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**Ecosemiotics and biosemiotics: a comparative study**

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**Abstract:** Ecological semiotics belongs to the field of culture, and biological semiotics refers to biology. There are both similarities and differences between ecological semiotics (ecosemiotics) and biological semiotics (biosemiotics). “Co-existence and co-prosperity” are the highest true meaning of human beings and nature. Faced with the increasingly serious ecological crisis, human beings, as the only semiotic animal that can reflect on sign activities, are ultimately responsible for other species and the entire ecological community.

**Keywords:** biosemiotics; ecosemiotics; semiosphere; semiotic threshold

**1 Introduction**

Jakob von Uexküll is a well-known pioneer in the field of biology who promoted the transformation of biology into semiotics and promoted the study of semiotics to gradually expand from the human-centered study to the field of biology. “Ecosemiotics” was put forward by Winfried Nöth in his article “Ecological Semiotics” in 1996. Nöth defined ecosemiotics as the study of the sign relationship between organisms and their environment (Nöth 1996), and Jesper Hoffmeyer also elucidated ecosemiotics in his articles (1996a, 1996b). In 1998, Winfried Nöth and Kalevi Kull published “Ecosemiotics and Semiotic Ecology” in the same issue of the famous semiotic journal *Sign Systems Studies*, established in 1964 by Juri (Yuri) Lotman. In this paper, Kull defined “symbolic Ecology” (later renamed ecological semiotics) as the study of the sign relationship between humans and ecosystems. Ecological semiotics as a branch of science has two directions: biosemiotics and ecosemiotics. There are some studies about biosemiotics and ecosemiotics, such as “biosemiotics in Tulus S. novel artworks” (Octo and Sri 2019), but few comparative
studies in Web of Science; for example, Zhang (2019) has clarified the concept of biosemiotics and ecosemiotics. Chinese scholar Professor Zhuanglin Hu has already developed several important perspectives on ecosemiotics in his paper in China National Knowledge Infrastructure, which mainly deals with a brief introduction to the combination of ecology and semiotics (Hu 2014). There are both similarities and differences between ecosemiotics and biosemiotics, but comparative studies between ecosemiotics and biosemiotics are few both in Web of Science and CNKI. On account of this, it is an important and urgent task to clarify the relationship between them.

2 Ecosemiotics

2.1 The definition of ecosemiotics

Ecosemiotics is the abbreviation of ecology semiotics. There is no unified and authoritative definition of ecosemiotics at present, because of scholars in different disciplines with different perspectives on the combination of ecology and semiotics. However, they have chosen different breakthrough points (Hu 2014).

Ecology is the indispensable foundation of ecosemiotics. Ernst Haeckel coined the term “ecology” in 1866 (Brasovan 2016). According to his view, ecology is the science which deals with the relation between organism and external environment. Ecology belonging to the natural science was originally a branch of biology, but ecosemiotics is the interdisciplinary combination of ecology and semiotics mainly focusing on cultural factors. The discipline connotation of ecosemiotics or semiotic ecology is mainly the study of the combination of nature and culture, and each discipline has its own focus. Ecosemiotics focuses on semiotics from the perspective of ecology, while semiotic ecology focuses on ecology from the perspective of semiotics.

In addition to the definition of ecosemiotics from Ernst Haeckel, some other definitions of ecosemiotics follow. Although ecosemiotics has drawn much attention in different contexts since the beginning of the 1990s (Kull 1998), scholars have observed ecosemiotics as a paradigm since the publication of Winfred Nöth’s article in 1996. Two years later, Kalevi Kull from Tartu University further narrowed ecosemiotics and defined semiotic ecology as a subject to study sign relations between humans and ecological systems. Afterwards, the definition of semiotic ecology by Kull, as a subsection and supplement to that of Nöth, became another orientation for developing ecosemiotics, that is,
cultural ecosemiotics. Nöth (2001) distinguished between cultural ecosemiotics and biological ecosemiotics: the definition of cultural ecosemiotics is as a part of the semiotics of culture, which surveys human relationships to nature which have a semiotic basis.

The ecosemiotics seminar held at the Imatra International Summer Institute for Semiotic and Structural Studies and the special issue of *Semiotica*\(^1\) also witnessed the birth of a new paradigm. More recently, Maran and Kull (2014, pp. 41–55) have elucidated ecosemiotics as “a branch of semiotics that studies sign processes as responsible for ecological phenomena.” On one hand, ecosemiotics is the inclusion of communicative processes of the entire ecosystem, and on the other hand, ecosemiotics offers a systematic and general basis for the usage of the semiotic approach in ecology. Maran (2017) has proposed that ecosemiotics referred to the broader context of living biological processes.

