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Lotmanian Perspective on Complexity in Cultural Systems

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Abstract. This article sets out to discuss the potential of Juri Lotman's semiotic theory to serve as a ground from where a new understanding of cultural complexity could emerge. While the connection between Lotman and complex systems theory is quite well established, what is yet to be clarified is the ways in which his approach differs from the universally accepted understandings of complex dynamics, i.e., what makes Lotman's perspective on complexity unique? The article also explores the possibility of developing Lotman's ideas further in the context of the contemporary paradigm of complex thought with the aim of clarifying the specifics of complexity in cultural systems. In order to fill these aims, the article will first compare Juri Lotman's ideas with a generally recognized understanding of complexity to delineate a common ground. Then, the paper will address the issue of how studying complexity differs in physical systems and cultural systems, focusing on how this matter has been discussed in semiotics. The final part of the article will propose some initial lines of thoughts regarding how Lotman's ideas could be advanced further to grasp the phenomenon of complexity in culture.

Keywords: cultural complexity, Juri Lotman, semiotics of culture, modelling, constraints.

1. Introduction

In the past decades, complexity research has gained wide popularity in various scientific fields, including disciplines in social sciences and the humanities. Nevertheless, the majority of investigations of

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complex systems are still conducted in the so-called hard sciences and therefore, the frameworks for understanding complexity are mainly inspired by research conducted in fields dealing with physical systems. At the same time, the inter- and transdisciplinary research of complexity has led to an increasing need to differentiate between different types of complexity and pay attention to the specifics of various kinds of complex systems. While all complex systems seem to share some common ground, there also seem to be profound differences in the way these systems behave depending on whether we are observing complexity in physical systems, societies or in culture.

Jüri Engelbrecht, a mechanics scientist, has written that in the case of complex physical systems, "the interactions between the constituents are described by physical laws and can be measured at least with a certain degree of accuracy" (Engelbrecht 2021: 83). According to him the situation in complex social systems is much more complicated due to the fact that the interactions are guided by "accepted rules, traditions, language, and governance, on economic and environmental conditions, and certainly on values. In addition, an important question in social systems is how its members interpret social problems" (Englebrecht 2021: 83). The need to contemplate this difference has also been stressed by Scott Page from Santa Fe Institute, who has pointed out that while physical and computational measures of complexity exist in abundance and "can provide a starting point for creating social complexity metrics, […] they need refinement for the simple reason that electrons don't think. Thus, it's relatively easy to understand how their behaviors aggregate. People, on the other hand, do think. We base our behaviors on mental models, belief systems, and passion" (Page 2010: 3). Following this line of thought, the paper aims to address this gap in our understanding of cultural complexity and sets out to explore possible ways of how to describe the dynamics of such "thinking systems".

The present article proposes that Juri Lotman's semiotic theory of culture is an inspiring dialogue partner for this aim, and his ideas can serve as the basis for developing a better grasp of the specifics

of cultural complexity. Even though Lotman was among the first scholars to rethink the dynamics of cultural systems using the ideas of complexity theory, his contributions to this research area have remained largely unnoticed outside of semiotics. In recent years there have been, however, a growing number of works in the field of semiotics and culture theory that have discussed Lotman's ideas in relation to complexity thinking (see Grishakova 2009, Gherlone 2013, Salupere 2017, Haidar 2019, Hartley, Ibrus, Ojamaa 2020, 2021, Ibrus, Schich, Tamm 2021, Rickberg 2022). All these works bring out various important aspects that allow us to view Lotman's semiotics in the context of the complexity paradigm. However, what yet remains to be clarified is in what ways do the principles described in Lotman's theory of semiotics differ from the generally accepted understanding of the dynamics of complex systems? What can Lotman's rigorous investigation of the workings of culture contribute to the field of complex systems? And could it provide a basis for developing a qualitative perspective to complement the computational methods currently dominating our ways of understanding cultural complexity?

In order to discuss these questions, I will first give an overview of some of the main principles that can be seen as universal from the perspective of the contemporary paradigm of complex thought and examine in which ways these principles are presented in Lotman's works. This will allow me to delineate a common ground. Then I will briefly inspect some of the ways in which cultural complexity has been approached in various areas of research, including semiotics. Finally, I will discuss how Lotmanian ideas about the workings of culture could be developed further in order to arrive at a better understanding of the specifics of complexity in cultural systems.

