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SEMIOTIC MODELING OF DIRECT PERCEPTION:

ENVIRONMENT AS TEXT AND CREATING IT THROUGH LEARNING

Master Thesis

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I hereby declare that I have written this Master Thesis myself, independently. All of the other authors' texts, main viewpoints and all data from other resources have been referenced.

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Introduction

0.1. Delimitation of the research topic

This thesis, comprised of two papers and a framing introduction, concerns semiotic modeling of direct perception of the environment with a two-fold aim: first, to use a consistent methodological approach in each paper toward the testing and redefining of semiotic models, and second, to develop on the topic further in the introduction by specifying semiotic concepts for the study of direct perception. Direct perception is defined by James J. Gibson (1986) in ecological psychology as immediate perception of the environment, as contrasted with mediated perception via symbolic depictions such as pictures, verbal descriptions, and narratives, or tools that enhance our perception such as microscopes or telescopes. The common methodological approach used in each paper is an ad hoc approach that treats the research object as a subject by evaluating the relevance of the theories considered, then explicitly appropriating the chosen theories to the particularities of the research object. Such an approach is described by Peeter Torop (2014) as one used toward dynamic research objects, or research objects with low analyzability. This methodology is also a marker of the Tartu-Moscow school of semiotics, discussed by Torop as Juri Lotman's movement toward the model of the semiosphere in regards to the dynamic object of culture (ibid). This methodology is important, as it allows the researcher to be receptive to the dynamic research object. The final development in the introduction, specifying four semiotic concepts, is essentially a clarification of semiotic metalanguage at an abstract level of analysis.

The first paper contains an analysis of human perception of a specific, named stretch of river from the functional point of view of a whitewater raft guide. This paper experimentally applies Lotman's early, more structural theory of text in order to reveal similarities and differences from traditional applications of text, and to make the appropriate modifications to the metalanguage in the context of the new research object. The second paper is at a more general level of perception that is not species-specific, and critically examines the applicability of concepts from structural linguistics to perception. This paper brings forth the theories of Jakob von Uexküll and Gregory Bateson in the enhancement of a

metalanguage that could apply to communication and interaction across multiple species. In both papers, perception is regarded as an act (sometimes referred to by the author as functional perception) and the subject and environment are treated as an indivisible unit. This kind of approach is employed by Jakob von Uexküll, James Gibson, Gregory Bateson, and Tim Ingold, whose works are drawn from in the papers.

0.2. Context and overview of research in the field

This study is part of a larger ongoing search in the environmental humanities for suitable research concepts and methods that transcend traditional dichotomies of nature/ culture, mental/material, etc. This section will touch upon specifically semiotic approaches to perception, followed by research in the context of each paper. The first paper is more relevant in the emerging field of landscape semiotics, as it combines structural and perceptual models to a particular stretch of river as framed by the activity of whitewater rafting. The second paper ultimately specifies the role and concept of learning in relation to Uexküll's umwelt theory. This finds significance in the field of ecosemiotics, a field that has become more defined since 1998, when two papers were published in English on the topic in *Sign Systems Studies* (vol. 26) by Kalevi Kull (1998) and Winfried Nöth (1998). This paper especially relates to an ecosemiotic approach as described by Lindström et al. (2014: 123) as one concerning "environmental design by organisms" via distinctions organisms make, intentionality and learning of the organisms, "communication and its role at all levels of living systems", etc.

Uexküll's umwelt theory and concept of functional cycle is foundational for a semiotic approach to perception of the environment and is the central topic of the second paper of this thesis. Originally inspired by Uexküll's approach, perceptual models have also been well-developed by Thomas A. Sebeok, the founder of zoosemiotics and catalyst for the emergence of biosemiotics. In response to the modeling theories of Lotman, Sebeok and others suggest the primacy of a zoosemiotic modeling system underlying a secondary linguistic modeling system and a tertiary cultural modeling system (for example, Sebeok and Danesi 2000; Sebeok 1994). In a parallel manner, Alf Hornborg outlines three types of human sign systems toward perception of the natural environment: the phenomenological or

unconscious layer from which only a fraction can be codified linguistically, the linguistic layer which includes metaphors and taxonomies (anything that can be conveyed through language), and economic sign systems, or the most detached type of sign systems from the environment (2001). John Deely, a close associate of Sebeok, contributes works extending and specifying the concept of the human umwelt (e.g. see Deely 2001; 2003; 2005) and also devotes much research to the topic of the semiotic threshold, providing a detailed overview of this debate in *The Basics of Semiotics* (1990).

Also relevant from the field of semiotics is Almo Farina's ecofield hypothesis, which treats the concept of landscape in terms of a configuration of objects defined by their use in relation to organisms (Farina and Belgrano, 2004; 2006). Farina and Napoletano's concept of "private landscape" develops this idea further into a perceptual context, which "[…] shifts the notion of landscape from the popular notion of a large-scale spatial mosaic to a more dynamic entity whose scale and configuration depends both on the organisms being considered and their immediate resource requirements" (2010: 181). Anthropologist Tim Ingold (2000), though not claiming to represent a specifically semiotic approach, should still be mentioned in this context, as his pivotal collection of essays on human perception of the environment largely draws from the works of Uexküll, Gibson, and Bateson, and he essentially frames perception in terms of semiotic activity.

In the context of the first paper, contemporary studies of human activity on rivers tend to take psychological or phenomenological approaches, focusing on the recreational side of the activity. Examples of psychological approaches are prevalent in leisure studies, such as Kyle et al. (2004) and Frederickson, Anderson (1999). A phenomenological turn spanning multiple disciplines, including the fields of human geography and landscape studies, began to treat landscape or environment as a more holistic and corporeal experience (e.g. Christopher Tilley's (1994) phenomenological approach in archaeology; Abram 1996). Phenomenological approaches toward rivers include Beck (1987), Krause (2013), Strang (2004, 2005) and Suchman (2007). The phenomenological turn was a critical reaction against structural approaches and essentially views structural approaches as representational. This paper differs by taking a structural approach that is considered to be immediate, rather than mediated, and also explicitly draws parameters around the research object at the level of conscious

perception, leaving unconscious perception outside the scope of structural analysis. This leaves room for a more unconscious and open phenomenological layer of experience that would require a different, more flexible metalanguage to describe it. To borrow Hornborg's (2001) typology of economic, linguistic, and phenomenological sign systems, the lattermost would be the least abstract layer and the most connected to the environment.

The application of text to the river results in a unique combination of structural and perceptual models in the context of semiotics as well as other related fields where this has been done, namely landscape studies and human geography. Lotman (1990) himself touches upon the possibility to apply the notion of text to the city in his analysis of St. Petersburg, but he focuses on cultural and symbolic meanings and memory. The structural approach to reading the river combines Lotman's early notion of text with Gibson's structural approach to visual perception, the latter of which treats meaning in terms of affordances discovered by subjects through an active process of "information pick-up" (1986: 147). The resulting notion of text is different in that it is a functional approach that ties actions and orientations of the river guides to the features of text that Lotman has pointed out as fundamental to the meaning-making process: demarcation, hierarchical structure, and the realization of a system of signs (Lotman 1977).

Other structural approaches tend to focus on social relations and their embodiment in material surroundings (Duncan 1992), or they emphasize the interpretation side in order to reveal the diversity of viewpoints (e.g., de Certeau 1984). Anne Spirn (1998) contributes notable work applying the concept of language to landscape, but has a much broader scope and also devotes a great deal of attention to the aesthetic as well as metaphorical side of landscape. The analysis of reading the river as a whitewater raft guide explicitly defines the scope of analysis, which also sets it apart from other works on the similar topics. It is a very specific and detailed break-down of visually perceived forms and corresponding actions and shows that human visual perception can be structurally analyzed, even in a dynamic situation such as orienting a river, because there are many layers to our perceptual experience.

The second paper was originally inspired by an insightful suggestion made by Thure von Uexküll, who states, "Thus, we can compare terms such as system, structure, unit, code, etc., which have been taken from linguistics, to the terminology of the Umwelt theory,

because the linguistic terms seem to illustrate the concepts of the Umwelt theory in a more precise manner than do the illustrations drawn from music, which Uexküll favored" (Uexküll, T. 1992: 286). Due to differences that have later been pointed out between animal and human semiosis (e.g. Deacon 1997, Maran 2012, Kull 2014), the author argues against taking this direction, and suggests another line of development toward the impact of learning on the umwelt and ecosystem as a whole. At first glance this appears to be contradictory to the first paper, which demonstrates the possibility of structurally analyzing perception. However, the first paper is species-specific to humans. Many other studies, such as in cognitive linguistics (Lakoff, Johnson, 1999), demonstrate relations between verbal language and human perception, which may play a role in the analyzability of human percpetion in structural terms. The second paper deals with the much more general level of animal perception, and therefore this level of abstraction necessitates a different metalanguage.

The concept of learning plays an important role in the metalanguage of the second paper. The semiotics of learning has been addressed implicitly by Gregory Bateson (2000 [1972]), which is relied upon in the paper, and more recently in explicit terms by Kalevi Kull, who correlates different types of learning to different types of semiosis, defining learning in general as the establishment of new sign relations in his statement, "If a response becomes a habit […] it is called *learning*" (Kull 2014: 52). Andrew Stables (2006) also contributes a semiotic approach to learning for fields of human activity, such as education, with the aim of displacing conventional dichotomies such as mind-body. Learning is primarily studied in the fields of psychology and education and has been broadly categorized into two major paradigms of objectivism (the transmission of an abstract code) and constructivism (an active process of interpretation dependent on individual histories and situational conditions). This dichotomy is addressed in the pivotal works of Pierre Bourdieu (1990), Jean Lave and Etienne Wenger (1991), and George Lakoff (1987), and becomes a useful tool for distinguishing implicit concepts of learning in structural linguistics and Jakob von Uexküll's approach.

0.3. The research questions and methodological basis

The questions driving this thesis are: 1) can we analyze human direct perception of the natural environment with a concept of text, and how does this dialogue affect the semiotic

metalanguage, and 2) can we bring concepts from structural linguistics into Jakob von Uexküll's perceptual model, and if not, what would be the next steps for development? Both of these questions concern a refinement of the semiotic metalanguage for analyzing functional perception of the environment - one with humans in particular, and the other toward animals in general. Through the process of seeking answers, both papers clearly define the parameters of the research object, as well as the scope of the applied theory. The conclusions of the thesis specify semiotic concepts from these studies that are relevant at a more abstract level of direct perception in general.

Both papers emphasize the importance of ad hoc methodology as a fundamental part of a semiotic approach. Peeter Torop has addressed ad hoc methodology and reflexivity as specific features of the Tartu-Moscow semiotic school, and more specifically in response to novel objects with low-analysability that demand the researcher to construct, define, and create the analysability (Torop 2014). The object of the first paper, reading the river from the point of view of a whitewater raft-guide, has been studied in terms of optimal experience from a phenomenological point of view in the Ph.D. thesis of LA Beck (1987), and from a more general phenomenological-anthropological approach connecting sensory experience to cultural models (Krause 2013). From a structural-semiotic standpoint, the author needed to be receptive to the particularities of the research object, which resulted in some modifications to the applied theory of text. For example, the changing water level turned out to modify the internal sign-relations of the environmental text, resulting in the concept of a natural meta-sign.

