коммуникация организмов (включая частично инженерную генетику). Отсюда следует, что акцептирование биосемиотической точки зрения влечет за собой множество выводов, затрагивающих и экологическую философию.

Biosemiootika ja looduse sisemise väärtuse probleem

Artiklis püstitatakse hüpotees, mille kohaselt G. E. Moore'i poolt formuleeritud ja keskkonnafilosoofias laialdaselt diskuteeritav looduse sisemise väärtuse probleem on paralleelne tänapäeva semiootikas toimuva diskussiooniga semioosise esinemisest looduses. Semiootika seisukohalt võib väärtust defineerida kui märgi intentsionaalset mõõdet. See on vastavuses väärtuse bioloogilise tõlgendusega, kui seda käsitleda lähtuvana bioloogilistest vajadustest. Seega võib semiootiline lähenemine bioloogias olla vahendiks ka

looduse sisemise väärtuse probleemi analüüsil. Ökosemiootilisest aspektist on probleem seotud bio- ja ökokunstiga. Ökokunst on kunst mis tegeleb inimese keskkonnaga, näiteks maastikuga. Biokunsti võib määratleda kui kunsti, mille materjaliks on elus keha või organismide kommunikatsioon (haarates osalt ka insenergeneetika). Seega osutub, et biosemiootilise vaatekoha aktsepteerimisega kaasneb hulk järeldusi, mis puudutavad ka ökoloogilist filosoofiat.

Beyond "universal grammar"

Review: Marcello Barbieri, *The Organic Codes: The Birth of Semantic Biology*. Ancona: Pequod, 2001

Noam Chomsky[1]

Dear Professor Barbieri,[2]

Just found this book at my office today[3], in the usual huge stack of mail, books, papers, etc. It looked so intriguing that I started reading it on the way home. Luckily for me, the bus was late, so I had more than the usual amount of time. It is really fascinating. About half way through before the bus stopped, I got back to it later.

Your book is very much along the lines of my own recent work, in some ways. Since the modern subject of the study of language took shape about 50 years ago in what's sometimes called a "biolinguistic" framework, it seemed clear to me that some day we would have to try to go beyond "universal grammar" — the relevant genetic endowment — and try to find out not just what it is but why it is this way, looking for the kinds of factors you mention in discussing cellular epigenesis. I was much intrigued by work of Turing (1952) on morphogenesis, and D'Arcy Thompson's classic work (Thompson 1942). In recent years, enough has been learned so that the questions seem perhaps open to serious inquiry, and what seems to be a sensible research

[1] Author's address: Noam Chomsky, Department of Linguistics and Philosophy, Massachusetts Institute of Technology, MIT E39-219, 77 Massachusetts Avenue, Cambridge, MA 02139 USA; e-mail: chomsky@mit.edu.

[2] Marcello Barbieri is an Italian developmental biologist from the University of Ferrara, the president and founder (in 1997) of the Italian Association for Theoretical Biology. *The Organic Codes* is a development and extension of his earlier book, *The Semantic Theory of Evolution* (1985), which has appeared with René Thom's foreword, and of his several papers (Barbieri 1987, 1997). For another review on M. Barbieri's book see: Kull, K. 2001. Living forms are communicative structures, based on the organic codes. *Cybernetics and Human Knowing* 8(3). [*Editorial footnote*.]

[3] March 9, 2001.

program has taken shape, with I think interesting results. Some of the best work is being done not far where you are (teaching embryology) — in Siena, Milan, Venice, and a few other places. Had the great pleasure of spending a month in Siena about a year ago.

Here are a few comments, based on first quick reading. One issue that seems to me unclear is whether what you call "the strong version" (p. 21) is really a falsifiable hypothesis. You write (p. 21):

> [...] the cell theory can be expressed either in weak or in a strong version. The theory can indeed be reduced to a mere description of life when it is formulated by saying that 'all known living organisms are made of cells'. In this case it has no predictive power and no falsifyable consequence.
>
> But there is also a strong version that does represent a true falsifyable generalization of the empirical facts, and therefore a true scientific theory. It is the statement that 'all possible living organisms are made of cells'.

That can be so only if the concept "living organism" is antecedently defined. But it seems to me that the project at this point is to define it. Not an unfamiliar pattern in the history of the sciences.

