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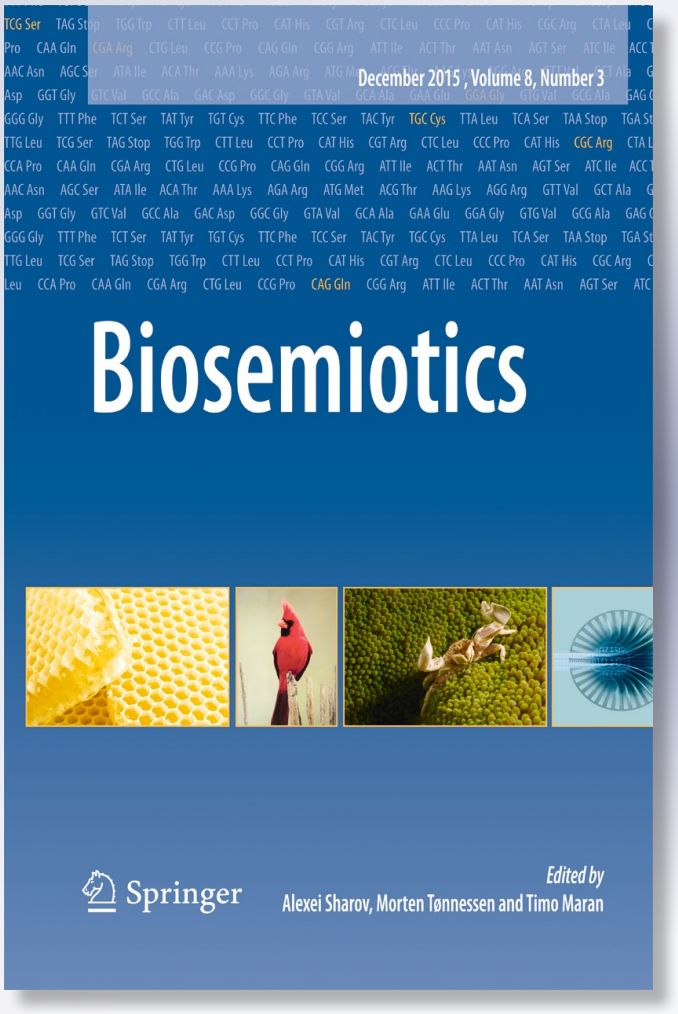

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EDITORIAL

Organisms Reshape Sign Relations

Alexei Sharov[1] · **Timo Maran**[2] · **Morten Tønnessen**[3]

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A key feature of biosemiotics is, in contrast with traditional semiotics, that it considers the dynamics of semiosis at multiple time scales, and emphasizes the active role organisms have in reshaping sign relations. Historically, semiotics has been focused either on the structural properties of signs systems or on the relations between sign vehicles, objects, and human interpretations. Questions about the origin and dynamics of sign relations have rarely been raised. Uexküll, who developed the foundational ideas of biosemiotics, was the first to propose that objects in the environment have specific meanings for different organisms. In his biological perspective, organisms have a pivotal role in developing their meaning relations with the environment. Uexküll (1926: 317) further observed that

> [t]he external world offers to the organism a certain number of properties separated in space and in time, from which to select, and therewith the possibility of making a poorer or a richer surrounding-world [Umwelt]. But the external world itself takes no part in the selection, which has to be made by the organism without external assistance.

Uexküll's understanding of evolution departed from Darwin's ideas of environmentally-driven natural selection. He thought that organisms are active players in evolution, and that embryogenesis and animal behavior are mediated by the meanings that are associated with various objects (Magnus 2011; Brentari 2015: 60).

The dynamic nature of sign relations and meanings has been emphasized e.g. in studies of child development in humans. Both Jean Piaget and Lev Vygotsky noted the role of sign-mediated processes in child development and described the developmental