Another important factor in an ad hoc approach is a specification of the level of analysis, as different levels or aspects of research objects may warrant different languages of description. The level of analysis plays an important role toward establishing parameters of theories and definitions of concepts. In the first paper, 'reading the river' as a text is on the level of a conscious and habitual practice, a level more abstract than the phenomenological, unconscious level, because it can be easily described linguistically, and less abstract than the level of general human physical constraints and cultural models. For example, it would be very difficult, if not impossible, to apply a structural concept of text to the unconscious, phenomenological layer dealt with, for example, by David Abram (1996). An example of this

would be like trying to apply the concept of text toward the balancing act of walking a slackline, something that is similar to a tightrope but sinks downward a bit when weight is applied, resulting in movement of the line as one walks on it. Every slight movement of the body is responding to movements of the line and vice-versa, in a dynamic interaction that is impossible to learn without doing it, new every time, and largely unconscious. As one becomes skilled at this activity, the borders between the body and the slackline become blurred, and such a dynamic research object results in low analyzability. However, the phenomenological layer is not denied importance for whitewater rafting, as it is observable from an outside perspective in the difference in skill between experienced river-guides, who easily stay in the current without paying much attention, and novice guides who are known to zigzag in and out of the current in a tireless effort to stay in it. One could say that the more experienced the guide, the less strong are the borders between the guide and the river. This aspect would warrant different research methods, such as participant observation, and a more flexible metalanguage than the concept of text.

As part of the ad hoc approach for determining the applicability of a theory to a specific research object, the author also uses the same framework for differentiating semiotic theories in each paper. This framework explicates the notions of sign and code in the theory, the aim of the theory, the methodology used, and the locus of meaning-generation emphasized by the theory. It is found that in the theories originating in linguistics and literary theory (e.g. Saussure 2011 [1959; 1916]; Jakobson 1956, 1960, 1967; Lotman 1977, 1978), the notion of sign is an arbitrary unit that is only intelligible in terms of differential value in relation to other units within a bounded hierarchical system. The "glottocentric" nature of studies of culture is criticized by Susan Petrilli as European-dominated (2012), and by Paul Cobley, who suggests that analyses of culture are built upon a premise of human exceptionalism, while biosemiotics offers a more "agent-friendly" approach (Cobley 2010: 228). Semiotic concepts of syntactics, semantics, and pragmatics also become useful for differentiating two different approaches. In structural linguistics and Lotman's early notion of text, as well as in the first paper of this thesis, more attention is paid to to the relations of syntactics and semantics, while in Jakob von Uexküll's and Gibson's approaches, more attention is paid to the relations between semantics and pragmatics. This results in different

methodologies, as the subject plays a much greater role in the perceptual models of meaning-making and must be studied as a result (for example, Jakob von Uexküll's umwelt research).

0.4. Abstracts of the papers and structure of the thesis

This section provides the abstract of each paper to introduce the papers with more clarity and to show the specifics of each paper. The introduction is then finalized by a conclusions section which synthesizes the findings of the two papers into an integral semiotic metalanguage tailored for the study of direct perception. The structure of the thesis could be viewed as concentric circles in regard to this research topic. The introduction is the largest, most abstract circle. The second paper, discussing primarily theories at a general level of perception that would include all animal species, would be the middle circle. The first paper, which is species-specific toward humans and activity-specific toward whitewater rafting, would be the smallest and most concrete circle.

0.4.1. Abstract of "Shoshone as a text: A structural-semiotic view of reading the river as a whitewater raft guide"

This article investigates the functional 'reading' of a river by whitewater raft guides in order to understand the semiotic mechanisms involved in human direct perception of the environment compared to the reading of cultural texts. This research finds significance in the on-going search for theories and methodologies in the environmental humanities. Juri Lotman's theory of text is applied in an ad hoc analysis of a section of river named Shoshone in Glenwood Springs, Colorado, USA in order to examine whether his theory is useful for interpreting and analysing human perception of the environment, and how his notion of text could be enhanced in this dialogue with a new research object. Lotman's theory is found to be useful for describing the cognitive side of reading the river, as connections between visually perceived forms on the river are connected to specific bodily movements in response. Lotman's theory is then brought into dialogue with the work of James J. Gibson, whose research on direct perception of the environment both problematises and potentially compliments Lotman's theory on this material. Basic similarities between cognitive perception of the environment and the reading of cultural texts are suggested; namely,

demarcation, hierarchical structure, and the realisation of a system of signs. Important differences are also discovered, such as the greater variety of interpretation afforded by cultural texts than interaction with the river, as well as the largely unconscious bodily attunement to the environment involved in reading the river. Two modifications are conclusively made to Lotman's theory, informed by both the object and Gibson's theories, as a step toward a semiotic research model for analysing human perception of the environment, which is at a blurry intersection between cultural mediation and physically functional perception.

0.4.2. Abstract of "Expanding Umwelt Theory: From Structural Linguistics to Cognitive Learning"

I present a response to Thure von Uexküll's attempt to complement Jakob von Uexküll's theories by incorporating concepts from structural linguistics. I more closely compare structural linguistics and Jakob von Uexküll's theories, noting significant differences unmentioned by Thure von Uexküll, leading to the claim that Jakob von Uexküll's theories need further development in relation to cognitive learning. I suggest that learning has a higher status and different conceptualization in a bio- or eco-semiotic approach than it does in structural linguistics. Bateson's concepts of proto- and deutero-learning are found to be complementary to Jakob von Uexküll's theory at the intra-specific level, while Hoffmeyer's notions of semethic interaction and semiotic freedom are useful to describe interspecific relations and semiotic capacities of organisms.

0.5. Preliminary conclusions and future directions of study

The aim of this thesis was to test and redefine semiotic models in a consistent way, and to develop the topic a bit further in the framing introduction via the specification of semiotic perceptual concepts. Both papers suggest steps toward new research models. The first outlines an environmental concept of text informed by a dialogue with the research object and with Gibson's theory of affordances. The semiotization of the water level by the river guides leads to the concept of a natural meta-sign, or a sign in the environment that changes the context or internal syntactical relations of a meaningful environmental unit.

Additional modifications in response to Gibson's theory is the differentiation of two different levels of pragmatic constraints, the lowest level being the actual situation and actions taken in the moment, and the more abstract level that includes cultural models, human physical capabilities, and individual histories and skill. The second paper suggests complementing Jakob von Uexküll's theories with Bateson's multi-leveled approach to learning, with proto-learning being the level of habitual sign processing, and deutero-learning at the level of establishing correspondences with greater contexts, or learning new patterns of proto-learning. Using these findings as well as additional literature on the topic, some semiotic concepts related to direct perception of the natural environment are outlined.

1. In semiotic perceptual models of the environment, the subject is inherently part of the structure of the sign in its active distinction between self and other. Signs are therefore acted. This is discussed more explicitly in the second paper, in the breakdown of the notion of sign. In the case of reading the river, the meaning of the forms perceived on the river are the actions taken by the river-guides. Only those particular features on the river that play a role in the action and orientation of the guides become signs (including features on the river that are given proper names), while other features are not recognized.
2. The concept of code is viewed as a continuum from closed to open codes (open codes first suggested by Maran, 2012). Linguistic and symbolic codes are at the closed end of the spectrum, having the capacity for decontextualization, while ecological codes are at the open end of the spectrum. The river as text is closed to the extent that it involves only one species, can be described linguistically, and is fixed as a cognitive plan in the mind of the guide on the river, but also more open than linguistic texts, as it is subject to environmental changes, such as the water-level. A fully open code includes multiple species and means no participant has access to the full code, each participant contributes to the construction of the code via acted signs, and the code is contested and in constant flux. This overlaps with Gibson's concept of perception as continuous, with past and present indiscrete, as well as Ingold's concept of environment (and therefore, organism) as never complete, or in other words, a process that is "continually under construction" (2000: 20).
3. Learning is situated and hierarchical. It is understood as the creation of correspondences in a spatio-temporal context. At the level of proto-learning, this is the creation of

correspondence between a sign and its meaning. At the level of deutero-learning, this is the creation of correspondences between a sign and its context. In the case of the river, this concept of learning would be on the situational and perhaps phenomenological level of reading the river, which is outside of the scope of the paper, while the transmission of the text of Shoshone via verbal description and maps would be a different and more human-specific notion of learning.

4. Natural meta-signs are signs perceived in the environment that are about other environmental signs, altering their meaning for the perceiver. To conceptualize meta-signs as discrete seems much easier from a human perspective, given the capacity to codify environmental phenomena linguistically (such as in the case of the water level for river guides). Meta-signs for animals should be considered much more distributed and holistic, such as the qualitative changing of seasons, differences in time of day, or internal physiological state. Gregory Bateson conceives body language and other "paralinguistic" signs among mammals as meta-communicative, which, for example, changes the meaning of words for humans (2000[1972]: 371). These could also be considered non-discrete meta-signs. Recognition of new contexts is not always via the processing of meta-signs. For example, it also occurs through organisms' ontogenetic development, an aspect well articulated by Jakob von Uexküll.

This list is intended to be a step toward the construction of a metalanguage in response to the dynamic research object of direct perception. A future research problem for development is the analyzability of the process of learning. How could this be studied and better understood from a semiotic perspective? This could be done via participant observation methodology in the same research object of reading the river, by observing new river-guides and learning to river-guide oneself. In addition to the hierarchical levels brought out in this thesis, different stages could also be established, and different sign types relied upon in learning could be brought out. For example, in her study of inter-specific communication, Riin Magnus (2014) points out that one semiotic principle in the formation of signs between guide dogs and their handlers is that referential communication shifts from symbolic to symptomatic signs, or in other words, from segmented verbal signs to subtle bodily movements that are less visible to the outside observer. Considering the common knowledge

among river guides that the more experienced guides effortlessly remain in the current while the newer guides tend to zig-zag across it, this shift from symbolic to symptomatic signs may also be relevant in the process of learning to read the river.

Another line of development for this thesis could be to explicate further ecological sign types. Could there be a further analysis that goes deeper than the abstract notion of meta-signs, and how might these be described? Maran's idea of archetypical structures already gives examples of this, such as loud, low sounds or quick movements inspiring an archetype of fear (2012). This very abstract layer of signs in the animal world brings forth a closer look at semiotic connections across various species.

Functional-perceptual semiotic concepts could also be extended toward human reception of cultural texts in order reveal similarities and differences between the two. Tim Ingold's essay on "mind-walking" explores this topic further and suggests that "[…] the terrains of the imagination and the physical environment, far from existing on distinct ontological levels, run into one another to the extent of being barely distinguishable" (2010: 15). Cobley also contributes a paper demonstrating the relevance of biosemiotic concepts to cultural and linguistic phenomena (2010).