Anyway, I am really enjoying the book. I have indeed finished it, with much appreciation. It is very stimulating and thought-provoking. Thanks for sending it.

References

Barbieri, Marcello 1985. *The Semantic Theory of Evolution*. London: Harwood Academic Publishers.

— 1987. Co-information: A new concept in theoretical biology. *Rivista di Biologia* 80: 101–126.

— 1997. Biological forms as natural conventions. *Rivista di Biologia* 90: 485–488.

— 2001. *The Organic Codes: The Birth of Semantic Biology*. Ancona: Pequod.

Thompson, D'Arcy Wentworth 1942. *On Growth and Form*. Cambridge: Cambridge University Press.

Turing, Alan 1952. The chemical basis of morphogenesis. *Philosophical Transactions of Royal Society London* B 237: 37–72.

The emergence of signs of living feeling: Reverberations from the first Gatherings in Biosemiotics

Claus Emmeche[1]

What is biosemiotics and why bother — or gather — around it? During the final decade of the twentieth century, *biosemiotics* grew from being an idea conceived by a few semioticeans, biologists, ethologists and other specialists to becoming a more widely recognized perspective for the study of the "signs of life" as well as the "life of signs". Due to its unifying vision biosemiotics has implications, not only for a diversity of separate fields inside physics, biology, medicine, psychology, anthropology, semiotics, and philosophy as well as cross-disciplinary research programs such as cognitive science, artificial life or autonomous agents, but also for our very idea of living nature. Biosemiotic analysis may also offer interesting new ways of evaluating biological technology, and may also be seen as a fundamental new approach to theoretical biology. Biosemiotics has been on the agenda of many international meetings, and the 1990s saw a couple of publications devoted to biosemiotics proper (e.g. *Sign Systems Studies* vols. 27 and 28; *Semiotica* vols. 120(3/4) and 127(1/4), etc.).

As stated on a website recently established for this activity,[2] *Gatherings in Biosemiotics* is intended to enact a regular framework for discussions of this new perspective on living beings. The gatherings will be international annual meetings for scholarly exchange of ideas and views in semiotic biology. Until this year's Gatherings, biosemiotics has not been the prime focus for any regular international activity, but hitchhiked on other initiatives. That has been a fruitful way of establishing such a new field of research, but time was ripe for a more focused platform for the discussion of biosemiotics as a biologically grounded domain of study and its relation to other fields of knowl-

[1] Author's address: Niels Bohr Institute, University of Copenhagen, Blegdamsvej 17, DK-2100 Copenhagen Æ, Denmark; email: emmeche@nbi.dk.

[2] See http://www.zbi.ee/~uexkull/biosemiotics/.

edge. For the present, Denmark and Estonia will alternate as hosts for these meetings, and the first Gatherings took place in Copenhagen in May 24–27, 2001.

As a participant and co-organizer — together with Jesper Hoffmeyer and Kalevi Kull — I'll try to convey some personal impressions from the event, which took place in the building of Botanical Institute of the University of Copenhagen, the place where Wilhelm L. Johanssen in 1909 coined the terms 'gene', 'genotype' and 'phenotype' without intending all the materialist connotations that the notion of genes took on, especially after the breakthrough of molecular biology. It came as a nice surprise to the organizers that so many people reacted positively on our call for papers, and we ended up having 29 highly interesting papers presented by specialists from all over the world, during two and a half intense days. On the web site mentioned one can find a list of abstracts, and I do not intend to give a detailed summary of the whole programme here.

No wonder that whenever a new interdisciplinary field of research is on its way of establishing itself, questions pop up as to the scientific status of that field, its methods, and its relations to other areas of inquiry. We have seen that for general semiotics too. The very metaphor of a field may indeed be misleading, as one of the ambitions of biosemiotics is not so much to cultivate a special crop of scientific objects of investigation (like ichthyology, the study of fishes) as it is to connect patterns of knowledge from disparate sources of experience, and to contribute with one of the much needed supplements to the traditional experimental research. And of course, also to contribute to solve long standing puzzles and even deep metaphysical riddles left untouched by scientific progress. In his introduction to the prehistory of biosemiotics, Kalevi Kull from the University of Tartu, Estonia, emphasized that although biology is much too large to be comprehended neither by any biologist nor by semiotics or any other single approach, the semiotic perspective — a view that connects mind and matter — is so basic in understanding even the most simple living systems (cf. Thomas A.Sebeok's work on the modelling systems and the first cell as the starting point of semiotic processes), that the semiotic approach is necessary for all major branches of biology.