2. Juri Lotman's semiotics of culture in the contemporary paradigm of complex thought

Placing Lotman's works in the context of the contemporary complexity paradigm is supported by parallels in the historical

development of the two. Complexity thinking as a separate branch of research arose in the confluence of several areas of Western science that began to develop in the 1950s and 1960s, including cybernetics, systems theory, artificial intelligence, chaos theory, fractal geometry, and nonlinear dynamics (Davis, Sumara 2006: 8). In the same scientific context and motivated by the search for a new metalanguage and exact methods for literary analysis, Juri Lotman started building his own theory of culture in dialogue with the ideas from cybernetics, information theory and structural studies (see Salupere 2015, Grishakova, Salupere 2015). The most comprehensive overview of various connections between Lotman and complexity has been given by Laura Gherlone in her article "Lotman's Epistemology: Analogy, Culture, World". The author demarcates four important steppingstones in Lotman's theory that connect him to the complexity paradigm: (I) Lotman's turn to cybernetics, (II) Lotman's interest towards studies of the human brain, (III) Lotman's dialogue with the works of Vladimir Vernadsky, and lastly (IV) his interpretation of Ilya Prigogine's works (see Gherlone 2013), showing how the emergence of complex thought in Lotman's works has had various inputs and taken place in different periods during his academic path. While Gherlone's article focuses on the most important influences on Lotman's ideas in relation to complexity, my aim here will be to look at Lotman's works from the perspective of how complexity is understood today and see whether similar ideas are present also in Lotman's writing and in which context and forms they appear.

One of the obstacles in fulfilling this goal is that it is difficult to pinpoint what could be this shared understanding of complexity. Despite the wide popularity of the complexity approach in various fields of research, the disciplinary identity of this academic area is not very clearly defined, and it is not possible to talk of a unified theory of complexity. However, as various complexitivists have tried to clarify the boundaries of their research object, i.e., the complex system, some invariant features can be observed that appear in various wordings in these descriptions. A research paper that

focused on delineating these invariant features of complex systems was published in 2018 by Rika Preiser, Reinette Biggs, Alta De Vos, Carl Folke. In their article, the authors propose "a conceptual typology of six organizing principles of CAS [complex adaptive systems][1] based on a comparison of leading scholars' classifications[2] of CAS features and properties" (Preiser et al. 2018). As the authors explain, "the six principles provide a conceptual typology by which similar salient features, properties, and behaviors of CAS can be clustered together. The categorization is based on how the organizing principles are conceptualized to cause CAS features and attributes to come into being, in other words, how complexity is generated as a systems property".

The reason behind choosing this typology lies in the fact that the authors have aimed to combine together the works that present quite different perspectives on complex systems and find common ground in this diversity. As such, this article gives a good representation of what can be considered a shared understanding of complex systems in the paradigm of contemporary complexity thinking. While the article by Preiser et al. moves on to analysing these principles in the context of social-ecological systems as complex adaptive systems, in my view, the focus of their study has not explicitly influenced the way they have described the principles of complexity in this typology as they have tried to provide a generalized understanding of complexity that should account for various types of complex systems. However, it is important to emphasise that this does not mean that the six principles proposed by the authors represent the best or the most adequate way of describing complexity – they merely indicate these principles that are represented the most in various classifications. Hence, without a doubt, it is possible to find other important aspects that are not represented in this typology but appear in other classifications and are also relevant to Lotman's works. However, a complete overview of various aspects that connect Lotman with various theories of complexity is a task that goes beyond the objectives of the present article.

One last aspect that needs to be mentioned before introducing this typology is that while such descriptions that allow to divide the phenomenon of complexity into separate features and thus create a possibility for analysis and comparison of different systems have high heuristic value, at the same time, it is important to keep in mind that any such attempt inevitably distorts the object of study. That is why all the principles of complex systems that will be discussed below should be viewed as inseparable from one another and keeping in mind that complexity as systems property can arise only in the interaction of all these aspects. In what follows, I will briefly introduce these organizing principles of complex systems as proposed by Preiser et al. (2018) and examine in which ways these principles are presented in Lotman's semiotic theory of culture.

Principle 1: Complex systems are constituted relationally. The first universal feature of complex systems that the authors bring out is that "they are defined more by the interactions among their constituent components than by the components themselves", which is why it is the relations that are the basic unit of analysis, not separate parts of the system (Preiser et al. 2018). In addition to studying the nature of the relations between system elements, this shift of focus also includes the interactions that occur between a system and its wider environment. As such complex systems appear as relational networks in which "systems can also be connected to, or nested in, other systems, representing hierarchies of relations at different scales" (Preiser et al., see also Holland 1995, Cilliers 1998, Levin 1999).