Finally, a somewhat different direction could be taken in terms of specifically human perception of the environment. Whitewater rafting serves as a fruitful research object to understanding the many different sign systems applied to a concrete environmental text. It could be widened to include further human sign-systems. For example, it could include the layer of economic sign systems as articulated by Hornborg (2001), as there are at least six known commercial companies running the section of Shoshone studied by this thesis, and Shoshone is used as a unit to measure the cost and structure the type of trips. In addition to studying the relations between the economic sign system and the vitality of the ecosystem it impacts, relations between the functional sign system and the economic sign system could be explicated (for example, it is better for business to hit big waves or to see specific features from specific positions on the river). Symbolic stories could also be included and related to other sign systems and underlying cultural models. The different forms of memory that these various sign systems are stored in could also be taken into account, and different types of texts could be brought out and compared (functional texts, historic narratives, etc).

SHOSHONE AS A TEXT: A STRUCTURAL-SEMIOTIC ANALYSIS OF READING THE RIVER AS A WHITEWATER RAFT GUIDE

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Abstract. This article investigates the functional 'reading' of a river by whitewater raft guides in order to understand the semiotic mechanisms involved in human direct perception of the environment compared to the reading of cultural texts. This research finds significance in the on-going search for theories and methodologies in the environmental humanities. Juri Lotman's theory of text is applied in an ad hoc analysis of a section of river named Shoshone in Glenwood Springs, Colorado, USA in order to examine whether his theory is useful for interpreting and analysing human perception of the environment, and how his notion of text could be enhanced in this dialogue with a new research object. Lotman's theory is found to be useful for describing the cognitive side of reading the river, as connections between visually perceived forms on the river are connected to specific bodily movements in response. Lotman's theory is then brought into dialogue with the work of James J. Gibson, whose research on direct perception of the environment both problematises and potentially compliments Lotman's theory on this material. Basic similarities between cognitive perception of the environment and the reading of cultural texts are suggested; namely, demarcation, hierarchical structure, and the realisation of a system of signs. Important differences are also discovered, such as the greater variety of interpretation afforded by cultural texts than interaction with the river, as well as the largely unconscious bodily attunement to the environment involved in reading the river. Two modifications are conclusively made to Lotman's theory, informed by both the object and Gibson's theories, as a step toward a semiotic research model for analysing human perception of the environment, which is at a blurry intersection between cultural mediation and physically functional perception.

Introduction: epistemology of Tartu semiotics

Various notions of text have been applied to landscape in human geography. One common approach, textual analysis, is connected with discourse analysis, and "describes the attempt to understand the content, mode of address and authority, organization, and other aspects of language-in-use" (Dittmer 2010, 280). This approach centres on power relations and natural language-based concepts of text. Other applications of text include structural and post-structural approaches, the latter emphasising the interpretation side of the text and

thereby aiming to uncover the multi-vocal nature of landscape representation (Duncan & Duncan 2010). Structural semiotic approaches, most often using theories derived from Ferdinand de Saussure, are criticised for the researcher's alleged assumption that s/he is an "expert decoder" of the landscape (op cit, 226). Underlying these approaches and criticism is the idea that landscape as a text is notably separate from reality. Text in this sense is an arbitrary representation of landscape and something to be contested.

This paper takes a different approach to textualisation of landscape in an application of Juri Lotman's notion of text to direct perception of a particular section of the Colorado river, about 3.4 kilometres, called Shoshone in Glenwood Springs, Colorado, USA. A few words about epistemology are important in order to understand what is different about this approach, and why it is useful. The ad hoc, object-based epistemology often employed by Tartu semiotics reflects the assertion that different research objects, levels, or aspects of research objects may necessitate different languages of description, as well as modify the theory in the process of analysis. This relates to the importance of distinguishing the metalanguage from the object language, expressed in the notable statement: "[...] we should distinguish between the conception of culture from its own point of view – and from the point of view of a scientific metasystem which describes it" (Uspenskij et al 1973, 1). This is a particular form of reflexivity based on the premise of modelling theory. The way that the researcher describes the object undoubtedly transforms it by selecting certain aspects and drawing particular organisational relations between them – a process guided by the organisation of the theories used and broader academic and paradigmatic discourse. Lotman states that this is the case for all theoretical knowledge, as "any logical model is known to be poorer [i.e. more abstract] than its object and can be an instrument of knowledge only under this condition" (1975, 199). However, in models like the one used in this analysis, extra-systemic empirical features found to contradict the researcher's system of explanation do not intrinsically render the explanation insufficient, but are a necessary part of these two different levels of reality. As Lotman states, deformation "is a means and a condition of knowledge" (op cit, 203). It is rather more important to ascertain the appropriateness of the model chosen for the research object, opening up a dialogue between the two. Instead of necessitating a more specific critical approach to power relations, a step often taken in human

geography, this transformative phenomenon based on different codes, contexts, and interpreters – or in one phrase, the "theory of models" – is considered to be one fundamental aspect of meaning generation (op cit, 200). Additionally, the separation of text from reality is not something to be marked as a peculiar phenomenon, as reality for all observers is always partial, constructed, and transformed through modelling systems. Therefore semioticians do not necessarily consider their research as expert decoding, but rather as a useful, constructive point of view.

1.1. Theory, object, and discovery

1.1.1. Theory and object

Shoshone as a text is specific to the point of view of a river guide within the activity of whitewater rafting, explicating a functional connection between visually perceived forms and corresponding bodily actions. The material for this analysis includes visual, written, and verbal representations associated with river guiding, as well as previous participation by the author in a river orientation course and professional guiding on Shoshone and other rivers. This study finds significance in several contexts. First, it is part of a larger on-going search for suitable methodologies and research concepts in the environmental humanities (for example, ecocriticism, new materialism, human geography, and landscape studies) for interpreting and analysing human interaction with the physical environment. Second, this contributes to an understanding of the semiotisation of the physical environment in the context of the Tartu semiotic tradition by critically examining the use of literary concepts for environmental perception. Finally, this study contributes a possible approach for the emerging field of ecosemiotics, understood generally here as the semiotic analysis of the relations between nature and culture. Therefore, this study expands Lotman's theory of text while also contributing to transdisciplinary research developments exploring relations between nature and culture.

The *Conceptual Dictionary of the Tartu-Moscow Semiotic School* has abstracted eight different definitions of text from Lotman's work (Levchenko & Salupere 1999). For the purpose of this analysis, being rather far from traditional applications of text, just three basic

features are taken from *The Structure of the Artistic Text*: the text realises a system of signs, it is demarcated as a unit, and it has an internal, hierarchical structure (Lotman 1977). These basic features are chosen because direct perception of the river is not near as arbitrary as an artistic text, the latter of which is much more complex in combining multiple sign systems on the same level. An artistic text necessitates greater attention to extrasystemic features, having their own autonomous orders which often contradict each other, enabling the generation and storage of large amounts of information through this heterogeneity of sign systems. Only one sign system is described in this textualisation of the river, which cannot be localised at the cultural level, but is in between direct perception and culture. This more situated, functional knowledge is less open to interpretation than an artistic text. It is influenced by culture as a socially mediated activity pursued for a myriad of reasons, and as the body of knowledge associated with how to physically function on the river, what kind of technology is required, and the specific terminology associated with the activity and locality of Shoshone.

In practice, culture is responsible for providing the opportunity to develop this specific functional perception. Once actually rafting on the river, human physical capacities for perception and action come into play and attune to the river over time through practice, alongside the verbal and visual descriptions of how to be a good river guide, and explanations for things that go wrong. While the textual nature of a functional perception of the river could be said to be simpler than an artistic text, the experience as a whole is a rich one, ranging from phenomenological affect to the symbolic narratives attached to significant features in Shoshone, and to Shoshone as a whole. These aspects of whitewater rafting exceed the limits of this paper, though they deserve further study.

The basic concept of text used in this analysis also complements James J. Gibson's approach to direct perception of the environment, who sought terminology to describe how optical information pick-up, enabled by locomotion within an entire perceptual system, consists of a concurrent recognition of variant and invariant structures in the environment (1986). While Lotman is relied on much more heavily for this analysis, Gibson provides a relevant theoretical point of comparison in order to not only observe what Lotman's theory contributes, but also to understand how it is changed and problematised on this material.

Applying Lotman's notion of text to perception of the natural environment is unexplored territory both in human geography and in traditional Tartu-Moscow semiotics.[1] The closest application by Lotman himself was his analysis of St. Petersburg, which suggests potential, but he primarily focuses on the level of the city as a whole, including historical development, mythologies, and symbolism embodied in the architecture and geography (Lotman 1990). The meaning described in this paper is functional meaning framed by a specific activity. Lotman's work has, however, served as an impetus for debates about the primacy of perception as a modelling system (for example Sebeok & Danesi 2000). Thomas A. Sebeok, who established the field of zoosemiotics and later catalysed the development of biosemiotics, has contended that a zoosemiotic modelling system must be the primary one, while language is a secondary modelling system and culture a tertiary one (for example Sebeok 1994). John Deely, a close associate of Sebeok, also contributes a great deal to the discussion on the semiotic threshold, and has thoroughly integrated these perspectives in his extensive work, *The Basics of Semiotics* (1990).

'Reading the river' is common phrasing used by river guides and river orientation instructors. There are many different ways of physically reading the river that occur simultaneously. One not only sees the current in contrast with slower moving water, but feels it in the way that the boat moves. Guides constantly adjust their actions in response to situated, multi-sensory information, a process referred to by Gibson with a variety of terms, such as "attuned", "sensitized", and "education of attention" (1986, 254). Tim Ingold calls this process "sensitisation", defined as the "'fine-tuning' of the perceptual system to new kinds of information" (2000, 166). Ingold's term 'sensitisation' will be used from here on to refer to Gibson's concept. Such a process itself may warrant a different metalanguage or level of description, though the process as a whole could be positioned in a potential model that combines Lotman and Gibson on this material, which is discussed in part three.

The notion of text borrowed from Lotman appears to be most useful for describing the cognitive side of reading the river, with a focus on a habitual connection between visual recognition and bodily actions. Cognitive approaches and visual perception in landscape

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[1] In an interview with Kalevi Kull in 1992, Lotman states that it would "undoubtedly" be legitimate to apply his theories to biology and that, "[...] what does not exist in the simple will never exist in the complex" (Lotman & Kull 1992). This conversation is available in Russian.

studies and human geography have been reacted against for their historical roots in a nature-culture dichotomy, giving rise to "phenomenological, non-representational, actor-network and performative theories [...] which emphasize materiality and embodiment, prediscursive knowing and fluidity [...]" (Duncan & Duncan 2010, 239). However, cognitive and visual aspects cannot be denied importance, especially in this activity. Their functional significance for river guides is reflected in one of their key maxims, 'set up early'. Because the river is constantly moving, this means consciously reacting in preparation to what is spotted up ahead on the river in terms of bodily movements to position the boat, modify speed, and communicate with the crew the plans for action.