The meeting succeeded in establishing contacts between scholars who hitherto have been working independently and partly in parallel within that periphery of contemporary molecular and cell biology called *theoretical biology*. The cell biologist and expert on mitochondria Anton Markoš from Charles University in Czechia presented "a hermeneutics of the living", and gave an entertaining critique of the logocentric philosophy of life that has dominated western science, from St. John's Gospel, "in the beginning was the word" to the Central Dogma of molecular biology. But how to derive Marilyn Monroe from DNA and protein folding? Markoš pointed to *ontogeny* as the most crucial and often neglected problem in biology today and stressed that we may only understand a complex and developmental system in analogy with another complex system. Thus, doing biosemiotics proper — dealing

with nature's own sign processes on various levels of organization — we are also forced to consider what may be called the system-observer semiotics, i.e., to inquire into the nature of the modelling relation of the various systems we can observe, describe, conceptualize and construct theories about, a semiotic of scientific experiment, observation, interpretation, operation and measurement. In this respect we have to consider critically our choice of ways of representing various sign system functions. In an ideally clear talk Yagmur Denizhan and Vefa Karatay from Bogazici University in Turkey presented a framework called "Evolution of the *window*", which allows one to describe how, during the course of evolution, complexity increases by meta-system transitions. There is a trend towards increasing semiotic interactions and the "evolvable window" stands for the totality of the semiotic interactions of an organism, including the models and meta-models used for anticipation. Their paper provided a promising way to synthesize the Peircean theory of sign interpretation with a complex systems perspective on multi-level integrative systems by using the notions of emergence and downward causation to describe how strong semiotic controls are generated with the appearance of, for instance, multi-cellular organisms.

Coming from social studies of science, Thierry Bardini from the University of Montreal, Canada, placed one of the central metaphors in molecular biology (and biosemiotics as well), that of the genetic code, in the perplexing but highly relevant context of metaphor theory in Paul Ricoeur, literary criticism, cognitive semantics and history of science (including Lily Kay's recent historical work on the genetic code). He used the discovery of "junk DNA" in gene mapping as a case to reflect upon the long running debate on the use of models and metaphors in science. Here, Jan T. Kim, a German bioinformatics scientist from the University of Lübeck, reacted by questioning the relevance of taking the metaphorics surrounding the human genome project in mass media's pop science at face value, when workers within the field are acutely aware of the fact that many of these notions are convenient ways of talking rather than scientifically adequate propositions. The form of this "convenience", however, needs further study, and so does the kind of (cryptosemiotic) knowledge that molecular biologists actually have about genes, DNA and codes. Later on, in a general discussion session, bravely moderated by anthropologist Myrdene Anderson from Purdue University in the USA, the hot topic about metaphors came up again, and she elegantly cached the saying "just a metaphor" and fixed it on the blackboard to further semiotic scrutiny. Evidently, various intuitions about the status of metaphors exist in the humanities and the natural sciences.

Several times during the gatherings questions were raised about the complex relation between human language and how we as humans "read" nature, including other semiotic agents in nature. The linguist Han-liang Chang from the National Taiwan University described some peculiarities of classical Chinese pictographic writing, especially how animals are named by citing all the creatures, real or fabulous, with a /ma/(horse) radical. In the discussion he