In Lotman's works, this principle is present already from his first semiotic monograph, "Lectures on structural poetics", and remains one of the cornerstones of his thinking throughout his academic career. For Lotman this principle stems from the core idea of structural studies which he describes in the following way: "The peculiarity of structural study is that it does not imply consideration of individual elements in their isolation or their mechanical combinations, instead it focuses on the interconnectedness of the elements to each other and their relationship to the

structural whole" (Lotman 1964: 5). The idea that these relations form hierarchical structures can also be found in Lotman's early works where the syntagmatics of the artistic text is discussed not in a form of chain of signs, but as a hierarchy where "the signs will fit together like *matreški*, with each doll inserted into another" (Lotman 1977 [1970]: 23). Later on, this view becomes one of the organizing principles of Lotman's semiotic theory according to which the various levels of semiotic space can be seen as semiospheres nested within each other in the manner of matryoshka dolls, making each individual "both a planet in the intellectual galaxy, and the image of its universum"[3] (Lotman 1990, p. 273).

Principle 2: Complex systems have adaptive capacities. The second characteristic of complex systems is that they "adapt over time in response to feedbacks from interactions between system elements, and between elements and their environment. The connections between elements and how these relations give shape to the structure and function of a system are sustained by self-generating organizational capacities" (Preiser et al. 2018, see also Rosen 1991, Günther, Folke 1993, Morin 1999, Levin 2005, Fox Keller 2008). The authors emphasize that the adaptive capacity of complex systems results from the system's ability to learn and have memory.

The principle of adaptivity can also be found already in the "Lectures on Structural Poetics" (1964) where Lotman presents the idea of artistic text as an adaptive system:

> The feedback system that exists between all elements and levels of elements allows a work of art to acquire a certain independence after its creation and behave not as a simple sign system, but as a complex structure with feedback, significantly surpassing all known feedback systems created by man so far, and approaching, in a certain respect, living organisms: a work of art is in feedback with the environment and is modified under its influence. (Lotman 1964: 90)

In the conclusion, he repeats this comparison of art and living being: "Like a living cell, art appears as one of the most intricate structures with a complex system of internal self-regulation and

feedback" (Lotman 1964: 187, see more on this in Salupere 2017: 43). In the following years, Lotman expands this discussion to the sphere of culture presenting the view of culture as a self-adapting living organism (Lotman 1998 [1973]: 645). In an article written together with Boris Uspensky in 1971, Lotman discusses the problem of adaption in relation to cultural (non-hereditary) memory, postulating that the necessity for continual self-renewal, to become different and yet remain the same, constitutes one of the chief working mechanisms of culture (Lotman, Uspensky 1978 [1971]: 226). Further on, Lotman presents the ability to adapt as a universal characteristic of all intelligent semiotic entities[4], i.e. those that can store and transmit information; perform algorithmic transformations to decode information; and create new messages (Lotman 2019 [1978]: 33–34). In 1978 Lotman wrote that an intelligent system can be defined by its ability to "react flexibly and effectively to changes in its environment and to reorient itself in that environment by generating more effective models" (45). The idea that culture functions in many aspects like a living organism capable of maintaining a state of balance become one of the defining features of the semiosphere model as well (see Lotman 2005 [1984], 1984b).

Principle 3: Dynamic processes generate complex behaviour. Another property that is commonly connected with complex systems is nonlinearity. Preiser et al. write: "The dynamic interactions that constitute CAS and their relations with the environment are nonlinear, which means that the magnitude of a system's outputs cannot be measured in direct proportionality to the magnitude of its causes (Preiser et al. 2018, see also Prigogine, Stengers 1984, Holling 2001). The rich repertoire of systemic behaviour, meaning that there are multiple trajectories of possible development, results from "non-linear feedback loops that can either dampen or amplify perturbations both internally and between the system and its environment", which in turn results in complex systems being inherently unpredictable and deeply uncertain (Preiser et al. 2018).

In Lotman's semiotics, the principle of nonlinearity forms the basis of meaning-making, which Lotman defines in the following way: "We will define meaning-making as the capacity of a culture as a whole or of individual parts to produce new, non-trivial texts. We will define new texts as those that arise as a result of irreversible (as Prigogine used the term) processes, that is, texts that are to a certain extent unpredictable" (Lotman 2019 [1989]: 85). For Lotman, such unpredictability seems to be connected to the universal structure of a thinking entity, which in its minimal form is at least bilingual and these two languages are to some extent incompatible (see Lotman 2019 [1989]: 86) – which is why any translation between those languages can never have one correct option, it always creates a multitude of possible meanings. The nonlinearity of cultural processes is thoroughly explicated in Lotman's works dealing with the notion of explosion. On a structural level, the moment of explosion for Lotman is analogous to meaning-making as he describes: "explosion can be interpreted as the moment of the collision of two opposing languages: the assimilating and the assimilated. An explosive space appears: a cluster of unpredictable possibilities" (Lotman 2009 [1992]: 135). What seems especially important for him is that "the moment of explosion is also the place where a sharp increase in the informativity of the entire system takes place. The developmental curve jumps, here, to a completely new, unpredictable, and much more complex path" (Lotman 2009 [1992]: 14).