✉ Alexei Sharov
sharoval@mail.nih.gov

[1] Laboratory of Genetics, National Institute on Aging, Baltimore, MD, USA

[2] Department of Semiotics, University of Tartu, Tartu, Estonia

[3] Department of Social Studies and Department of Health Studies, University of Stavanger, Stavanger, Norway

stages in semiotic terms (e.g. symbols and signs in Piaget 1951). "The early human umwelt", as Tønnessen (2014: 281) observes, "is characterized by rapid change, radical transformations, and gradual establishment of the first and most basic umwelt objects by way of exploration and learning." In the foetal and infant human Umwelt, most Umwelt objects are not concise and stable, but diffuse and unstable (ibid, 295). In the Uexküllian perspective, Umwelt objects have various functional tones. This implies that a specific Umwelt object only acquires a stable character once its functionality for the organism has been established in perceptual terms, at some point in the organism's ontogeny. In the human case we can therefore state, as a rule of thumb, that "[o]nly for the adult (or the mature teenager) has the meaning carried by umwelt objects become altogether stable and predictable" (ibid, 302). To make use of Uexküll's words, once some object has fallen under the spell of a human Umwelt, it is either ultimately neglected or "altered and reshaped until it has become a useful meaning-carrier" (Uexküll 1982: 31). Infancy and childhood are thus, in the ontogeny of human beings, first and foremost a time for continuous alteration, reshaping and, as Uexküll would have it (in the context of evolution, where he used the term *Einpassung*), fitting-in.

Healthy development presupposes that the organism in question is surrounded by a semiotically and structurally rich environment that meets its species-specific requirements. Only there an organism can exercise its activity in selecting significant elements, attributing meanings to environmental objects and developing one's Umwelt. This holds true whether we are talking about human child development (where required elements include social caretakers and eventually companions) or the ontogeny of organisms in general. Emphasizing the active role of organisms has crucial implications for understanding the dynamics of ecological and evolutionary processes. By altering sign relations, organisms are capable of influencing what and how they recognize and respond to, and what environmental resources they make use of (Farina 2012). Semiotic activity allows the organism to manipulate, to a certain degree, ecological factors that act upon it. The organism thus alters and maintains its own ecological niche (cf. theory of niche construction, Odling-Smee 1988, 2003). Intraspecies recognition and communication are also phenomena that are known to be factors that lead to species change and the emergence of new species (Irwin et al. 2001; Leal and Losos 2010).

Organisms reshape sign relations, and not only those sign relations that are under their own control, but also in other species. This is especially evident in parasitism, where parasites modify the behaviors of their hosts in a way that is beneficial for the parasite. For example, insects infected by virus or fungus often tend to crawl up on the vegetation, which facilitates the spread of the infection (Hoover et al. 2011). Mice infected by a single-cell parasite *Toxoplasma gondii* become attracted to cats' urine, which increases the chances of completing the life cycle of the parasite (Ingram et al. 2013). In mimicry relations, the semiotic activity of an organism may establish a connection between the predator's perception and the body of the mimetic species, and imprint in evolutionary time an image of the predator's Umwelt into the perceptible features of the prey (Maran and Kleisner 2010). As demonstrated by these examples, the semiotic activity of organisms has various ecological and evolutionary effects.

Papers published in this issue exemplify new developments of the notion that organisms actively reshape sign relations. Following Uexküll's ideas, Dr. Karel Kleisner argues in his paper that the behavior and cognition of living organisms are

both products and factors of these organisms' development and evolution. In particular, organisms develop what he calls "semantic organs", which "are semi-autonomous relational entities facilitated by exposed organismal surfaces and defined by the meaning they acquire due to a particular perceiver". These are organs that are used for communication purposes, either exclusively or (more commonly) in addition to other functions. Kleisner emphasizes that semantic organs exist as multi-species sign relations, and that they are therefore sustained by multiple genomes and multiple developmental and learning capacities. This notion challenges the traditional views of upward causation in biology and genetics that genomes determine phenotypes and fitness. Moreover, according to Kleisner, "exposed surfaces of animals do not necessarily carry just one meaning and need not have a unique addressee". It would thus be an oversimplification to treat them as mere signals. Semantic organs (e.g., faces) are especially important for higher animals and humans who use them for recognizing individuals and to form individual-based social relations. The existence of semantic organs proves that behaviors have a direct effect on the evolution not only of the same species (as in the Baldwin effect), but also of other species.