Up to now, the scholars have supplemented and made clear the scope of ecosemiotics, namely Nöth’s biological ecosemiotics studying sign relations between biology and environment, and Kull’s cultural ecosemiotics studying sign relations between human culture and nature.

### 2.2 The disciplinary foundation of ecosemiotics

The Tartu-Moscow School, zoosemiotics, Umwelt and different natures laid the foundation of ecosemiotics. Firstly, ecosemiotics benefited from the Tartu-Moscow School, especially Juri Lotman and Jacob von Uexküll, the Tartu-Moscow School founder and biosemiotic predecessor, respectively. Secondly, American semiotician T. A. Sebeok set zoosemiotics and developed the modeling system of the Tartu-Moscow School, in addition, he expanded semiotic threshold to the whole domain of life. Thirdly, Kalevi Kull’s different natures contribute to Ecosemiotics.

#### 2.2.1 The Tartu-Moscow School

Besides studying biosemiotics, the Tartu-Moscow School, mainly studying ecosemiotics, has experienced a systematic process from general semiotics, a combination of traditional Tartu-Moscow School concepts as modeling system, semiosphere and Umwelt to the systematic process of micronature, different nature and local nature, displaying interdisciplinary studies.

\(^1\) Semiotica 2001. Special issue. Jakob von Uexküll: A paradigm for Biology and Semiotics, Vol. 134 (1/4).
Modeling system is a central concept of the Tartu-Moscow School of Cultural Semiotics. The term originated from cybernetics and linguistics where it was employed to understand the functioning of literature, art, and other cultural phenomena (Zaliznjak et al. 1978). Lotman (2011) has proposed that modeling system is a structure of elements and rules of their combination, existing in a state of fixed analogy to the whole area of the object of perception, cognition, or organization. Modeling system has two aspects: the primary modeling system and the secondary modeling system. The primary modeling system refers to natural language, and the secondary modeling system includes art, religion, and myth. According to Lotman, a special feature of secondary modeling phenomena is that they do not depend on a single language but create models by combining the languages of the genre, cultural epoch, social group, idiosyncratic languages of the author, etc.

Two influential papers were published in the journal Sign Systems Studies issued by the University of Tartu Press: “Ecosemiotics” (Nöth 1998) and “Semiotic ecology: Different natures in the semiosphere”, which marked the beginning of ecosemiotics in Tartu (Kull 1998). Table 1 illustrates some famous events and activities in Tartu’s ecosemiotics.

### 2.2.2 Thomas Albert Sebeok’s zoosemiotics

After 1954, Sebeok published some papers on psycholinguistics, where some of his zoological interests are seemingly rooted, but the first appearance of the topic of

| Time  | Events and activities |
|-------|-----------------------|
| 1998  | Papers “Ecosemiotics” (Winfried Nöth) and “Semiotic ecology: Different natures in the semiosphere” (Kalevi Kull) published in Sign Systems Studies (vol. 28). |
| 2001  | First ecosemiotics summer seminar “Eesti loodus mõt(t)eviisid” [“Modes of estonian nature thought”]. |
|       | A special issue of Sign Systems Studies on semiotics of nature (vol. 29. Nöth, Winfried; Kull, Kalevi, eds.). |
| 2002  | First research grant on ecosemiotics awarded by the Estonian science foundation “The outlines of the ecological dimension of semiotics and the analysis of Estonian examples” (2002–2005; Principal investigator Kalevi Kull, department of semiotics, University of Tartu). |
| 2009  | The course “Ecosemiotics: Cultural interpretations of nature” is taught at the department of semiotics for the first time. |
| 2016  | Special issue of Sign Systems Studies, framing nature and culture. |
| 2018  | “Seminar on nature-cultures: Messages of nature protection” |
zoology dates only to 1962 (Sebeok 1962). Since then, animal communication has become a frequent topic of his publications. About the same time when zoology started to be his field, he also involved the field of semiotics. Quite soon after that, he started to use the term ‘zoosemiotics’ (Sebeok 1965). It means that Sebeok coined the term ‘zoosemiotics’. Sebeok’s book Perspectives in Zoosemiotics includes most publications in the first decade of the field of zoosemiotics (Sebeok 1972).