questioned the universal validity of an analogy (based upon the analog/digital distinction) in some early biosemiotic writings between written language (based on a digital alphabet) and life (based on the digital "DNA alphabet"): If one had taken departure in a "Chinese" understanding of written language, one might have sought for a metaphor that did not put the same weight on the genetic sequence, but focused on a structure or process that was already to some degree significant or minimally meaningful (as an icon is). The anthropologist-biologist Andreas Roepstorff from the University of Aarhus in Denmark analysed ethnographic material from Greenland to demonstrate that people there regard animals as "non-human persons", that is, as sensing and thinking beings who are able to build up knowledge about their environment. E.g., the behaviour of seals near icebergs are interpreted by human hunters who acknowledge semiotic competence to the seals regarding the state of the fragile and dangerous icebergs. Here, Lévi-Strauss' notion of "thinking with animals" in *The Savage Mind* takes on a new meaning, the animals are not simply embodiments of ideas already in the "savage mind"(or the world); rather, in this field of Greenlandic "experiential biology" (see below), animals are "persons", or biosemiotic agents, with both soul ['tarneq'] and body ['timi']. Both talks emphasized the limitations of a traditional western dualist account. Another participant, the ethologist Dominique Lestel from Ecole Normale Supérieure in Paris, gave a new interpretation of the human-animal interaction in the attempts to learn chimpanzees some kind of sign language. These experiments on talking apes were seen by Lestel not so much as experiments in psycholinguistics (how far can animal learn human language) but as wonderful experiments on the communities of communication between human beings and animals. He emphasized the necessity of strong emotional involvement of the human part of the relation, and suggested that human language should not be seen as a property that puts human being apart of other living creatures, but as something that makes human being able to better communicate with non human living creatures and to create hybrid communities of sharing interests, meaning and emotions.

It has long been evident that the semiotics of C. S. Peirce is a good starting point to develop a dynamic theoretical framework within biosemiotics, and a whole session were assigned to the Peircean approach. The Brazilian scholar Jorge de Barros Pires from Universidade Estadual Paulista, São Paulo, stressed the formal, general and normative aspects of Peirce's semiotics, as well as its definitely non-cartesian notion of a subject (or an agent, to use a more general term) — themes that are familiar to readers of this journal, but which is often difficult for biologists to understand when confronted with biosemiotics for the first time, e.g., that "an interpretant" is itself a sign that in no way needs necessarily to be an interpreter organism. The philosopher Tommi Vehkavaara from University of Tampere, Finland, suggested "to naturalize" semiotic concepts for biosemiotics. "Naturalising" mentalistic concepts has for long been a cottage industry in empiricist and analytic variants of philosophy of mind that try to accommodate the waves of reductionist re-

search in "cognitive science". However, as far as I can see, Vehkavaara's suggestion to redefine semiotic concepts (agent, consciousness, pain, etc.) in terms of "concepts referring to external experiences" may well be hard to reconcile with the basic non-dualist ontological perspective in Peirce, and such a project's own metaphysical presuppositions need to be clarified, despite the possible gain in clarity and "objectivity" of such concepts as the very notion of a sign's object, a point Vehkavaara stressed. Another attempt to make Peircean notions of sign interpretation more palatable to scientists was Alexei Sharov's version of a "pragmatic approach" to biosemiotics. Sharov, formerly a Russian zoologist now at the Virginia Technical University in USA, is well-known within the emerging biosemiotic community. He has developed what I would call an operationalist version of biosemiotics in which signs are seen as generated and interpreted as agents who have goals and values, and as anticipatory systems these agents control their own probability of transition. Sharov showed how such an approach was accessible for mathematical treatment and could be applied to economic agents (concerned with "present value") as well as Darwinian agents (concerned with "reproductive value"). Such an approach may indeed be useful to bridge the gap of communication between contemporary evolutionary biology and biosemiotics. Though it may be in discord with the "internalist" critique of neo-Darwinism deriving from some biosemiotic works, only time will show whether we shall get a semiotization of neo-Darwinism or an "economicization" of biosemiotics!

The meeting showed that transdisciplinary synthesis can be configured in a variety of ways, extending the horizon of the founding figures of semiotics. Søren Brier, the editor of *Cybernetics & Human Knowing* from the Royal Veterinary and Agricultural University in Copenhagen, presented his bold systemic "cybersemiotic" theory, drawing on figures such as Peirce, N. Luhman, Maturana and Varela, K. Lorenz, and even elements of Wittgenstein's philosophy of language, taken in and transformed into this synthetic endeavour. For the particular occasion, Brier presented a new concept, called "intrasemiotics", denoting the interpenetration of sign-games situated within biological, psychological and social systems, as illustrated in one of his complex diagrams that made one of the participants complain that such kind of Venn-like diagrams made him feel like looking at a map of the former Yugoslavia with all its territories, but are all these spheres and borders really pertaining to reality? An interesting discussion followed about whether we actually as human agents distinguish between our biosemiotic, psychosemiotic and sociosemiotic activities. Another synthetic theory, more formal in approach, was presented by Edwina Taborsky, a semiotician from Bishop's University in Canada, editor of the on-line journal of *Semiotics, Evolution, Energy, Development*. She outlined an ambitious attempt to describe the ontological and epistemological architecture of evolutionary semiosis, based on an extremely general (pansemiotic) notion of codification, i.e., "patterns of organization of energy", in which also "information" is codified energy. Having