1.1.2. Research questions and discoveries

Two main research questions drive this analysis, one ontological, and the other theoretical. The first question is, what are the similarities and differences between human perception of the environment and reading a cultural text? This question is a very relevant one for semiotics as a study of general meaning-making, and finds special significance in the context of Tartu semiotics today, which includes the rich history of cultural semiotics alongside the growing fields of biosemiotics and ecosemiotics. The second more theoretical question is, can Lotman's theory of text, having originated in literary theory, provide a useful model for interpreting human perception of the environment? This opens up the opportunity for potential changes to be made to his theory in the process of this dialogue with a new research object, which could expand and enhance his theory of text.

The answers to these questions are pursued in two ways. The first approach, covered in part two, is object-focused in an analysis of Shoshone as a text. Reading the river as a river guide is a hybrid activity that blurs the boundaries between cultural mediation and direct perception of the environment, paving the way toward combining them into a new model. This analysis reveals something important in the research object which could further refine Lotman's theory of text in relation to a possible type of research object under the umbrella term 'human perception of the environment'. The fluctuating water level of the river, which is within the text, functions as a meta-sign that changes the internal sign relations of this text in a systematic way.

Meta-sign is a term adapted from Gregory Bateson to describe paradoxical signs that are both within the frame and acting as the frame (Bateson 2000 [1972]). Lotman refers to similar features in traditional texts in relation to their cultural contexts, when he states: "[...] a text may contain within it both textual and metatextual elements as particular substructures [...]. In this case the communicative currents move vertically" (Lotman 1988, 56). In the case of the natural environment, such a meta-sign is based on repetition of a significant change in the environment, which has been dealt with in landscape studies in terms of rhythms or seasonality. The formal marking point for such a sign is only partly arbitrary, as the habits of action are based on affordances offered by the river, the technology of the raft, and the physical capabilities of human beings, in addition to the cultural level of whitewater water rafting. Meta-signs may be one way of recognising seasonal changes or rhythms in the environment that systematically reorganise the internal sign relations of perceived environmental structures. Other changes may occur as a gradual change of content that eventually crystallise into a new internal structure, which parallels landscape researcher Kenneth Olwig's notion of qualitative seasons, or "this qualitative bounding of quantitatively unbounded phenomena" (2005, 261). Systematic variance, whether indicated by signs within the text or coming about from a gradual change of its internal sign relations, as opposed to the variance generated by diversity in interpretation, is an additional theoretical component required for analysing perception of the natural environment as a text.

The second perspective taken in this paper, discussed in part three, is at the level of theory in a discussion of the possible interaction between Lotman and Gibson on this material. Lotman provides a more precise semiotic metalanguage for analysing the semiotisation of the river, while Gibson provides a more general theoretical basis for linking together perception and action in terms of pragmatics and physical constraints. Important differences are also explicated between these two theories. Most notable is the different role of the subject in Lotman's notion of text and Gibson's approach to perception of the environment, which relates to different methodologies and explanations of meaning-generation. Charles Morris's general theory of signs is used as a reference point for comparison and an additional resource for terminology in the move toward combining Lotman and Gibson into a new model. Lotman's theory of text, enriched by both the object

and Gibson's theories, is found to be a useful contribution toward the analysis of this research object, uncovering similarities and differences between meaning generated through cultural texts and meaning generated through perception of the environment.

1.2. Analysis of Shoshone as a text

1.2.1. Demarcation

As mentioned before, three basic features of the text are used to describe Shoshone. First, the text must be demarcated as a unit. This unit can carry different functions for different social communities (Lotman & Piatigorsky 1978). Shoshone is collectively demarcated by a variety of users, including commercial rafting companies, the forest service, and private adventurers, by the 'put-in' or boat ramp (located on the highway exit called Shoshone) and the Grizzly Creek 'take- out' (located on the highway exit called Grizzly Creek), or the next boat ramp down-river of the put-in. This level of the whole functions economically for rafting companies as it marks one possible 'trip' tourists can purchase. It also marks a section to be patrolled by the forest service, a federal institution responsible for ensuring, among other things, that commercial companies are following safety laws associated with using the river. This unit also functions for various individuals in over a dozen YouTube videos, who record their adventurous experiences with water-proof video cameras on the river trips. Such videos include "Shoshone" in the title or description and begin and end the video with the put-in and take-out boat ramps.

Of most interest for this analysis is the functional meaning of the whole for river guides, which is expressed by the International Scale of River Difficulty (Whitewater). This system rates particular rapids as well as whole sections of rivers like Shoshone on a scale of one to six, six being too dangerous for commercial usage. These ratings are based on the general morphological structure of the river and the strength of flow of the river. Shoshone is divided in a partly arbitrary way into 'high' and 'low' water according to seasonal changes in the water level, and is rated a class four at high water and a class three at low water. What is most significant about this classification system in relation to Shoshone as a text is that from class three and up, previous visual inspection of the river is required before one can actually

travel the river. This means walking alongside the river and noting significant features and possible routes that can be taken, as ad hoc reading would be too dangerous. Therefore, a functional textualisation of the river, or in other words, a memorisation of significant features (often facilitated by giving them proper names, as will be seen in the next section) and habitual actions associated with them to form a specific route through a bounded section, is probably more common from class three rapids and up, when visual inspection and a specific cognitive map is necessary.

1.2.2. Sign system and hierarchical structure

The second basic feature of the text is that it must realise a system of signs. Lotman states that, in this sense, the text is the material realisation of an abstract system, analogous to Saussure's speech and language (Lotman 1977). The abstract system realised by Shoshone consists of visually recognised and termed features of the river with corresponding habitual actions shared (at least) by the local rafting companies and a river orientation course at the local community college, Colorado Mountain College. The author calls this system the river-bound sign system. The structure of the river-bound sign system can be understood in comparison to natural language. Since Lotman references Saussure's language and speech, the structure of natural language can be understood in Saussure's terms; that is, a system of phonetic and conceptual differences (respectively: cat/hat; father/mother) (Saussure 2011 [1959]). The river is a fitting analogy to Saussure's idea of amorphous thought and sound, and its features are also intelligible in terms of differential value. Relevant contrasts distinguish larger features, exhibiting a hierarchical structure of perception.

Hierarchical structure in terms of perception of the natural environment has been described by both Gibson and landscape architect Anne Spirn with a term called "nesting", and Spirn explicitly relates this to language (Gibson 1986, 9; Spirn 1998, 16). Nesting describes how features of the environment appear as forms within forms, each level having a different order, such as a leaf within a tree within a forest. The river is a bit different in that there is a relative independence of form from a constantly flowing substance, probably creating a different phenomenological affect. However, forms on the river still exhibit a hierarchical structure that is important for functional meaning. At the most minimal level are

those differences that function to recognise features – differences in the speed of the water, the direction of flow, and the texture, shape, and colour of its surface. At the next level are those termed features such as the current, eddies, rocks, and waves. They are more complex in that they consist of multiple differences working together. A significant difference from Saussure's concept of language, however, is that such differential value on the river is not entirely arbitrary, but is based on perceptual capabilities of humans, affordances offered by the river, and the material technology associated with the specific activity of whitewater rafting.

There are many examples of differential value in the river-bound sign system. One very important feature is the current, or the fastest moving part of the river, where it is generally best to keep the boat, as it helps build speed for waves. The current is only intelligible in contrast with slower moving water. Another feature is an eddy, or calm water that slowly moves in a circular direction against the main current (Figure 1). Eddies are created by an upstream obstacle, such as a jutting shore or a large rock. They are distinguished by a line separating them from the rest of the water flowing downstream, as well as a glassier surface and a detectable difference in the direction of flow. Eddies function as places to stop the boat, often necessary to comply with the safety law enforced by the forest service to maintain visual and auditory connections with other rafts that are part of the same company and trip. The habitual actions for entering an eddy are to position the boat at a forty-five degree angle to the eddy with the back of the boat pointing toward it, come as close to the upstream obstacle as possible without hitting it, and enter backward with as much speed as possible.

Another example is a sleeper, or a dangerous rock just under the surface of the water (Figure 2). They are barely detectable by a slightly slower moving spot on the water with a subtle glassy appearance. Sleepers are obstacles always to be avoided by the raft. In addition to recognising waves in general, which are distinguished by differences in speed, shape, colour, and direction of water flow, one must recognise waves that are safe to hit, and waves that are not. Safe waves must have a higher amplitude than the water level directly upstream, and are therefore determined by a difference in height. The rule for action associated with hitting waves is to hit them straight on, with enough speed, the latter depending on the height

of the wave. Therefore, after spotting an oncoming wave, the guide will begin rowing and command the crew to paddle. As soon as the guide sees the front end of the boat reach the base of the wave, this is a sign to dig both oars in the water and push through the wave with as much strength as possible.

The final feature that will be mentioned here is that of the rapid, or a series of waves. The entrance of a rapid usually forms a downstream 'V' (Figure 3). In general, it is best to enter down the centre of this 'V'. It is easily detectable by the difference in colour, shape, and movement. While general terms such as current, eddy, and wave are used to distinguish features of the water, another practice associated with textualising the river is applying proper names to certain rocks, rock complexes, eddies, waves, rapids, and entire sequences of rapids, like Shoshone. This is shown in a map used by the company, Whitewater Rafting, LLC., where the author worked as a river guide (Figure 4).

As can be seen, reading the river as a river guide means recognising relevant features and moving through the river accordingly. This is more of a kinetic experience than reading a novel, appreciating a work of art, watching a film, or listening to a symphony. Gibson's ecological affordance theory stresses the reciprocal relationship between locomotion and visual perception, because affordances, or action possibilities offered by the environment, need to be physically explored and discovered by the organism (Gibson 1986). He states: "[...] we must perceive in order to move, but must also move in order to perceive" (op cit, 223). This marks a key difference from traditional applications of Lotman's text, uniting perception, cognition, and physical movement in semiosis.

1.2.3. The river textuality

Lotman describes the text as the material embodiment of the system (1977). He states: "We should stress that in speaking of the material expression of a text, we have in mind one highly specific property of sign systems. It is not 'things' themselves, but the relations of things, which are the material substance of sign systems" (1977, 53). Shoshone as a text is materialised in its particular relation of features to each other in time and space in order to enable corresponding habitual actions, which in their totality form a specific route taken by river guides. Using Korzybski's famous distinction between the map and the territory,

Gregory Bateson states that what gets onto the map are differences that make a difference (2000 [1972]). In its materialisation as a text, Shoshone has become a set of differences that make a difference. In addition to countless rocks, waves, and eddies that go unnoticed from the perspective of the river guide, there are infinite other differences that could be made when viewing Shoshone from other perspectives, such as a geologist, or a tourist.