According to the initial formulation by Lotman, language is the primary modeling system, whereas culture is the secondary modeling system. Unlike the modeling system of the Tartu-Moscow School, Sebeok put forward three kinds of modeling: zoosemiotics modeling, linguistic modeling, and artistic modeling, and regarded an organism’s perception system as the primary modeling, linguistic modeling as the secondary modeling, and artistic modeling as the tertiary modeling.

### 2.2.3 Jakob Von Uexküll’s Umwelt

When Darwinian “evolution” was dominating biology, Jakob Von Uexküll was the first scholar to describe the concept of “Umwelt”. The term “Umwelt” is a set of relations which an organism has in an ecosystem (as in a semiosphere). One definition says that Umwelt is the individual world of an organism, an egocentric world, and the world as known or modelled (Cobley 2010). There cannot be an Umwelt without life centered on organisms. The organization of an Umwelt relies on the innerwelt as the primary modelling. For Uexküll, environmental themes are paramount: the notion that every animal inhabits a specific sort of Umwelt situated ecologically together with ethological questions at the heart of biology.

Umwelt includes the Merkwelt and Wirkwelt of organism, and they merge with each other to form the functional cycle. In the definition of functional cycle provided by Uexküll, the organisms could remodel their Umwelt when they communicate with the world. When at least two Umwelten communicate, in fact, they exist in the semiosphere. In the Umwelt of a flower girl, flowers are ornaments; in the Umwelt of a young man, a flower is a tool to woo a sweet girl; in the Umwelt of a bee attempting to forage, the petals’ roots are ideal access to the source of food.

Uexküll replaced Haeckel’s “outer environment” with the word “Umwelt”. The study of environmental signs is not limited only to the relationship between the innerwelt of an organism and its outer environment, but also to the semiotics of the internal objective environment that exists in the organism in addition to the semiotics related to the external environment, which Sebeok called “endo-semiotics” (Hu 2014).
2.2.4 Kalevi Kull’s different natures

Based on traditional views of the Tartu School, Kalevi Kull, one of founders of ecosemiotics, gave a critical comment on Nöth’s definition of ecosemiotics, which emphasized the subject concept of humans, focusing on studying nature’s significance to humans, communication between humans and nature and interaction by way of semiotics, etc.

Kalevi Kull raised a view of different natures from human influence. Zero nature refers to nature itself (e.g., absolute wilderness), untouched and unknown to humans, unable to describe via scientific language. First nature is the nature as we see, identify, describe, and interpret. Second nature is the nature which we have materially interpreted, in other words, material nature, a changed nature, or a produced nature. Third nature is a virtual nature, as it exists in art and science (Kull 1998).

There is a logical relationship among four kinds of nature, and through a simple combination, it shows the creative process between nature and image. Zero nature is from nature to nature, first nature is the nature to image, second nature is from image to nature, and third nature is from image to image. Figure 1 illustrates the process of formation in multiple natures. The combination of first nature and second nature is what we call Umwelt.

3 Biosemiotics

3.1 The definition of biosemiotics

In the 1960s, when semiotics began to institutionalize and textbooks started to publish for the introductory and general courses of semiotics, the biological field as represented by zoosemiotics and biosemiotics which was established in 1962

![Figure 1: The process of formation in different natures.](image-url)
had already become a part of semiotics (as, for instance, reflected in the first introductory books to semiotics by Bense 1967; Vetrov 1968). However, biosemiotic work was quite scarce until the early 1990s, when biosemiotics began to develop more intensively. An important landmark was the first book to bear the title of *Biosemiotics*, which also laid the foundation for an international collective of biosemioticians (Sebeok and Umiker-Sebeok 1992). Following Sebeok, biosemiotics is synonymous with global semiotics, the study of the “life of signs” and the “signs of life” (Sebeok 1979).

Kull (2016) gave a particularly lucid explanation of biosemiotics: a semiotic approach in biology is the study of the organisms’ own approach, the study of difference that they make, what they recognize, what they intend, and what they know, in a broad sense. Biosemiotics, which studies the production and interpretation of signs and codes in living systems (Kull 2016), derived from Peircean semiotics, but also from more zoologically oriented roots, such as Jakob von Uexküll’s concept of Umwelt (Kull 1999), then general system theory, later cybernetics, and information theory, etc.