Principle 4: Complex systems are radically open. The fourth principle that Preiser et al. delineated as universal is that complex systems are "open systems[5] meaning that energy, information, and matter are exchanged between the system and its environment" . The openness of such systems means that it is almost impossible to "distinguish which components belong inside the system and which belong to the broader environment" (Preiser et al. 2018). As Paul Cilliers has written about the "openness" of complex systems:

> There is thus no safe "inside" of the system, the boundary is folded in, or perhaps, the system consists of boundaries only. Everything is always interacting and interfacing with others and with the environment; the notions of "inside" and "outside" are never simple or uncontested. (Cilliers 2001: 142)

In addition, authors emphasize that the boundary of the systems is often the function of the perspective of the observer (Preiser et al 2018, Cilliers 2001).

Such "radical openness" is present in Lotman's model of the semiosphere as well, where the "porous" boundaries are seen as the hottest spots for semiotizing activity due to their dual function of simultaneously separating and uniting (Lotman 1990: 136). Lotman presents boundary as a polylingual mechanism that transforms "external" into what is "internal" and vice versa (Lotman 1990: 136–137). Borrowing an analogy from Vernadsky, Lotman writes: "The function of any boundary or filter (from the membrane of the living cell, to the biosphere which according to Vernadsky is like a membrane covering our planet, and to the boundary of the semiosphere) is to control, filter and adapt the external into the internal" (Lotman 1990: 140). However, Lotman emphasizes that such a view of a boundary is only the minimal simplified model of a semiotic space, and a more accurate way to think about the relation of "inside" and "outside" of the system is the following:

> [T]he entire space of the semiosphere is transected by boundaries of different levels, boundaries of different languages and even of texts, and the internal space of each of these sub-semiospheres has its own semiotic 'I' which is realized as the relationship of any language, group of texts, separate text to a metastructural space which describes them, always bearing in mind that languages and texts are hierarchically disposed on different levels. These sectional boundaries which run through the semiosphere create a multi-level system. (Lotman 1990: 138)

In addition, as the boundary of the semiotic systems is first and foremost the boundary set through the self-description of

the system (Lotman 1990: 131), its concrete "location" is always a matter of perspective.

Principle 5: Complex systems are contextually determined. The fifth principle is closely tied to the previous one and is caused by the dynamic interaction between system elements and their wider environment. In the case of complex systems, as their context changes, "the system will change and elements in the system may take on a different role or function. A CAS and its components, therefore, have multiple context dependent identities" (Preiser et al. 2018, see also Chu et al. 2003, Zellmer et al. 2006).

In Lotman's semiotics, the idea of contextual determinacy is present in various forms and is also elaborated already in his early works. In 1969 Lotman writes that "the minimal working textual generator – is not an isolated text, but a text in context, a text in mutual interaction with other texts and the semiotic environment" (Lotman 1992 [1969]: 147). Further on what is important for Lotman is that in the case of artistic texts, every element of a text is capable of entering into several contextual structures and that it can take on a different meaning in each separate context (Lotman 1977 [1970]: 59–60). Lotman sees this as the most profound property of art. In the programmatic article "Cultural Semiotics and the Notion of the Text" written in 1981, Lotman elaborates this idea further by indicating that cultural context itself is a complex and heterogeneous phenomenon and as such, one and the same text can relate differently to the structures of different levels of the context (Lotman 1981: 7). The idea that one element of the system can have parallel identities on different levels of culture is also expressed in Lotman's view on the part and whole dynamics in semiotic systems. According to him, culture and other complex semiotic entities entail a unique structure "in which every part is at once a whole, and every whole functions as a part" (Lotman 2019 [1983]: 74). In a culture such structures are never stable as every monad that acts as a separate entity, is "constantly embedding its closed structure within the borders of another individual semiotic space, while at the same time acting as a segment, which, driven by the

urge to become complete, enters into ever newer combination" (Lotman 2019 [1989]: 88–89).

Principle 6: Novel qualities emerge through complex causality. The final property that Preiser et al. (2018) list as universal for CAS is emergence. Emergence can be viewed as the notion that allows us to differentiate between complicated and complex systems. Cilliers (2016 [2000]: 56) explains that complicated systems can have many components, but the relations between these components are fixed and clearly defined, while complex systems are constituted through a large number of dynamic, nonlinear interactions. This means that the properties of the system are not contained within individual components, instead, they emerge as a result of interaction between the parts. As Preiser et al. assert, "the emergent properties are exhibited by the system as a whole and cannot be attributed to the properties of individual components. Moreover, systems cannot be understood, nor their behaviour predicted on the sole basis of information relating to their individual parts" (Preiser et al. 2018, see also Heylighen et al. 2007, Cilliers 2008, Preiser, Cilliers 2010, Wells 2013, Capra, Luisi 2014, Hammond 2017).