The distinguished features such as rapids, rocks, and eddies, most of which are given proper names in Shoshone, never function in isolation but always in relation to each other in space and time. The minimal un-termed differences in the appearance of water relate to each other spatially, in their functioning to distinguish the greater forms, and can be found at any spot on the river. The author's use of the term 'spatially' is in an ideal sense, meaning the horizontal dimension of the river, as if viewed from the side as a fixed slice. This is opposed to sequentially, or the vertical or temporal dimension of the river described by terms such as 'up- and down-river'. The greater forms such as the current, eddies, rocks, and waves relate to each other both spatially and sequentially, simultaneously used to indicate local and immediate actions of orientation and those in preparation to 'set up early' for upcoming features. The named rapids from Baptism to Maneater (Figure 4) are comprised of multiple waves, and while they function in the same way as the other more generally termed features in terms of spatial and sequential orientation, they relate to each other only in terms of a sequence, as they are all included in the route.

An example will help demonstrate some particular sign relations of this text. The rapid, Tuttle's Tumble, lies sequentially in between a large sleeper and a dangerous rock complex named Marty's Diner. The sleeper indicates the entrance of Tuttle's Tumble, and the guide angles and positions the boat relative to this rock and the first wave. The guide also builds speed upon recognition of a certain distance from the sleeper. Upon entering Tuttle's Tumble, the guide keeps in mind that Marty's Diner is just down-river on the left, and after digging the oars in the water to push straight through the first two waves, s/he turns the boat 180 degrees in order to back away from it (which entails pulling on the two oars), which is the strongest, quickest manoeuver. Passing Marty's Diner is a sign for the guide to turn the boat back around again 180 degrees, in order to back across the river to avoid the next rock. This next

rock is a sign to set up early, in terms of position and speed, for the next rapid called The Wall. This brief example is meant to demonstrate the internal sign relations of this text.

Lotman also states that being a realisation of the abstract system, the text always contains non-systemic as well as systemic elements (1977). Because of its level of difficulty and intense morphological relations, certain parts of Shoshone have their own rules. For example, the normal code for action when approaching a wave is to hit it straight on, yet many areas in Shoshone force one to hit waves sideways in order to start crossing the river as fast as possible to avoid upcoming dangers. Shoshone contains so many extra-systemic elements that it requires its own intensive training, even after the guide has learned how to read the river in general. This includes walking the river and using visual diagrams to teach the guides the relevant features and corresponding actions they should take on Shoshone, before practicing on the actual river.

1.2.4. The water level as a meta-sign

One interesting feature revealed by this new application of Lotman's theory of text is what the author terms a meta-sign, which is adapted from Gregory Bateson's idea of metacommunicative signals, which paradoxically occur within contexts while functioning as frames for those contexts (Bateson 2000 [1972]). Shoshone is formally divided by river guides into high and low water, each of which have different respective routes and different training requirements. High water consists of 4000 to 6000 cubic feet per second (cfs), 6000 being the highest level that commercial companies are allowed to do on Shoshone. At the marking point of 4000 cfs, the internal sign relations within Shoshone change. The significant rocks and rapids all remain in the same place physically and have the same names, but their functional relations to each other change.

This can best be demonstrated with a brief example. Upon approaching the first rapid Baptism, the guide builds as much speed as possible and hits the first wave straight on. By the third and last wave of Baptism, there are two different action courses the guide should take depending on a formal distinction made between high and low water. In low water (Figure 5), the third and last wave of Baptism is a sign to turn the bow of the boat slightly to the left in preparation for an upcoming rock named Eddy Out Rock. The guide merges into the left hand

side of the river, and upon reaching a certain distance from Eddy Out Rock, turns the boat sideways and positions it so that the back end of the boat comes as close as possible to this rock in order to back into the eddy directly below it. This eddy is especially difficult to catch, so backing into it (the strongest manoeuver) is a must. Once the boat is stopped in this eddy, the guide verbally prepares the crew for the upcoming rapid, Tuttle's Tumble, which is back on the right side of the river. Low water enables this crisscrossing from left to right without getting caught up on the rocks down-river of Eddy Out Rock. In high water (Figure 6), the third wave of Baptism has a different meaning: to turn the boat to the right, to stay on the right hand side of the river, and enter Tuttle's Tumble straight on. Because the water is so much stronger and faster at this level, it is impossible to cross the river from Eddy Out Rock to Tuttle's Tumble without getting caught up on the rocks downstream. The higher water level also washes out the rocks on the right hand side of the river that need to be avoided in low water. This shows that at the marking point of 4000 cfs, the water level (formally speaking, but not necessarily in practice, as the specific marking point itself is not perceptible) changes the internal organisation of the text. In high water, Eddy Out Rock is not even part of the structure, as the water moves too fast to catch the eddy safely. Therefore, the water level acts as a meta-sign that is both within the text, and about the text as a whole.

This shows how the guides have systematised this dynamic, showing one way in which they cope with a fluctuating environment. Lotman describes a text's invariance by its particular relations of signs, which are organised hierarchically, the levels of which are held together with structural relations. He states: "It is these stable bonds (within each level and between levels) which give the text the quality of an invariant" (Lotman 1977, 53). He then describes that the text is broken up into variants as it functions in its social environment, i.e. as it is read by different readers. Since the water level relates to the text as a whole, acting as a sort of self-referential sign that changes how the entire text is read, it is not a variant that occurs due to an individual reader's particular background. Therefore, the natural meta-sign is something new to add to Lotman's theory of text, or a semiotic approach in general, in relation to perception of the environment.

1.3. A dialogue between Lotman and Gibson on reading the river

This section explores possible complementarity between the theories of Lotman and Gibson, as well as their important differences. Reading the river as a river guide is at a blurry intersection of a culturally mediated activity and physical interaction with the environment. Neither Lotman's theory of text nor Gibson's theory of direct perception of the environment are appropriate for this analysis on their own terms. Lotman's notion of text does not yet have the theoretical tools available for dealing with the on-going, pragmatic nature of a mutually constitutive subject-in-environment. Shoshone as a text deviates from Lotman's traditional applications in that it is tied to physical human capabilities and natural environmental affordances, thus is much less open to interpretation than an artistic text. One might try to navigate the rapids however they wish, but would quickly get corrected by the river. This object cannot be described in terms of Gibson's theory alone either, as rooting sign processes between human physical capacity and environmental structures alone would omit the vast influence of cultural mediation, such as socially transmitted knowledge, linguistic constrictions, and technologies of the raft. The fact that different technologies such as kayaks can have different routes points to the more arbitrary influence of culture on this material. Gibson's theory of direct perception of the environment stresses the physical capacities of the organism and the environment, as well as constant learning and situational knowledge, emphasising both immediate needs and historical experiences of the organism. He redefines perception in his academic context as a "skill that can be educated" (Gibson 1986, 246). This fluid concept of perception is connected to his lack of attention to the immanent structure of particular environmental objects and their delimitation, as his notion of invariant structure or nesting is more general. Lotman's notions of demarcation, internal sign relations, and realisation of a system of signs provides what Gibson's theory lacks in terms of describing the particular internal sign relations immanent to a bounded, meaningful cultural unit. This necessitates a closer look at these theories in order to see if it is possible to combine them in a model for environmental objects influenced by both nature and culture.

Key differences between these two theories of meaning-generation are interrelated and include a different role of the subject, a different notion and status of learning, and a different locus of meaning-generation. The different role of the subject is reflected in both the methodology and metalanguages of the two fields. The different terms used in the work of

Lotman and Gibson, such as (respectively) ‘reader’ or ‘receiver’ as opposed to ‘subject’ or ‘perceiver’, connotatively indicate the different ontological status this aspect holds toward meaning-generation, as the former terms are more passive, and the latter more active. In Lotman’s more structuralist writings, meaning is considered immanent to the text. His methodology does not take the particular interpreter of the text into account as much as the character of the text as such, and its embeddedness in other cultural texts. In order to understand a text, the reader must know (whether consciously or unconsciously) the codes which it realises. Thus, learning is implicitly delimited to learning the codes with which to understand the text. Meaning for Lotman is something either transmitted or generated by the text, which is analogous to an “autonomous individual” or “autonomous personality” (Lotman 1988, 56–57). Meanings of signs are therefore always bound to their relations with other signs and the interaction between larger sign systems, which is theoretically outside of the subject.

For Gibson, perception of the environment occurs in a complementary relation between the physical properties and activities of the subject and information available in the environment, independent of the subject. Gibson explains this apparent contradiction with his concept of sensitisation, or a constant attunement to the physical world in which new meanings can always be discovered by the subject. Information in the environment, for Gibson, is not transmittable but “inexhaustible”, because perception is a constant process (Gibson 1986, 243). Thus, learning for Gibson is also constant (though it could be argued to occur in different degrees of intensity) and nearly synonymous to perception. Gibson’s notion of learning has a much higher status and different conceptualisation than it does in Lotman’s theory of the text, which implies a more traditional perspective of learning as the transmission of an abstract code.[2] Gibson’s concept of learning is relational and situated, based on variant conditions rather than invariant content. While the same case could be argued for the interpretation process of a cultural text, it simply is not the focus of Lotman’s attention in his analyses. The primary meaningful distinction for Gibson is the distinction between self and

[2] Pierre Bourdieu discusses this traditional concept of learning, termed “objectivism”, as inherent to the Saussurean paradigm of thought (1980, 26). In a foreword to Jean Lave’s and Etienne Wenger’s *Situated Learning: Legitimate Peripheral Participation,* William F. Hanks also mentions this notion of learning in relation to “classical structural analysis” (Hanks 1991, 16).

environment, which parallels Jakob von Uexküll's elementary sign, or "ego-quality" (Uexküll, T. 1992, 288). The subject therefore plays a much greater role as physically part of the structure of meaning, which is relational in both space and time, and complementary to the environment. The invariant structures, or meaning, perceived by the subject are situationally and developmentally relative, dependent on the organism's physical properties, historical background, and pragmatic circumstance.

This all points to a different locus of meaning-generation in Lotman's and Gibson's respective theories. Charles Morris' general theory of signs is useful as a reference point for comparison, whose division of sign relations into syntactics (relations of signs to each other), semantics (relations of signs to their objects) and pragmatics (relations of signs to their users) provides a resource for further terminology and understanding (Morris 1971). Lotman, especially in his methodology of what he selects as his research objects, pays most attention to relations between syntactics and semantics, as signs and their meanings are immanent to the text and outside of the interpreter. Pragmatics for Lotman is understood as the variance according to social function and interpretation of the text. Gibson, on the other hand, stresses the connection between semantics and pragmatics. A different definition of code provided by Timo Maran helps describe Gibson's different emphasis, which is, "a system of correspondences between messages and their significance or behavioural outcomes" (Maran 2012, 148). Syntactics, semantics, and pragmatics need to be combined for this material, as Lotman's approach leaves out the physically constrained bodily attunements of the river guide, while Gibson's approach in terms of syntactics does not get any more specific than the general label of hierarchical structure or nesting, which fails to analyse specific internal sign relations of particular, delimited environmental objects. Morris' theory of signs on its own is also too general to use for this object, as it leaves out the important function of the demarcation and textuality of Shoshone.