If a primal scene was to be identified representing the conception of biosemiotics, Charles Sanders Peirce and Jakob von Uexküll may well be identified as the leading participants. Both Favareau (2006) and Hoffmeyer (2009) align Peirce and Uexküll as major pioneers in the field of biosemiotics. In addition, John Deely (1942–2017), a philosopher and semiotician, made a significant influence on both general semiotics and biosemiotics through his extension of the study of the fundamentals of semiotics (the study of signs and semiosis) and his positioning an analysis of the history of semiotics as the primary point of his complete reorientation of the history of philosophy (Cobley et al. 2017).

### 3.2 Biosemiotics and biology

Semiotics is the bridge between biosemiotics and biology. According to one standard scheme for the broad classification of organisms, five super kingdoms include protists, bacteria, plants, animals, and fungi (Sebeok 1997). These five groups represent different basic communication strategies, and accordingly, correspondent branches of biosemiotics are relevant. As biology is using corresponding divisions in scientific inquiry as bacteriology, protistology, botany, mycology, and zoology, one can correspondingly apply biosemiotic divisions for each kingdom, e.g., bacteriosemiotics, phytosemiotics, mycosemiotics, zoosemiotics, etc. Building biosemiotics exceeds the borders of biology. In fact, there is much work to do for serious philosophy, in view of philosophical topics (mind,
language, epistemology, and metaphysics), which cannot remain unaffected by the biosemiotic turn (Emmeche 2002).

Sebeok regards semiotics as a life science, which means that biosemiotics is not only its interpretation as a mere “section” of semiotics but also life science. Semiotics after Sebeok is not only zoosemiotics but also machine semiotics, environmental semiotics, and medical semiotics.

3.3 Biosemiotic balance

The problem of biosemiotic balance: In nature, organic balance and life’s balance are semiotic balance. In fact, the matter of ecological balance not only covers the problems of culture, but also the problems of human health; thus, protecting biodiversity and cultural diversity turns out to be parts of the same general problem—the protection of diversity, or quality (Petrilli and Ponzio 2005).

Biosemiotics purports to free the study of life of (humanistic) ideologies by granting signs and communication their rightful place in intellectual and scientific discourse. This means that discourse no longer lends itself to discrimination against species, races, ethnicities, sexes, or languages. The balance of biosemiotics is relatively stable, but sometimes biosemiotics loses balance (e.g., extinct species, and the surge of viruses), so humans should prepare some strategies.

4 The comparison between ecosemiotics and biosemiotics

4.1 The characteristics of ecosemiotics and biosemiotics

The characteristics between ecosemiotics and biosemiotics not only have similarities, but also distinctions. Clarifying ecosemiotics and biosemiotics is beneficial for understanding the relation between them.

4.1.1 The same characteristics

4.1.1.1 Semiotic threshold

Eco (1979) originally mentioned the notion of ‘semiotic threshold’ in his *A Theory of Semiotics*, which used the term to expound the boundary between the semiotic and non-semiotic world. According to Eco, the semiotic threshold is located on the
boundary of culture. On the contrary, as the founder of zoosemiotics, Thomas A. Sebeok disagreed with Eco. Sebeok said that there are sign processes in all living processes, therefore, the semiotic threshold is suited at the boundary of life.

Semiotic threshold is intricate and unstable, so the circle in Figure 2 is a dotted line instead of solid. Semiotic threshold is just like the membrane which is in contact with the external environment through the outer side of membrane, selectively exchanging substances, absorbing external substances, and converting them into internal specific structures. The semiosphere can only communicate with the external non-sign space through the boundary. The non-semiotic world will become semiosphere through semiotic threshold. Language is the boundary of the semiosphere and the direct embodiment of the cultural core. It is just like a membrane that acts as a filter, so that outer texts must traverse the membrane before they can enter semiosphere. Semiotic threshold cannot be visualized by means of the concrete imagination. Just as in mathematics, the border represents a multiplicity of points, belonging simultaneously to both the internal and external space. In the same way, ecosemiotics threshold and biosemiotics threshold are dynamic. Some parts of ecosmiotics penetrate ecosmiotics threshold to biosemiotics, while some parts of biosemiotics penetrate the biosemiotics threshold to ecosmiotics.

Figure 2: Semiotic threshold.