This understanding that culture is an emergent system lies at the very core of Juri Lotman's semiotic theory. Lotman's approach to cultural analysis stems for the idea that in order to explicate the workings of culture, the point of departure of any such investigation has to be the semiotic universe in its entirety. The reasoning behind such an assertion is explained in his article "On the Semiosphere" written in 1984. There Lotman emphasizes the problematic nature of a common scientific line of inquiry that moves from simple to complex. He explains that the danger of this approach is that "heuristic expediency (the convenience of analysis) comes to be accepted as the ontological character of the object, which is assigned to it by the structure derived from the simple and clearly outlined atomistic elements, in accordance with their complexity. The complex object is thus reduced to the totality of the simple" (Lotman 2005 [1984]: 206). As Lotman figuratively explains, such an approach in research could be compared to an

attempt of constructing a calf out of cut-up stakes. A much more productive way of studying culture, for Lotman, is connected to a perspective according to which separate parts of culture relate to each other in a similar manner as parts of a living organism and thus cannot be understood in isolation from the whole system. Therefore, in studying the workings of culture, simultaneous attention towards the part and the whole is necessary. Again, while this idea was most explicitly voiced in his discussions around the model of semiosphere, we can also find the beginnings of this understanding in the 1960s where he asserts that a work of art is not the sum of its features, but a functioning system, a structure (Lotman 1967: 93–4).

As the present part has hopefully shown, Juri Lotman's theory of culture shares many similar features with the typology representing the generally accepted characteristics of complex systems. This does not mean, however that Lotman's complex view on culture would be identical to the one represented in the Preiser et al. typology. There are many other aspects in Lotman's works that connect him with complexity thinking that were not mentioned here as well as different accentuations in his works describing aspects of cultural dynamics. However, the aim of this part of the article was to delineate the common ground between the core ideas of today's complexity thinking and Lotman's theory and also to show that there is a strong and manifold connection between Lotman and complexity thinking that cannot be narrowed down only to some concrete aspects of his scientific thought like cybernetics or his readings of Prigogine.

While demonstrating this compatibility of Lotman's ideas with state of the art in complexity studies is crucial for building a ground for a dialogue, what is even more important is the question about the ways in which Lotman's approach to cultural complexity differs from today's common understanding of complex systems and what it can contribute to this field of knowledge. To answer that question, let us first briefly explore the question of how the research dealing with physical systems differs from research concerning

cultural complexity and explore some ways of applying complexity thinking in studying cultural systems.

3. Towards complexity thinking in studying cultural systems

Despite the fact that Preiser et al. (2018) have shown that finding a common ground between various versions of describing complexity is possible, there are also significant differences in how complexity is studied in various fields. However, these differences should not be seen as a problem, as they point to the fact that the phenomenon of complexity is itself profoundly varied. One of the significant division lines seems to run between complexity research dealing with physical systems and research concerning cultural complexity. To understand this division, it is first necessary to consider an important differentiation proposed by Edgar Morin (2007) between restricted complexity and general complexity[6]. Restricted complexity is commonly understood as a phenomenon that emerges from rule-based interactions amongst simple elements (Byrne, Callaghan 2014: 5). Researches dealing with such phenomena use computational approaches such as cellular automata or multi-agent simulation to model "actions and interactions of autonomous agents, both with each other and with their environment" (Hager, Beckett 2019: 163) which allow to identify patterns of change in such systems. According to Hagger and Beckett, in social and human sciences, the use of restricted complexity approach has been confined:

> to more reductive areas of inquiry where individual persons can be treated as statistical variables. Examples of such applications are: traffic flows; voting behaviour and patterns of disease, infirmity or infection across different localities. That is, restricted complexity provides broadbrush understandings of organisational, institutional or population-based aspects of social functioning, in circumstances where neither humans as distinct individuals nor the nature of the specific interpersonal relations between individuals are relevant to the particular focus of the inquiry. (Hagger and Beckett 2019: 164)