had difficulties earlier of precisely getting at the Taborskyan way to cut up the universe, I was delighted to see a much more clarified and, it seemed to me, consistent exposition of her version of a modernized Peircean metaphysics. The basic intent of her talk, if not her specific conceptual scheme, was later supported and made concrete by another pansemioticean, the physicist Peder Voetmann Christiansen from the University of Roskilde in Denmark. He interpreted Peirce's notion of habit formation as symmetry breaking in the early universe and gave a beautiful talk about the Peircean categories of Firstness, Secondness and Thirdness in relation to the cosmology of the early universe and physical concepts of "virtual fluctuations", "nucleation" (with its tendency to spread out and form larger islands of order) and irreversibility. Furthermore, he addressed the relation between bio- and physicosemiosis by noticing that "life" is not simply the particular set of objects investigated by biology; *life* as such is an internal quality of matter, called "living feeling" by Peirce, and in this sense, the biological organism is encoded life, similar to the phenomenon of matter as being encoded energy.

Another new term introduced at the meeting was Tom Ziemke's "robosemiotics". Ziemke, a researcher in autonomous robotic systems at the University of Skövde in Sweden, has embraced the "new robotics" movement that in many respects is much more biologically interesting than traditional AI-styled robotics. Still, these artificial "creatures" have an intrinsic semiotic activity that in many respects is organized quite differently from "real" autonomous organisms, as Ziemke convincingly showed, much inspired by the old biosemioticean Jakob von Uexküll's characterization of the sensing organism and its Umwelt (a coming issue of *Semiotica* will deal with J. von Uexküll). An interesting and newly discovered form of sensing, "quorum sensing" in bacteria, was explored by the Venezuelan researcher Luis Emilio Bruni, presently at the biosemiotics group at the University of Copenhagen. He exposed some of the molecular and ecological details of this fascinating system, consisting of a community of bacteria living in symbiosis inside a squid, who exploit the light-production of the bacteria to camouflage its shadowy gestalt when seen by predators from below against the moonlight.

Stepping up several levels of organization, there were papers dealing with the biosemiosis of the nervous system. In a thrilling talk the neurobiologist Donald Favareau from the University of California, Los Angeles, USA, discussed the neurosemiotic emergence of intersubjectivity and empathy. He saw biosemiotics as a way to ask the crucial questions that are often left behind in experimental research, and as a way to escape what he called "the fallacy fallacy" — i.e., smuggling down higher level varieties of semiosis to lower levels, claiming that only lower levels should be the "real" ones (e.g., that "racism" is something to be located exclusively in the brain). He balanced his view between Searle's observation that "I speak English, my neurons don't" and his own contribution to investigate the important role of so-called mirror neurons to code for highly specific kinds of actions. And from actions, we can have a self: A significant contribution of the mirror neuron system to human

cognition is not the dualistic idea that representation is mutual between agents ("my representation of *x* and your representation of *x* occur similarly in both of us, therefore you and I are similar") but, rather, the biosemiotic conceptual orientation that intersubjectivity — mutuality itself — is an intrinsic property of representational experience within agents ("my (primary level) representational experience of *x* is mutual to both my (higher-order) representational experience of myself and to my (higher-order) representational experience of you"). Martin Skov, a scholar from the University of Copenhagen, focused on the lack of knowledge (in brain as well as sign science) of how the nervous system integrates various kinds of information and pointed to Terrence Deacon's work as a promising example of the development of "neurosemiotics". And Anton Fuerlinger, a member of the Konrad Lorenz Institute for Evolution and Cognition Research near Vienna, Austria, complemented by pointing to the centrality of the organism's movement for a natural history of the higher level "codes": As brains are really the organisms' movement detectors, and movement is closely coupled with measuring (and remembering and comparing) the muscles positions, neuroscience has to take seriously the semiotics of the coherent neuro-muscle system. After several attempts to present a power point presentation, but failing because of technical problems of compatibility (a challenge for another kind of semiotics) Jyoo-Hi Rhee, a philosopher from Bielefeld University, Germany, finally chose to embody her digitalized paper and thus gave an in-depth critique of some of the prevailing metaphysical presuppositions in philosophy of mind regarding the "hard" problem of qualia (such as Jaegwon Kim's presupposed requirement of "causal closure of the physical universe"). Instead, she proposed to see qualia as biologically generated signs, a kind of natural sign-processing, and to redefine "the physical" and "the mental" as special ways to represent the world.