Life semiotics consists of two parts: ecosmiotics and biosemiotics. The scholars use relative conception and methodology of ecosmiotics and biosemiotics to analyze the questions in the semiotic field. The overlaps are the same characteristics between ecosmiotics and biosemiotics. Figure 2 illustrates the relation between them. In addition, the overlaps exist between ecosmiotics and edusemiotics, biosemiotics and edusemiotics, and so on. So ecosmiotics, biosemiotics and edusemiotics are complementary.
4.1.1.2 Semiosphere

Since 1984, when J. Lotman’s article “On Semiosphere” was published, this concept has been moving from one terminological field to another. Kalevi Kull listed 17 different definitions of semiosphere, which is beneficial for full understanding of the term. Some definitions follow: “Lotman (1990) said that the semiosphere is the consequence and the condition for the development of culture”. Kaie Kotov and Kalevi Kull have explained how the concept of the semiosphere expresses the predominance of semiotic processes: “semiosphere is a sphere of semiosis and an experience thereof; and as such, it is a prerequisite for any single act of communication to be interpreted as one” (Kotov and Kull 2011, pp. 179–194).

Hoffmeyer (1996a) used the concept of the semiosphere to express the sum of all semiotic and communicative processes on the planet. According to Hoffmeyer (1996a), the semiosphere is a domain just like the atmosphere and biosphere. It includes every aspect of other spheres, incorporating all forms of communication: sounds, colors, shapes, electrical fields, thermal radiation, touch, and so on. In short, signs of life. American medievalist and eosemiotician Alfred K. Siewers, who used the term “ecosemiosphere” proposed another interpretation of the semiosphere that connects culture and nature. According to him, “an eosemiosphere literally means an ecological bubble of meaning (borrowing the term “semiosphere” from semiotics). In the same way, a biosemiosphere literally means a biological bubble of meaning. Eosemiosphere and biosemiosphere are parts of semiosphere. However, semiosphere not only includes eosemiosphere and biosemiosphere, but also covers edusemiosphere, ethsemiosphere, and so on.

Overlaps are the same characteristics of eosemiotics and biosemiotics in Figure 2, and diversity is another shared characteristic. Kull’s elaboration of the semiosphere in the form of the ecosphere as a space of diversity seems essential (Kull 2004). Diversity not only exists in eosemiotics but also in biosemiotics, and diversity is the central concept of eosemiotics as well as biosemiotics. The suggestions made by these authors indicate that the diversity of the semiosphere probably goes beyond humans and incorporates both the semiotic activities of other species as well as semiotic potentials of inanimate nature. Cultural diversity and biological diversity should be a process of mutual interaction and influence. In this aspect, semioticians need to carry out in-depth research.

There is no communication or language outside the semiosphere (Nöth 2014). The internal and external space of the semiosphere is unstable; in other words, it is a dynamic process, especially the semiotic threshold. Semiosphere is a set of all related umwelten. If any two umwelten are in conversation, they are parts of the same semiosphere (Sutrop 2001).
4.1.2 The different characteristics

In addition to the same characteristics between ecosemiotics and biosemiotics, scholars researched different characteristics. Thomas A. Sebeok not only touches on biosemiotic problems but also refers to the area of representations of (and approaches to) nature in cultures in his writings. This field, known nowadays as (cultural) ecosemiotics, which is different from biosemiotics because it does not deal with biological problems and belongs rather to the domain of the semiotics of culture (Kull 2003).

In addition to the lineage of biosemiotics, ecosemiotics has applied principles inherited from Uexküll and Peirce to conceptualize the collective interactions of organisms together with and within a shared environment mediated by sign relations. Much like ecology more generally, the field of study determined by ecosemiotics is not entirely sure. Papers published by Nöth (1998) and Kull (1998) served to encourage interest in ecosemiotics, but early on a distinction was between biological and cultural ecosemiotics (Nöth 2001). Whereas the former concerns the significance sustained by organisms of different species in the relationships they form together with an environment, the latter focuses specifically upon human relationships to the natural environment in terms of their semiotic basis.

4.2 The relations between ecosemiotics and biosemiotics

The development of biosemiotics (an approach to biological systems as communicative or semiotic systems) and the discussions about semiotic processes in and between biological organisms have set the foundation for an ecological approach within semiotics (on biosemiotics, which is the general study of sign processes in the living world, except in human culture) (Emmeche and Kull 2011).