According to Morin (2007: 6), the problem with restricted complexity lies in the fact that it is oriented towards searching for the "laws of complexity" and as such, is actually decomplexifying its object of study. This does not mean that restricted complexity research is not useful in studying complex systems; it merely indicates the necessity to acknowledge the limits of such an approach. As explained by Cilliers (2016: 58): "Because of the nonlinearity of the interactions constituting a complex system, it cannot be 'compressed'. Any simplifying model will have to leave out something, and because of the nonlinearity, we cannot predict the significance of what is suppressed". That is why, general complexity as an epistemological approach, while interested in the theoretical investigation of the properties of complex systems, recognises at the same time that the behaviour of a complex system cannot be formalized. As such general complexity simultaneously addresses the "self-organized and systemic nature of the world and the cognitive limits of human observers" while also calling into question "the deterministic, reductionist, and positivist principles of classical science" (Malaina 2015). Alvaro Malaina points out that these two approaches to complexity have developed in deep separation from one another and would actually benefit greatly from reunification into a scientific paradigm, with one side establishing the "worldview" and the other side providing the "models of scientific realizations" (Malaina 2015).

A similar perspective of complexity research as a potentially unifying area of knowledge where natural sciences, social sciences and humanities could come together is presented by Engelbrecht, who sees general and restricted complexity as two sides of the same coin and emphasizes that both need to be studied (Engelbrecht 2021: 84) and can be seen as mutually illuminating (86). For Engelbrecht one of the important differences between dealing with complexity in physical systems and complexity in social systems lies in the nature of constraints that limit the behaviour of these systems. According to him, in physical systems, it is often the thermodynamical considerations that constrain the possible path

of development of a complex system, and this allows for some consistency and possibility of measuring, while there are no stable and clearly definable constraints in social systems (Engelbrecht 2021: 53). Engelbrecht proposes that in case of social complexity it is possible that values[7] are the leading and guiding principles that limit the processes in societies (30).

The question of how to think about constraints in cultural systems has been examined also by a semiotician and translation studies scholar Kobus Marais. Drawing primarily on the works of biosemiotician Terrance Deacon, Marais sets out to examine the possibilities of a qualitative approach to studying complex adaptive systems in the humanities with a focus on the double-sided nature of constraints and attractors in culture (Marais 2019). Deacon defines constraints as the elimination of certain features that could have been present (Deacon 2013: 198) and attractors as dynamical regularities that form due to self-organizing processes and embody the options left by these constraints (197). As Marais explains:

> When a particular whole emerges from the relations between parts, a particular pathway is realized from what was a potentially unlimited set of possibilities. The unrealized possibilities now become a set of constraints on the whole, causing the whole, in its further development, to develop in a particular direction. (Marais 2019: 56)

In complex systems, attractors are patterns towards which the system is moved by its long-term dynamics (Hager, Beckett 2019: 180), and they can vary in their form. For example, the simplest form of an attractor is a point: "In some simple physical systems such as the swinging of an unforced pendulum under gravity, the ultimate steady state of the object is still at a point. Everything reaches an equilibrium and stays there" (Byrne 1998: 168). However, in social systems, we are dealing with "strange attractors", i.e., a set of possible states of the complex system about which it moves without ever reaching these states. The result is an ongoing pattern of variations, which describes the complex system's limits (Hager, Beckett 2019: 180). When in the case of simple attractors, the

movement of the system is predictable, then in the case of strange attractors, we can, in the best-case scenario merely indicate the set of possible states.

According to Kobus Marais, the implication of strange attractors for humanities is that: "semiosis (and thus all of society and culture) gravitates (tends) towards particular trajectories without being as stable as to be predictable. A semiosic trajectory can be predicted to be in the vicinity of the attractor, but exactly where the trajectory would move can never be determined beforehand. This means that semiosis takes on (somewhat) stable forms without ever repeating itself" (Marais 2019: 59). Hence, what Marias emphasizes is that the unpredictability of the process of meaning-making does not imply randomness. On the contrary, the meaning becomes possible only due to the occurrence of constraints through the process of emergence. He writes:

> Before there was a whole, the parts had unlimited potential. The moment a whole has been crystalized, the unrealized possibilities have a constraining effect on the whole and its future development, which means that the whole can only result in a more constrained next whole. Paradoxically, creativity, and newness entail increased constraint. (Marais 2019: 60)

Marais proposes that what is needed in humanities is a qualitative method that would allow to model the dynamics of semiosis and the development of social trajectories through exploring the role of attractors and the emergence of constraints. He goes on to suggest a method that combines a narrative approach and a possible-worlds approach and entails the creation of a number of possible narratives, each constrained by different attractors, to model a particular trajectory that one aims to explore (Marais 2019: 60–62). While undoubtedly useful, the modelling capacity of such an approach is primarily oriented towards phenomena which entail a narrative structure. In order to analyse a wider range of cultural phenomena, a different kind of approach is needed, one that would be more inclusive of various types of semiotic systems.

In the next part of the article, I will consider the question of how we can model the dynamics of various cultural systems from the perspective of Lotmanian semiotics.