One possible step toward combining Lotman and Gibson on this material is to differentiate two levels of pragmatic constraints on Shoshone as a text. At a greater level of abstraction, pragmatics frames semantics and syntactics (the latter two being the correlation of bodily actions with visually perceived forms on the river). The pragmatics at this level concern general physical capabilities of human beings, including vision and movement, as

well as the technology of the raft, the cultural influences of the activity, and local affordances of the river. All of these factors contribute to the specific route, or the totality of visual forms + actions, through Shoshone as a whole. At this level of pragmatics, both cultural and natural constraints can be included without differentiating them into superficial categories of nature and culture. At a more concrete level would be situational pragmatics, which is where we can place Gibson's notion of constant perception-learning or sensitisation. This situational level of pragmatics is more physically constrained than the general level of pragmatics.

Reading the river as a river guide combines a cultural practice and a functional perception of the environment. Shoshone as a text is a culturally mediated and partly arbitrary, while the perceptual and kinetic capabilities of the river guides develop increasing precision toward it over time through direct engagement with the river. Such a hybrid activity blurs the boundaries between cultural texts and direct perception of the environment, but opens up possibilities for combining the theories of Lotman and Gibson through the specification of a dual-levelled pragmatics. This contributes a step toward a research model for this activity, and potentially other similar activities involving human interaction with the environment.

Conclusions

The aim of this research was two-fold: to discover similarities and differences between human perception of the environment and reading a cultural text, and to critically examine the usefulness of applying Lotman's theory of text to perception of the environment. The first step of this research was the application of Lotman's theory of text to the object of reading the river as a whitewater raft guide, in order to see which aspects of this theory are relevant and when. Based on the nature of the research object and a complementarity with Gibson's research on perception of the environment, three basic features of Lotman's theory of text were used: its demarcation, hierarchical structure, and realisation of a system of signs. This structural-semiotic approach is most useful for describing the habitualised cognitive side of reading the river, which appears most relevant at class three rapids and up, when previous visual inspection, planning, and setting up early are crucial. This level of river difficulty requires previous visual inspection and a specific route to be taken through the section, which

is also memorised as a cognitive map that enables guides to set up early on the river. One way to facilitate the memorisation of this route, as well as represent it in visual maps, diagrams, and verbal discourse, is to apply proper names to significant features of the river, which is demonstrated by Shoshone.

These features taken from Lotman's theory of text reveal the importance of demarcation and text-system relations for this material, which adds to Gibson's approach. Gibson's more general notion of an invariant hierarchical structure, situationally extracted from the environment, does not attend to the internal sign relations of particular structures that are memorised and more fixed over time, especially those that carry cultural significance. Lotman's approach, coming from a cultural semiotic perspective, studies the significance of particular bounded meaningful units that have their own internal structure, which appears also relevant for the case of Shoshone, whose structure cannot be described based purely on physically functional or situational needs, but is culturally mediated and thus partly arbitrary. On the other hand, an important difference from Lotman's traditional applications of text, informed by Gibson's theory, is that cultural texts have a greater potential for a variety of interpretation, as they are less physically and pragmatically constrained than the activity of moving through a river. Another related difference is the kinetic experience of whitewater rafting, which unites visual perception, cognition, and physical actions in a functional semiosis, which is unlike the reading of traditional texts in the context of literary studies.

The analysis of this object also revealed an important modification to be made to Lotman's theory of text, which might be a step toward specifying his theory in relation to perception of the natural environment in general. This is a natural meta-sign, abstracted from the systematised water level of Shoshone. In other words, it is the regular impact on the text's internal structure by the seasonality of the environment, or a recurring holistic change, which marks another important difference in the research object from traditional applications of text. Therefore, when applying Lotman's notion of text to landscape, it is important to distinguish regular changes in the environment that result in a corresponding reorganisation of the text's internal structure. This aspect deals with the systematicity of landscape perception, and meta-signs such as the water level may be one mechanism of recognising these regular changes. Other changes may lack actual meta-signs and simply occur as gradual qualitative changes of

content in the landscape that eventually crystallise into a different internal structure, which cyclically repeats itself. While this analysis focused on functional meaning only, other more phenomenological or symbolic meanings may also be altered by seasonality and meta-signs, and it may be promising to explore different types or layers of meanings connected to perception of a particular landscape.

The second approach in this paper took a closer look at the interaction between the theories of Gibson and Lotman on this material, noting the different role of the subject, different status and conceptualisation of learning, and different locus of meaning-generation in each theory. This prompted another change to Lotman's theory of text, which is to take into account two levels of pragmatic constraint. The more abstract level acknowledges equally both cultural and physical constraints, such as the local affordances of the river, the technology of the raft, the general physical capabilities of human beings, the activity of river guiding, etc., and is notably different from pragmatics in Lotman's traditional applications of text, which would be confined to the diversity of interpretation among readers. The general pragmatics associated with reading the river as a river guide are more fixed and abstract, framing the semantic and syntactic relations of Shoshone as a text. The situational level of pragmatics on the river is a more physical constraint that includes Gibson's process of sensitisation. This level is more analogous to the level of interpretation of a cultural text, which can vary per individual and social group, as both sensitisation to the river and interpretation of a cultural text are influenced by skill. Sensitisation itself may not be describable with Lotmanian text-based semiotics, as this is an emergent and largely unconscious learning process and the theory of text deals with forms. The ad hoc epistemology of Tartu semiotics is one way to mediate the lack of attention to this level, which probably warrants a different metalanguage and methodology.

To sum everything up, Lotman's basic theory of text was indeed useful in this analysis for describing mechanisms of cognitive river orientation as a river guide, in order to explicate similarities and differences between perception of the environment and reading a cultural text. A few extrasystemic additions to Lotman's theory were necessary due to some of the differences, informed by both the object and by Gibson's theory of direct perception of the environment. Morris' notions of syntactics, semantics, and pragmatics were used as a

reference point from which to compare the approaches of Lotman and Gibson, leading to a combination of their theories. Morris' theory of signs alone was not used for this analysis because it is too general, as Lotman's textual features of demarcation, hierarchical structure, and materialisation of a system of signs were found to be relevant for Shoshone, as were Gibson's relations of subject and environment. The materialisation of Lotman's theory of text in this analysis, resulting in the addition of the natural meta-sign and two different levels of pragmatic constraints, is a step toward a research model for this activity, which could hold potential for exploring other similar cases of human interaction with the environment. This contributes a semiotic perspective to the on-going search for methodology and research concepts in the environmental humanities, including the emerging field of ecosemiotics, while continuing the tradition of Tartu semiotics by expanding Lotman's theory of text.

Notes

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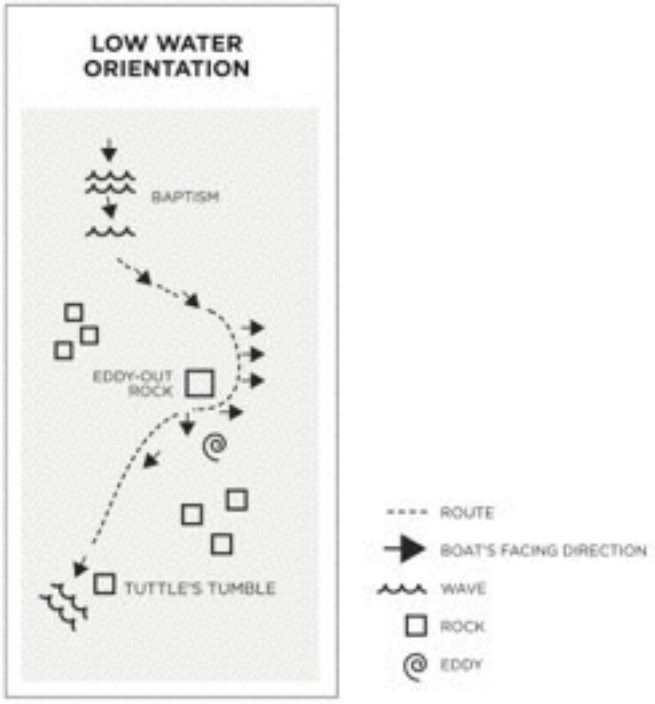

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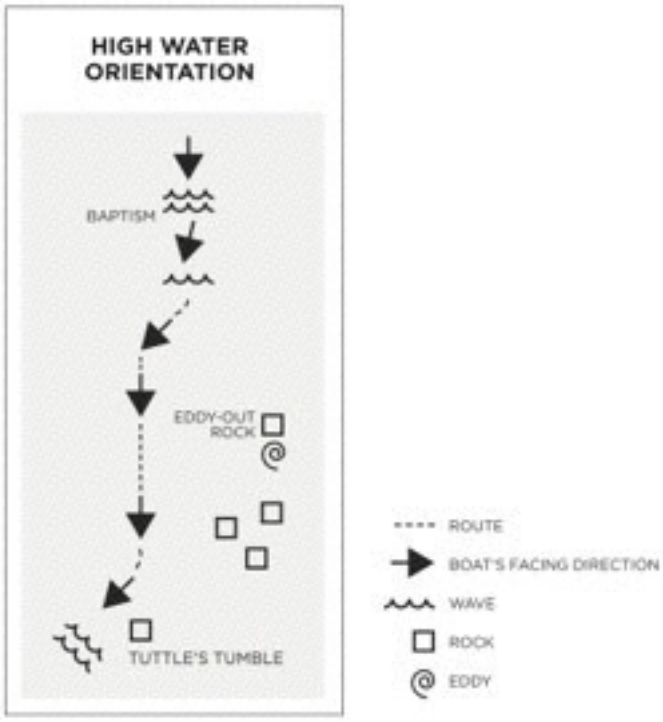

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EXPANDING UMWELT THEORY

FROM STRUCTURAL LINGUISTICS TO COGNITIVE LEARNING

Jamie Kruis

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Abstract: I present a response to Thure von Uexküll's attempt to complement Jakob von Uexküll's theories by incorporating concepts from structural linguistics. I more closely compare structural linguistics and Jakob von Uexküll's theories, noting significant differences unmentioned by Thure von Uexküll, leading to the claim that Jakob von Uexküll's theories need further development in relation to cognitive learning. I suggest that learning has a higher status and different conceptualization in a bio- or eco-semiotic approach than it does in structural linguistics. Bateson's concepts of proto- and deutero-learning are found to be complementary to Jakob von Uexküll's theory at the intra-specific level, while Hoffmeyer's notions of semethic interaction and semiotic freedom are useful to describe interspecific relations and semiotic capacities of organisms.