In his paper "The Spatiality of Being", Dr. Ireland, a biosemiotician and architect, shares his vision of living organisms as agents capable of organizing their functional space. Following Gregory Bateson's ideas, he writes that "an organism is affected by, and thereafter affects, the world as a result of differences which it perceives and acts on by means of its ability to identify and perform". The paper introduces a sensory- and interaction-based concept of space, which is then used to build a model of dynamic niche construction where organisms are embedded in the environment that is their own creation. For organisms, space is more than just geometric coordinates – it is marked with various meaningful signs and modified in order to satisfy living needs, including interaction with other organisms. "If living systems are both products and manipulators of signs," Ireland states, "then they are also intrinsically products and manipulators of space as well, because signs almost always involve some spatial dimension." The idea of niche construction is illustrated by a simulation model, where a niche of an agent is geometrically represented by a moving amoeba-like shape with multiple semiotic components at the boundary that sense neighboring areas and respond by either advancing or retreating. The model shows how agents respond to environmental signals and to the presence of other agents. Multiple agents may either merge or disjoint their niches depending on the nature of their interaction (i.e., attraction or avoidance). As a result, interacting agents within a community develop a complex mosaic of partially overlapping niches, which represents their functional space.

Dr. van Hateren proposes a new model of evolution according to which organisms can predict their own fitness (in terms of potential for survival and reproduction) and modify their activities accordingly. In other words, van Hateren establishes that in addition to the objective fitness of Neo-Darwinian evolutionary biology there is also subjective fitness, fitness as perceived by organisms. Higher animals can consciously select behaviors that are likely to increase their chances to survive or reproduce in a particular environment. However, van Hateren targets his model to organisms that do not have the cognitive complexity that is required for selecting behaviors in this way. He assumes that organisms can change the *variation* of their activities: if subjective fitness is high, then organisms keep their activities as they are, but if subjective fitness is low, then they increase their behavioral variability. In this perspective, the whole

evolutionary process comes to resemble the movement of bacteria in water: starving bacteria initiate rapid movements in various directions, and this helps them to find sources of nutrients. But after arriving to a nutrient-rich area, bacteria switch back to local, low-speed searches. The most interesting aspect of van Hateren's model is that evolution appears to be semiotically driven, because it is mediated by perception of one's own fitness and subsequent selection of behavior. Van Hateren claims that his model explains how agency, goals, and meaningful behaviors emerge in evolving organisms.

The paper by Dr. Adornetti explores pragmatic aspects of the evolution of human language, and in particular the role of discourse coherence, which is essential for effective communication. Adornetti proposes that coherent communication emerged after the human lineage departed from that of other great apes. She further claims that it is related to the development of the executive functions (responsible for action planning and execution) in the course of hominin evolution. In other words, the deep foundation of human language is joint activity, not the grammatical structure of sentences. According to Adornetti, "discourse coherence and goal–oriented behavior rely on the same neurocognitive systems responsible for planning and organizing action". The connection between speech and action is exemplified by cases of traumatic brain injury and communication between humans and apes.

Dr. Lindholm explores parallels between biosemiotics and the Extended Evolutionary Synthesis (EES). He proposes the formula "DNA dispose, but subjects decide" to emphasize the active and semiotic role of organisms in evolution. After briefly summarizing the role of developmental and epigenetic factors (Evo-Devo theory) and niche construction in evolution and speciation, Lindholm turns to his main topic: the role of *learning* in the evolution of animals. He revisits a textbook example, the radial speciation of the Darwinian finches inhabiting the Galapagos Islands, and provides a novel explanation for the process, which he regards as driven by animals' cognitive and semiotic faculties. Lindholm further analyzes the conditions that allow animals to learn and to choose to perform certain actions. Although learning capacities are heritable and thus depend on genes, behaviors are not *determined* by genes but can be initiated *de novo.* This can in turn lead to unexpected, unpredictable evolutionary changes. Examples include the effect of food choice in Galapagos finches, the effect of mate choice in song birds, and the effect of habitat choice in various bird species.