In 1996, Nöth presented the term ecosemiotics in his work “Ecosemiotics”, defining it as a study on sign relations between life and environment, which, however, overlapped definitions of biosemiotics, human ecology, theories of environment, and value in boundary, directly causing the silence on the beginning of study on biological ecosemiotics towards the concept of universal biology.

According to several scholars, the relation between ecosemiotics and biosemiotics is not certain. Figure 3 illustrates internal nature and external nature in Hoffmeyer’s three-dimensional view of culture. When discussing the relationship between culture and nature, Hoffmeyer (1996a) at the University of Copenhagen, Denmark, divided nature into internal nature and external nature, thus drawing a triangle relationship including culture, external nature, and internal nature. The
The relation between internal and external nature is the domain of biological semiotics, the relation between culture and external nature is the domain of ecosemiotics, and the relation between culture and internal nature is the domain of psysemiotics (Kull 1998).

According to Hoffmeyer’s explanation, biosemiotics analyzes living systems as sign systems, with the purpose of studying the origin of sign. Ecosemiotics belongs to synchronic, but Hoffmeyer supposes that ecosemiotics should also study the diachronic process of culture-nature relationship, that is, the development of nature in the cultural process. Because the research field of biological ecosemiotics advocated by Nöth overlaps too much with biosemiotics, the latter soon covered and submerged the former. Compared with the rapid development of biosemiotics, the research progress of ecosemiotics has been relatively slow, but it has greatly developed and produced fruitful results in multiple research directions.

5 Conclusion

In the books *Semiotics Unbounded: Explanative Routes Through the Open Network of Signs* and *Sign Crossroads in Global Perspective: Semioethics and Responsibility* by Augusto Ponzio and Susan Petrilli respectively, it was pointed out that global communication had turned the earth into a biosemiotics sphere in which human beings, as the only semiotic animal that can reflect on sign activities, were ultimately responsible for other species and the entire ecological community.
Hoffmeyer (2008) said that semiotic mutualism involving a delicate balance of interactions among many species is widespread. “Co-existence and co-prosperity” are the highest true meaning between man and nature; if man and nature cooperate, they will win, and if they do not cooperate, they will be worst enemies. If they continue to split, the living environment of humans will continue to deteriorate, which is a revenge on humans by nature, and the result will be the extinction of human beings and the degradation of nature. Therefore, human beings should protect endangered animals and plants, and fulfill the “co-existence and co-prosperity” between humans and nature.

Without nature, the sign has no place; without culture, the analysis of the sign is difficult, and human cognition will be stuck in zero nature and first nature, making it difficult to cross over to second nature and third nature. In the face of serious ecological crisis, the meaningful world is not the whole of the human world. We need to break through the formalism trend of mainstream semiotics, question ethics, responsibility, and morality, and cross into a vast world of ethical semiotics.

References

Bense, M. 1967. *Semiotik: Allgemeine theorie der zeichen*. Baden-Baden: Agis.
Brasovan, N. S. 2016. An exploration into neo-confucian ecology. *Chinese Philosophy* 43(03). 203–220.
Cobley, P. 2010. *The Routledge companion to semiotics*. London, England: Routledge.
Cobley, P., D. Favareau & K. Kull. 2017. John Deely, from the point of view of biosemiotics. *Biosemiotics* 10(1). 1–4.
Eco, U. 1979. *A theory of semiotics*. Bloomington: Indiana University Press.
Emmeche, C. 2002. Günther Witzany: Life: The communicative structure – A new philosophy of biology, Libri books on demand, Hamburg 2000. *SATS: Northern European Journal of Philosophy* 3(1). 155.
Emmeche, C. & K. Kull. 2011. *Towards a semiotic biology: Life is the action of signs*. London, England: Imperial.
Favareau, D. 2006. *Introduction to biosemiotics: The new biological synthesis*, 1–67. Berlin: Springer-Verlag.
Hoffmeyer, J. 1996a. *Signs of meaning in the universe*. Bloomington: Indiana University Press.
Hoffmeyer, J. 1996b. Für eine semiotisch reformulierte Naturwissenschaft. *Zeitschrift für Semiotik* 18(1). 31–34.
Hoffmeyer, J. 2008. *Biosemiotics: An examination into the signs of life and the life of signs*. Scranton: Scranton University Press.
Hoffmeyer, J. 2009. Biology is immature biosemiotics. In J. Deely & L. G. Sbrocchi (eds.), *Semiotics 2008: Specialization, semiosis, semiotics*, 927–942. Ottawa: Legas.
Hu, Zh. L. 2014. The unity of opposites between nature and culture: On the theoretical orientation of ecosemiotic studies. *Foreign Languages Research* 146(4). 1–5.
Kotov, K. & K. Kull. 2011. Semiosphere is the relational biosphere. In C. Emmeche & K. Kull (eds.), *Towards a semiotic biology: Life is the action of signs*, 179–194. London, England: Imperial College Press.