Keywords: biosemiotics; ecological code; functional cycle; learning

Introduction

In his *Introduction: The Sign Theory of Jakob von Uexküll*, Thure von Uexküll (1992) argues that the laws of nature as described by Jakob von Uexküll are analogous to the structural laws of linguistics. He suggests that we borrow terminology from linguistics, such as "system, structure, unit, code, etc." to provide more precision than the musical analogies Uexküll used for umwelt theory (T. v. Uexküll 1992: 286). After accepting the assumption that linguistic laws and the laws of nature are homomorphic, i.e. share a recurrent fundamental principle or form on different levels of complexity, he states, "[...] Saussure's distinction between *langue* and *parole* (*or the more general distinction between code and message)* may be viewed as an illustration of Uexküll's own distinction between an active plan and a concrete living phenomenon" (T. v. Uexküll 1992: 282, emphasis mine). Reflecting this idea that there is a general concept of code and message that can include language and J. v. Uexküll's concept of plan, he relies most heavily on the general sign theory of Charles Morris (1971) to support his argument, and uses the human umwelt as the core of his comparison. When he does turn to the level of contrapuntal correlation or meaning rules, he refers only very briefly to Bertalanffy's systems theory.

Building on some of T. v. Uexküll's arguments, I compare the aim, methodology, notion of sign, and general explanation of meaning-generation of J. v. Uexküll's theory with that of structural linguistics, using Ferdinand de Saussure and Roman Jakobson as main representatives of this latter field. This comparison is aided is by Timo Maran's (2012) description of ecological codes, which demonstrate the more ambiguous and fuzzy nature of ecological codes than the typical notion derived from linguistics and information theory. This reveals several important differences between structural linguistics and J. v. Uexküll's theories, which lead me to suggest that the theory of the "composition of nature" needs further development in relation to cognitive learning, due to a greater role of the subject and relatedly, the different nature of ecological codes. Since J. v. Uexküll was responding to Darwin and his synchronic umwelt research was innovative at the time, it makes sense that he did not fully develop this phenomenon past his concept of plan, as it would be a much later step in the process of umwelt research. I argue that learning itself should take on a different status and conceptualization in the two different fields, and that Gregory Bateson's concepts of proto- and deutero-learning are most complementary to Uexküll's theory in a semiotic way.

2.1. Two Different Systems of Thought

This section takes a "metasemiotic" perspective toward a comparison of structural linguistics and Uexküll's umwelt theory.[3] The aim, methodology, notion of sign, and explanation of meaning-generation, all interrelated and together comprising a general system of thought, differ significantly between these two fields. The aim of structural linguistics is to describe the hierarchical structure and function of the code. The methodology abstracts invariants from speech and it is these invariants that are most important, playing a dominant role to the subject, whose speech both realizes and is made possible by the code. As Saussure states, "The linguist must take the study of linguistic structure as his primary concern, and relate all other manifestations of language to it" (Saussure 2011 [1959]: 9). In a similar

[3] Juri Lotman discerns two tendencies in semiotics: metasemiotics, where the objects of study are the researchers' "models of models", and semiotics, where the object of study is at the level of culture, or "texts as such" (Lotman 1988: 52).

manner, Roman Jakobson, being influenced by information theory, describes similarities between the fields of linguistics and communication theory, stating "Linguistic analysis [...] came to resolve oral speech into a finite series of elementary informational units. [...] Thus, form in language has a manifestly granular structure and is subject to quantal description" (Jakobson 1960: 570). The notion of sign, or meaningful element, is an arbitrary unit that is only intelligible in terms of differential value in relation to other units within a bounded hierarchical system (Saussure 2011 [1959]). Therefore, the methodology of structural linguistics appears to give greater ontological status to the code than the interpreter, in terms of explaining meaning-generation.

The aim of Uexküll's approach is to reconstruct the subjective universe of the organism under study. His methodology begins from an analysis of the umwelt of the human researcher, in order to understand our particular limits, the general nature of an umwelt, and "neutral objects" that have no direct functional meaning for the researcher, who can measure and manipulate such objects (T. v. Uexküll 1992: 297). Neutral objects are used to place the organism in the role of sign receiver and discover what forms of these objects the organism acts on, and how this organism acts on such forms, transforming them into a meaning-carrier. The researcher can manipulate and alter these signs in order to experimentally discover the nature of these forms for the organism. Discovering all of the forms and corresponding actions of the organism leads to a reconstruction of its umwelt, or its entire world of perception and action.

Uexküll's notion of an elementary sign is the active distinction between self and non-self, or "ego-quality", placing greater emphasis on subjectivity and context-sensitivity (T. v. Uexküll 1992: 288). The minimal element is therefore a relation in space and time between subject and meaning-carrier. Therefore the subject is part of the structure of the sign, unlike in structural linguistics, where the sign is outside the speaker. This results in a comparatively greater ontological status of the subject for Uexküll than structural linguistics, in terms of its position in the explanation of meaning generation.

2.2. Natures of Code

Using Morris' distinction of syntactics, semantics, and pragmatics, T. v. Uexküll (1992) provides a compelling argument for how Uexküll's elementary sign processes of organizing and content signs, which are types of perceptual signs, can be supplemented with a concept of syntactical codes. I think this is easier to compare, first and more generally because perception itself is intra-specific, and therefore the notion of code is less fuzzy as it is species-bound. Second, he uses human perception in this comparison. Granted, he was following step one of umwelt research to analyze the subjective universe of the researcher. Studies in cognitive linguistics, human geography, landscape studies, and other fields have shown similar possibilities for drawing connections between human perception or embodied experience and language or conception (Lakoff, Johnson 1999; Duncan, Duncan 2010; Spirn 1998). I agree with his use of Charles Morris here, as it shows how similarities between human language and perception can be discovered with a more general theory of signs. However, Maran (2012) notes that messages in animals are not as systemic as they are in human language, as spatio-temporal context largely determines the expressions and interpretations of an animal. This is a key point further on when we turn to learning.

Things get more complicated when considering T. v. Uexküll's (1992) claim that J. v. Uexküll's concept of plan is analogous to Saussure's concept of *langue*. He does not develop this statement in the article. When he later discusses the level contrapuntal correlation, he loosely ties it to Bertalanffy's systems theory instead. He notes a few differences between the two later on, notably that language is dialogical and a shared code, while biological sign processes are monological. Another difference he states multiple times is that language is culturally acquired while biological laws are innate. This difference seems less relevant at the ecological level, and in my opinion, Maran points out other aspects of ecological codes that illustrate more important differences.

First it is important to define what we mean by code. One definition mentioned by Maran is that a code is a "system of correspondences between messages and their significance or behavioral outcomes" (Maran 2012: 148). We could use Morris' theory of signs as a reference point by saying that this definition of code connects semantics to pragmatics, while in structural linguistics, the notion of code connects syntactics to semantics. Maran also references Kalevi Kull's definition of ecological code as a starting point. Kull states,

“Ecological code (as introduced, e.g. by Alexander Levich around 1977, see Levich 1983) can be defined as the sets of (sign) relations (regular irreducible correspondences) characteristic to an entire ecosystem, including the interspecific relations in particular” (Kull 2010: 354). Maran develops this definition by outlining three main properties of ecological codes that differentiate them from linguistic codes.

The first property of ecological codes is that they are “distributed and open” (Maran 2012: 150). Because they include multiple species with different umwelten, no single organism or species has full perception of an ecological code as humans do with language. New species can become incorporated in the ecological code in unpredictable ways, which makes this code subject to change. As is seen further on in connection to learning, Jakobson states that the structure of a linguistic code exhibits no change over time, despite changes in verbal style and vocabulary. The second difference is that ecological codes are specific to a local community, comprised of the regularities, habits and constraints of all organisms combined. As opposed to the arbitrary nature of linguistic sign relations, an ecological code consists of indexical sign relations that transcend the cognitive capacities of any particular observer. The third difference is that ecological codes are stored in different forms of memory, both conscious and unconscious. This includes the physical form of organisms, their genetic memory, and the cultural memories of species. This is why I consider T. v. Uexküll’s distinction that linguistic codes are culturally acquired while biological codes are innate to be less relevant at this level.

Maran concludes by suggesting that ecological codes do not resemble systemic codes such as language, but are more like “archetypal imagery or patterns — dispositions in animals to establish certain types of meaning relations in ecological communities and to link sign processes with actions in particular ways” (Maran 2012: 151). This archetypal imagery, inspired by Carl Jung, is meant to be a fuzzy, interspecific pattern that cannot be localized in the umwelt of a single species. He gives an example of the archetype of fear, which can be described across species in both general sign characteristics, such as unfamiliarity, unexpectedness, or sudden change, and more specific features such as images of eyes or fangs, large body size, low and loud sounds, and fast-moving shadows (Maran 2012: 153).

Describing these abstract forms and dispositions in animals is an interesting and fruitful approach to ecological codes, and it could be complemented by further development of the processes through which these dispositions are formed and change. This involves focusing on the open nature of ecological codes, as well as the "habitual semiosis, behavior, and action of animals" he notes in the second property of ecological codes (Maran 2012: 150). He points out that Jesper Hoffmeyer has attended to this with his concept of semethic interaction, which I later return to, but now I turn to the status and conceptualization of learning in structural linguistics in order to demonstrate that learning plays a much more important role for ecological codes, and should also be conceptualized differently.

2.3. The Status and Conceptualizations of Learning

Based on the ad hoc epistemology advocated by Tartu semiotics, and often employed in semiotics in general, I argue that learning should have a higher status when studying ecological codes, or Nature's composition in J. v. Uexküll's terms, than it does in structural linguistics. This is so because of the greater importance of the subject, the locality and fluidity of ecological codes, and the fact that the subject does not have perception of the whole code. Learning in structural linguistics is confined to a specific stage of development, and Jakobson argues that metalingual operations are key for learning language and for clarifying semantics in various contexts (Jakobson 1956). The metalinguistic function of language involves conscious or unconscious referral to the code. Jakobson notes that while verbal styles, vocabulary, and phraseology change over time, "[...] no progress whatever has been detected [...]" in the morphological and syntactic system, as well as the overall phonemic system (Jakobson 1967: 104). Therefore, once this code is learned during childhood, there is relatively little more learning to do, and participants have little impact on changing the nature of this code. Although metalingual operations are important for context-sensitive semantics, they are still considered to be one of the six functions of the code of language, confined to possibilities enabled by the system. However, because ecological codes are ambiguous and changing, the subject's own experience and decisions become much more important for the nature of this code and warrants a framework for studying the process of

learning. It could be argued ultimately that learning is constant in an ecosystem, and is partially constitutive of an ecological code.