4. In search for the "rules" of cultural complexity with Juri Lotman

While the complex understanding of culture in Lotman's research is often connected to his later works starting from the 1980s, then as our brief overview in the second part of the article hopefully managed to demonstrate, many of the principles that are viewed as central for complex systems appear in various forms in Lotman's works throughout his academic path. While there are authors who prefer to make a clear distinction between the early structuralist Lotman and the "post-structuralist" Lotman, who focused on the dynamics of culture, the present paper follows the line of thought of those who argue for a holistic take on Lotman's theory (see e.g., Salupere 2017, Avtonomova 2009). By viewing Lotman's semiotics of culture as a whole, I do not mean to imply that the shifts in Lotman's research focus, theoretical language and interests that took place over the years of his writing are insignificant. What is important in my opinion, is that these shifts did not usually cancel out the previous point of view; instead, each new turn added another perspective to the bigger picture.

Hence, the shift from focusing on the structural description of the mechanism of culture to the dynamic processes does not strike out the relevance of the structural perspective for Lotman. To exemplify this claim, let us take a look at how Lotman describes what he sees as the next essential step for the discipline of semiotics expressed in one of his very last books, *The unpredictable workings of culture*, written in 1991. There he writes that semiotics should move on to formulating a general theory of structures, a theory that links all forms of organization in the world – from physical to cultural phenomena" (Lotman 2010 [1994]: 37). His own goal in this book is more modest: "to provide an outline for a general

structural description of culture and tentatively to suggest the place of culture among broader and more general forms of organization" (Lotman 2013 [1994]: 53). As was shrewdly noted by Salupere: "From this description, it turns out that Lotman actually never left structuralism" (2017: 65). This, however, should not be perceived in a negative way as a fallback to old patterns of thought. On the contrary, in my view, it is exactly this creative merging of his structural description of cultural dynamics with the nonlinear processes of complex systems that may hold the key to addressing the specifics of cultural complexity and that differentiates his line of thought from the vast field of contemporary complexity research.

As was pointed out in the previous section, one of the central aspects that differentiate complex cultural systems is the nature of constraints which, in comparison to physical systems, are much more fluid and provide a greater variety of variants of behaviour. Hence, it is not possible to speak of constraints in cultural systems in terms of laws or rules in the same sense as they are used in natural sciences (see Cilliers 2000). In addition, it is also unlikely (not to say impossible) to be able to find one universal language for describing these constraints. However, as Paul Cilliers (2016 [2000]: 64), has reminded us, the fact that there are limits to our understanding of complexity does not mean that scientists should not engage with those limits enthusiastically; it simply reminds us to let go of the strive of obtaining a perfect grip on reality in order to control it. The capability of semiotics to grapple with phenomena at the limits of our knowledge that do not fit into clear-cut formulas has been considered by Kalevi Kull in his paper devoted to discussing the core principles of Lotman's semiotics:

> Sign processes can do literally everything; mind is almost almighty – the art of text is limitless; life's evolution is open-ended; there are 'no limits in learning'. While physical reality is limited by physical laws, and the mathematical realm as based on formal logic is restricted by the necessity of avoiding contradictions, the realm of imaginations and meaning-making has no such limits. We must ask whether the science of signs, semiotics, can tell us anything general at all about this vast diversity. Paradoxically, it can. (Kull 2015: 1)

Continuing this line of thought the present paper aims to argue that Lotmanian semiotics has the theoretical scope and flexibility to engage enthusiastically with the phenomenon of complexity. In this last part of the article, I will present some initial thoughts on how Lotman's semiotic ideas could be elaborated to develop a better understanding of the nature of constraints in complex cultural systems and how the analysis of these constraints could allow us to explain some aspects of the complex dynamics in culture.

Placing the question of constraints in the context of Lotmanian semiotics, we can start with a definition of culture proposed by Lotman and Uspensky. They write: "We understand culture as the nonhereditary memory of the community, a memory expressing itself in a system of constraints and prescriptions" (Lotman, Uspensky 1978 [1971]: 213)[8]. Elaborating this idea further, they continue:

> the definition of culture as the memory of a community raises the question about the system of semiotic rules by which human life experience is changed into culture: these rules can, in their own turn, be treated as a program. The very existence of culture implies the construction of a system, of some rules for translating direct experience into text. (Lotman, Uspensky 1978 [1971]: 213)

In a similar manner in the "Theses on the semiotic study of culture" (Lotman et al. 2013 [1973]: 68), the authors claim that the semiotic structure of culture and the semiotic structure of memory are functionally uniform, although they are situated on different levels. They write that culture "being in principle fixation of past experience, […] may also appear as a program and as instructions for the creation of new texts" (Lotman et al. 2013 [1973]: 68). How is this program manifested in culture? To answer this question, we have to turn to another definition of culture proposed by Lotman which adds one additional perspective to the previous descriptions we have offered here. Namely, that "Culture can be presented as an aggregate of texts; however, from the point of view of the researcher, it is more exact to consider culture as a mechanism

creating an aggregate of texts and texts as the realization of culture" (Lotman, Uspensky 1978 [1971]: 218).