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

Kull, K. 1999. Biosemiotics in the twentieth century: A view from biology. *Semiotica* 127(1). 385–414.

Kull, K. 2003. Thomas A. Sebeok and biology: Building biosemiotics. *Cybernetics and Human Knowing* 10. 1.

Kull, K. 2004. Semiosphere and a dual ecology: Paradoxes of communication. *Sign Systems Studies* 33(1). 175–189.

Kull, K. 2016. The biosemiotic concept of the species. *Biosemiotics* 9. 61–71.

Lotman, J. 1990. *Universe of the mind: A semiotic theory of culture*. Bloomington: Indiana University Press.

Lotman, J. 2011. The place of art among other modelling systems. *Sign Systems Studies* 39(2). 249–270.

Maran, T. 2017. Mimicry and meaning: Structure and semiotics of biological mimicry. In *Biosemiotics*, vol. 16. 123–132. Berlin: Springer.

Maran, T. 2018. Two decades of ecosemiotics in Tartu. *Sign Systems Studies* 46(4). 630–639.

Maran, T. & K. Kull. 2014. Ecosemiotics: Main principles and current developments. *Geografi-ska Annaler: Series B, Human Geography* 96(1). 41–50.

Nöth, W. 1996. Ökosemiotik. *Zeitschrift für Semiotik* 18(1). 7–18.

Nöth, W. 1998. Ecosemiotics. *Sign Systems Studies* 26. 332–344.

Nöth, W. 2001. Ecosemiotics and the semiotics of nature. *Sign Systems Studies* 29(1). 71–81.

Nöth, W. 2014. The topography of Yuri Lotman’s semiosphere. *International Journal of Cultural Studies* 18(1). 11–26.

Octo, D. A. & S. Sri. 2019. Biosemiotics in Tulus S. novel artworks. Advances in social science, education and humanities research. In *Proceedings of 3rd social sciences, humanities, and education conference*, vol. 380, 4–8. Netherlands: Atlantis Press.

Petrilli, S. & A. Ponzio. 2005. *Semiotics unbounded: Interpretive routes through the open network of signs*. Toronto: University of Toronto Press.

Sebeok, T. A. 1962. Coding in the evolution of signalling behavior. *Behavioral Science* 7. 430–442.

Sebeok, T. A. 1965. Zoosemiotics: A new key to linguistics. *The Review* 7. 27–33.

Sebeok, T. A. 1972. *Perspectives in zoosemiotics*. The Hague: Mouton.

Sebeok, T. A. 1979. *The sign & its masters*. Texas: Texas University Press.

Sebeok, T. A. 1997. The evolution of semiosis. In R. Posner, K. Robering & T. A. Sebeok (eds.), *Semiotics: A handbook on the sign-theoretic foundations of nature and culture*, vol. 1, 436–446. Berlin: Walter de Gruyter.

Sebeok, T. A. & J. Umiker-Sebeok (eds.). 1992. *Biosemiotics: The semiotic web* 1991. Berlin: Mouton de Gruyter.

Sutrop, U. 2001. Umwelt word and concept: Two hundred years of semantic change. *Semiotica* 134. 447–462.

Vetrov, A. A. 1968. *Semiotika i ee osnovnye problemy*. Moskva: Izdatelstvo politicheskoy literatury.

Zaliznjak, A. A., V. V. Ivanov & V. N. Toporov. 1978. Structural-typological study of semiotic modeling systems. In D. P. Lucid (ed.), *Soviet semiotics: An anthology*, 47–58. Baltimore: Johns Hopkins University Press.
Zhang, Y. 2019. Study on ecosemiotics from Russia to China. *Advances in social science, education and humanities research*. In *Proceedings of the 6th international conference on education, language, art, and inter-cultural communication*, vol. 378, 495–497. Netherlands: Atlantis Press.

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