It is important to define what we mean by learning as well, because there are many different conceptualizations of learning across time and academic disciplines. When learning language in structural linguistics, this type of learning is implicitly considered to be the transmission of abstract knowledge, a more traditional concept of learning derived from classical structural analysis (Hanks 1991). Another term for this concept of learning is "objectivism" (Bourdieu 1990: 26). When it comes to ecological codes, theories such as Bourdieu's habitus, Jean Lave's situated learning, and Tim Ingold's dwelling perspective, seem much more suitable, because they all emphasize the conditions in which learning occurs (whether individual, social, or environmental), as well as the collaborative nature of learning. These conditions and relations play a greater role than any abstract invariants considered to be the content of learning. Ingold uses a recipe book as an example, stating that this code is not itself knowledge, but that it "opens up a path to knowledge, thanks to its location within a taskscape that is already partially familiar by virtue of previous experience" (Ingold 2001: 22). Bourdieu (1990) points out another interesting part of the process — the tendency for the habitus to seek the conditions in which it arose, unconsciously embodying past experience. However, these theories lack the precision of a semiotic metalanguage as they are very general, describing the process and its tendencies at the level of the whole. Therefore, Gregory Bateson's framework for learning is closer to a semiotic approach, providing different types in terms of recognition by the subject. This best addresses the intraspecific and individual level of cognitive learning, and how this is one possible underlying process shaping the composition of Nature.

2.4. Toward Complementing Uexküll's Theory with Intra- and Interspecific Learning

While Bateson describes learning in terms of a logical hierarchy, at the most basic level i.e. proto-learning, learning is equated with regular sign processing. He states that this is "the simple receipt of information from an external event, in such a way that a similar event at a later (and appropriate) time [or context] will convey the same information" (Bateson 2000 [1972]: 284). He states this in other words as "a situation in which a subject receives a

message and acts appropriately on it" (Bateson 2000 [1972]: 204). At this most basic level, learning parallels J. v. Uexküll's model of functional cycle. For example, a moth hears the tone of a bat and learns that an enemy is near. Higher levels of learning function to enable the processing of sign *types* or categorization, which is itself a learned skill. Deutero-learning is a concept that refers to the subject's learning of the particular contexts in which proto-learning occurs. Deutero-learning may complement J. v. Uexküll's notions of circles (food circle, medium circle, etc.) and functional tones of the meaning carrier. It is important to note, however, that Uexküll did not distinguish circle from cycle in the German language (*der Kreis)*. This distinction is a fruitful one to develop as it enables the description of sign types distinguished by the organism, and therefore deutero-learning. Uexküll hints at this ability in an English translation of *A stroll through the worlds of animals and men: a picture book of invisible worlds*, when he uses the word "attitude" of the subject to explain the possibility of different functional tones, meaning different life stages or dispositions of the subject (Uexküll 1992 [1934]: 373). He also discusses, in *A Theory of Meaning,* those cases where the "carrier of meaning does not change in the least but, in spite of that, experiences the opposite treatment from the subject, because the latter has switched itself to receive another meaning" (Uexküll 2010 [1940]: 176). Such cases can be partially explained by the recognition by the subject of a new context, or deutero-learning.

While Uexküll notes how the umwelt "grows within the individual life span of every animal that is able to gather experiences" (Uexküll 1992 [1934]: 359), creating new functional tones, he describes this as a growing into Nature's plan, and focuses primarily on developmental processes and corresponding morphological changes. Bateson's hierarchical distinction can complement his work by accounting for two different levels of cognitive learning that contribute to the composition of Nature. What might still be needed is an account of the unpredictable nature of perception and action that increases in more complex organisms and contributes to the fluidity, locality, and openness of ecological codes. Accidents, mistakes, and environmental changes (probably often enacted by humans) also contribute to change in ecological codes, which would require flexibility and adaptive capacities of species in order to maintain the integrity of the ecosystem.

J. v. Uexküll hints at the importance of learning for the composition of Nature in his use of musical analogies, and his mentioning that the laws of nature continue to develop. Hoffmeyer's notion of semethic interaction may be another useful counterpart to Uexküll's theory of the composition of Nature, as it describes how multiple species create new relations together, each one having only partial access to the entire relational complex or ecological code, but each one affecting this code through their dynamic interaction. This brings us to the level of interspecific learning. "Semethic interactions" are the recognition of any regular behaviors or habits as signs by other organisms (Hoffmeyer 2008: 189). Hoffmeyer provides an explanatory counterpart to this description. As the biochemical rule states that any store of energy will always wind up being consumed by a species, he argues that any regularity or habit will become a sign for another individual or species, which can be quite complex by incorporating several different species (Hoffmeyer 2008). He provides an example of a certain caterpillar that begins eating the leaves of a corn seedling. Something in its saliva causes the formation of a signal that spreads to the entire plant, which responds by emitting a volatile compound that is carried away by the wind. Female wasps, which lay their eggs in such caterpillars, recognize this compound as a sign for oviposition, and follow the trace to its source. They lay their eggs there, which hatch a couple of days later and eat the inside of the caterpillar, eventually killing it. Therefore, the habit of the caterpillar (part of its saliva) is recognized by the plant, leading to another habit (the emission of a volatile compound) that is recognized by the wasp, leading to its own habit (laying eggs in the caterpillars), which results in a cooperation between the wasp and the plant. This example shows the complicated interplay between different species' umwelten, or the relations at the level of the ecosystem. To use his words, the advantage or disadvantage of a trait "depends on a complex, self-organizing context of semiotic relations that were gradually established through massively combinatorial trial and error events *at the lived ecosemiotic level* [...]" (Hoffmeyer 2008: 198). He argues that these synchronic, semiotic relations are most responsible for maintaining the stability of the ecological and biogeographical patterns of Earth (Hoffmeyer 2008: 190).

Another important notion of his is semiotic freedom, which he defines as a logical depth of meaning, or "the number of calculatory steps spent upon producing it" (Hoffmeyer 2008: 187). This varies in degrees across different species. For example, a bird that pretends its

wing is broken in order to lure a predator away from its nest has a higher degree of semiotic freedom than bacteria that choose to swim toward a source of nutrients. Hoffmeyer argues that evolution need not be characterized by the increasing multiplicity of morphological structures, but rather by an increase in semiotic freedom, which has an "inherent tendency to grow" (Hoffmeyer 2008: 186). This notion is important because semiotic freedom may be one way in which organisms may adapt to changing environments, or one way in which they change or create their environments.

Conclusion

Because linguistic codes (in structural linguistics) are less open to change by subjects than ecosystems are, learning plays a different role and is conceptualized differently. The method of abstracting invariants in structural linguistics is more useful when the nature of the code is more fixed and shared by the participants, and learning is the transmission of this code. Uexküll's theory provides a great starting point for ecosemiotics, though the composition of Nature could also be partially explained by processes of cognitive learning, which would move it farther away from the field of structural linguistics. Ecological learning cannot simply be a transmission of an abstract code, as no single individual or species has access to it. Instead it is realized in dynamic inter-specific relations through selective action and habituation, which vary according to time and space, and could be generally described as self-organization at the ecosystemic level. Bateson's proto and deutero-learning provide a useful typology at the intraspecific level to account for the less systemic nature of animal communication mentioned by Maran, which is largely dependent on spatial and temporal context. As a specific development of the notion of self-organization, semethic interaction contributes an explanation for both general functioning and diachronic changes at the level of the ecosystem. These theories help show how cognitive changes as part of the organism's ontogeny can complement Uexküll's theory of the composition of Nature.

More development is probably needed to describe different types of learning processes, as well as different stages or levels of learning. T. v. Uexküll suggests we bridge the human and natural sciences by applying terminology from structural linguistics to umwelt theory, but perhaps a better route would be to develop a semiotic metalanguage for describing patterns

other than rigid hierarchical structures, that unfold in time and can account for the ecological level. This partially explains why Clause Emmeche and Jesper Hoffmeyer turned from Saussure's theories to those of Peirce in biosemiotics in 1990, because Peirce's structure of the sign implies a subject who effects an interpretant, and he also developed a theory of habituation as well as a theory of the evolution of natural laws. However, it seems very difficult to find tools for describing emergent processes, as semiotics deals primarily with forms. So far it seems like our only options are to either describe this process in general, such as the case with concepts like habitus, situated learning, semethic interaction, or sensitization, or we can divide it into discrete stages or levels, where Bateson's typology falls. Jakob von Uexküll musical analogies may not have been so far off in this sense in their vagueness, because Thure von Uexküll's suggestion of further precision with terms from structural linguistics seems to move us farther away from what is happening.

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Vahetu keskkonnataju semiootiline modelleerimine: keskkond kui tekst ja selle loomine õppimise läbi

Kokkuvõte

Käesolev töö, mis koosneb kahest artiklist ja neid raamivast sissejuhatusest, tegeleb keskkonna otsese tajumise modelleerimisega kahel eesmärgil: esiteks, kasutamaks sidusat metodoloogilist lähenemist semiootiliste mudelite proovilepanekuks ja ümbertöötamiseks, ja teiseks, et arendada teemavaldkonda edasi, täpsustades otsese taju uurimiseks tarvilikke semiootilisi mõisteid. Otsese taju määratles James J. Gibson (1986) ökoloogilise psühholoogia jaoks keskkonna vahetu tajumisena, vastandina sümboliliste kujutiste poolt vahendatud tajule, olgu nendeks vahendajateks pildid, suusõnalised kirjeldused ja narratiivid, või ka meie taju võimendavad abivahendid, nagu mikroskoobid ja teleskoobid.

Esimene artikkel analüüsib konkreetse, omaette nimega jõelõigu tajumist kärestikul parvetamise giidi funktsionaalsest vaatenurgast. Artiklis rakendatakse eksperimentaalselt Juri Lotmani varast teksti-mõistet suhtes Gibsoni strukturaalse lähenemisega visuaalsele tajule, ning muudetakse metakeelt uue uurimisobjekti kontekstis, lisades sinna mõistena loomuliku meta-märgi, mis annab seletuse muutuvale veetasemele. Teine artikkel keskendub taju üldisemale tasandile, kaasates mitmeid eri liike, ning uurib erinevate mõistete rakendusvõimalusi, mis pärit strukturaallingvistikast Uexkülli omailma teooriani. See artikkel uurib õppimise rolli ja mõistet alternatiivse arenguliinina, rakendades selleks komplementaarseid, Gregory Batesonilt pärinevaid proto- ja deutero-õppimise mõisteid.

Mõlemad artiklid tarvitavad ad hoc lähenemist, mida peetakse keskseks Tartu-Moskva semiootikale ja mis annab eksplitsiitse hinnangu eri teooriate relevantsusele ning võtab nad omaks dialoogis uute uurimisobjektidega. Tööd raamivas sissejuhatuses esitatavad järeldused määratlevad otsese taju konteksti jaoks täpsemalt mõisted märk, kood, õppimine ja meta-märk. Töö struktuuri tervikuna võib kujutleda kontsentriliste ringidena, kus sissejuhatus on kõige suurem ring, olles kõige abstraktsem. Teine, teoreetiline artikkel semiootilistest tajumudelitest, oleks keskmine ring, ning esimene artikkel, käies liigispetsiifiliselt just inimeste kohta ja omades konkreetset uurimisobjekti, oleks kõige väiksem ring.

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