Needless to say that these brief remarks cannot do justice neither to any of the presented papers, nor to their many interrelations. After the powerpoint breakdown, Stefan Artman, a philosopher from Friedrich Schiller University in Jena, Germany, who introduced himself as coming from the Gutenberg age as he would "read" his paper, presented a clear conceptual analysis, based on the Kolmogorov-Chaitin theory of algorithmic complexity, of three types of semiotic indeterminacy, and applied this to a critical elucidation of the famous essay *Le hasard et la nécessité* by the molecular biologist and Nobel price winner Jacques Monod. The author of this note, a theoretical biologist, talked about an internal relation between the notion of function in biology and the notion of sign action in biosemiotics, both implying the organism as an irreducible complex structure. The organism is, of course, a crucial biological concept, often left out of focus in experimental biology, as well as a phenomenon of everyday "experiential" biology, and its causal structure involves a form of "downward causation" similar to the Aristotelian categories of formal and final causes. Wolfgang Hofkirchner from Vienna University of Technology, Austria, presented his reflections about biosemiosis in the context of emergent levels of self-organization. Abir U. Igamberdiev, a Russian

biologist from Voronezh University, now at the Risø Laboratory in Denmark, gave a rich talk about the semiotic structure of living systems, addressing imprints, codes and language games. The linguist Tuomo Jämsä from the University of Joensuu, Finland, developed a sketch for a biosemiotic version of speech act theory. Andres Luure from Tallinn Pedagogical University in Estonia talked about functional, adaptational and symbolic semiosis by taking his point of departure in theory of reference within contemporary philosophy of language, and suggested that referential expressions refer to objects, not in the world but in some model that asserts the existence of, say, a man with a glass of Martini standing in the corner, notwithstanding that the same man, in a better model, is most shockingly drinking water!

The last session included a talk by a central figure of contemporary biosemiotics, Jesper Hoffmeyer from the University of Copenhagen. He addressed the presumable schism between the "pansemiotic" approach (such as that of Voetmann Chrisiansen and Taborsky) and his own biosemiotic one. The point was that there is no real schism; pansemiotics is an unlucky term insofar it connotes "imperialist" aims, but in some sense we cannot do without at least some degree of a very broad notion of sign action in all of nature to have a genuine natural history of "subjectness" on the cosmic scale. It is logically impossible merely by the mechanics of natural selection to generate sentient living beings if there were no precursors of life and "living feeling" in the pre-biotic universe. Here, Hoffmeyer acknowledged the central role of Voetmann Christiansen for introducing to Danish scientists the broad Peircean outlook, and in particular for his way to reconcile bio- and physicosemiotics.

The Bateson-specialist and anthropologist Peter Harries-Jones from York University in Toronto, Canada, commented upon Gregory Bateson's important legacy in biosemiotics and his pivotal role for establishing a theory of the social inter-subjective aspects of biosemiosis, seen, for instance, in such phenomena as play, social exchange and reciprocity. Thus, higher order units of interpretation have to be considered in addition to Peirce's triadic signs and Uexküll's Umwelten. Finally, the immunologist Elling Ulvestad from Haukeland University Hospital in Bergen, Norway, gave an entertaining talk about the research on extraterrestrial life in which he compared biosemiotics as a field to astrobiology: SETI (Search for Extraterrestrial Intelligence) is indeed dealing with semiotic problems in deciding how to go about to detect extraterrestrial intelligent life, and addressing problems like "how does life begin and evolve?", "is the genetic code universal? " etc. And as what one ought to know, some satellites have indeed detected evidential signs of life on Earth.

You do not remember everything you do the first time. But the First Gatherings concluded with a shared and pretty living feeling that a rich field of research, germinating in distant areas of the world, have now progressed to a state where its further maturing imply a continuing and critical interaction by a diverse community of inquirers; and I look forward to the coming gatherings with the innocent hope that they will be just as intellectually joyful as the first.