The brief communication by Dr. Gómez et al. explores a notion initially proposed by Villarreal (2009), namely that parasites may be integral components for their hosts, thus determining some features of their identity. A cell then appears to be a society or an ecosystem of partially conflicting and/or cooperating molecular elements. One of the inspiration points for Gómez et al. is the philosophy of Nietzsche, who emphasized the importance of internal conflicts within individuals. According to the authors, the virus is a signal that "precipitates the cell's change from a latent to an active pathological state". This signal may be reactivating "pre-existing molecular affinities and activities, re-establishing ancient molecular webs of interactions, and giving fragments of ancient coded information (mostly in the form of RNA structural motifs) the opportunity to be re-expressed". The phenomenon of symbiosis is certainly more diverse and abundant than its description in biology textbooks indicates. This prompts us to rethink agency as possibly occurring in a multi-level community with partially conflicting interests and evolutionary trends. Here, the phenotype is a product of communication between multiple

subagents. Perhaps the most interesting aspect of interaction between organism components is their effects on each other's evolution. For example, integrated viruses that produce a toxin-antidote pair of proteins appear to prevent the development of antiviral mechanisms in their hosts (Villarreal 2009: 37, 63). Furthermore, a latent viral infection may facilitate increased complexity and more robust cellular mechanisms, which is beneficial for the infected organism in the long term (Gómez et al.).

The semiotic activity of organisms may in some cases create a complex interplay between nature and human culture. An example is provided in the paper by Dr. Maran, which describes the human response to the appearance of the Golden Jackal in Estonia. This response followed preexisting cultural models and was affected by speculations about the origin and effects of jackals, as well as by legal and bureaucratic hassle over the invasiveness of the species. It is, however, the activity of the new species itself, that adapts and spreads in these new ecological conditions, which appears to be the major initiating force of the human discourse. Jackals' changing diet and further migration in the Baltic region reshapes the initial human perceptions of the species. Maran's analysis stands in contrast to the common view in conservation discourse, where animals are considered as passive objects under human management, and he recommends developing more dynamical and biosemiotically informed approaches.

In conclusion, the set of papers in this issue emphasizes the key idea of biosemiotics that sign relations are actively constructed and reshaped by organisms. Moreover, organisms change sign relations in other species, either via direct control or by applying behavioral and evolutionary constraints.

References

Brentari, C. (2015). *Jakob von Uexküll: The discovery of the Umwelt between biosemiotics and theoretical biology (biosemiotics 9)*. Dordrecht: Springer.

Farina, A. (2012). A biosemiotic perspective of the resource criterion: toward a general theory of resources. *Biosemiotics*, *5*(1), 17–32.

Hoover, K., Grove, M., Gardner, M., Hughes, D. P., McNeil, J., & Slavicek, J. (2011). A gene for an extended phenotype. *Science*, *333*(6048), 1401.

Ingram, W. M., Goodrich, L. M., Robey, E. A., & Eisen, M. B. (2013). Mice infected with low-virulence strains of *Toxoplasma gondii* lose their innate aversion to cat urine, even after extensive parasite clearance. *PloS One*, *8*(9), e75246.

Irwin, D. E., Bensch, S., & Price, T. D. (2001). Speciation in a ring. *Nature*, *409*, 333–337.

Leal, M., & Losos, J. B. (2010). Evolutionary biology: communication and speciation. *Nature*, *467*, 159–160.

Magnus, R. (2011). The biological and philosophical implications of Jakob von Uexküll's time-plans. In L. Lukas, U. Plath, & K. Tüür (Eds.), *Umweltphilosophie und Landschaftsdenken im baltischen Kulturraum/ Environmental philosophy and landscape thinking (collegium litterarum 24)* (pp. 137–153). Tallinn: Underi ja Tuglase Kirjanduskeskus.

Maran, T., & Kleisner, K. (2010). Towards an evolutionary biosemiotics: semiotic selection and semiotic co-option. *Biosemiotics*, *3*(2), 189–200.

Odling-Smee, F. J. (1988). Niche-constructing phenotypes. In H. C. Plotkin (Ed.), *The role of behavior in evolution* (pp. 73–132). Cambridge: The MIT.

Odling-Smee, F. J. (2003). *Niche construction*. Princeton: Princeton University Press.

Piaget, J. (1951). *Play, dreams and imitation in childhood*. London: William Heinemann.

Tønnessen, M. (2014). The ontogeny of the embryonic, foetal and infant human umwelt. *Sign Systems Studies*, *42*(2/3), 281–307.

Uexküll, J. v. (1926). *Theoretical biology.* New York: Harcourt, Brace & Co.

Uexküll, J. v. (1982). The theory of meaning. *Semiotica*, 42(1), 25–82.

Villarreal, L. P. (2009). *Origin of group identity. Viruses, addiction and cooperation*. Irvine: Springer.