Considering all these definitions, how can we interpret them from the perspective of the functioning of constraints in cultural systems discussed in the previous parts? First, as we can gather from the quotations above, cultural memory is preserved in texts. However, these texts are not merely a collection of past knowledge. The texts themselves can start functioning as rules for creating new texts. Rules in this context should not be understood only as explicitly phrased regulations of what is allowed and what is forbidden, instead, we can think of rules also in the sense of pregiven patterns of meaning making in culture. When a new text emerges in culture, it creates a particular set of relations leaving aside an endless variety of options. The more this text is repeated in culture, the more these relations automatize. Eventually, the pattern which first occurred accidentally or as a result of conscious choice turns into a rule-like structure acting as a strange attractor towards which meaning making in culture gravitates (cf. Marais 2019: 59).

Hence, creating new texts in culture, which can be seen as the process of transforming the lived experience into a text of cultural memory, is always, to some extent, constrained by these pregiven patterns. This does not mean that it has to follow the rules preserved in cultural memory in full. If this would be true, cultural systems would lose their dynamicity. Some parts of culture, like art for example, are even actively oriented against such automatization aiming towards transgressing the pregiven boundaries of cultural norms. This relates to an important aspect in Lotmanian semiotics, according to which a text is not merely a manifestation of language as a set of rules, instead, text can also generate its own language (see Torop 1995: 228, Lotman M. 1995, 2019). Therefore, as was mentioned in the previous part by Marais that while semiosic trajectory can be predicted to be in the vicinity of the attractor, it is not possible to precisely determine it beforehand, meaning that semiosis can have "(somewhat) stable forms without ever repeat-

ing itself" (Marais 2019: 59). This means that although cultural dynamics is inherently unpredictable, it is still possible to map out the patterns towards which human behaviour gravitates. From the perspective of the semiotics of culture this can be done by analysing the existing structural organization of culture materialized in texts on various levels of meaning making.

In my view, Lotman's theory of culture entails a unique perspective for analysing the relation between cultural dynamics and the structural organization of culture due to the combination of three specificities of his semiotics: the principle of textuality, the principle of isomorphism and the principle of cultural universals. The first two have been interpreted as a closely connected core characteristics of Lotman's theory by Aleksei Semenenko (see 2012: 146) and Lotman's approach to cultural universals has been most profoundly discussed by Peet Lepik (2008 [2007]). For the purpose of present article, I will not elaborate these aspects in depth, only present some initial thoughts about how they could allow to create analysability of the dynamics of complex cultural systems.

The principle of textuality is connected to the view of the text as the basic unit of analysis in the semiotics of culture (Lotman et al. 2013 [1973]: 57–8). Lotman defines the concept of text through three characteristics: (I) text is expressed through signs; (II) text is demarcated, i.e., it has a clear boundary, (III) text has a structure, meaning that it has an internal organization which transforms it into a structural whole (Lotman 1977 [1970]: 52–53). Such a broad definition allows to model various meaningful entities on different levels of culture as texts and analyse them accordingly. The principle of isomorphism is closely connected to the textuality of culture. According to Peet Lepik, the vertical isomorphism of culture refers to the "analogy of the principles of structure and functioning, as well as mutually exchangeable functionality [that] is attributed to intellect text and culture" (Lepik 2008: 17). This means that by studying the structural principles of text on one level we can assume that similar structures will be at least to some

extent mirrored on higher and lower levels of culture. As has been explained by Semenenko:

> what Lotman's semiotics tells us is that in order to understand how we think, it is not necessary to go deep inside the brain and attempt to find the answers in its microstructure, but on the contrary, we have to look around ourselves, at the semiotic space that envelops us and makes up our conscious experience. (Semenenko 2012: 142–143)

Accordingly, the same idea is true for the movement in the other direction, meaning that by analysing texts on the lower level of culture, we can interpret also higher order cultural processes. This is due to the fact that text in culture being created by humans reflect the meaning making patterns of our mind, while our mind is shaped by the texts we encounter through participation in culture. As Lotman and Uspenky have argued: "Culture is the generator of structuredness, and in this way it creates a social sphere around man which, like the biosphere, makes life possible; that is, not organic life, but social life" (Lotman, Uspensky 1978 [1971]: 213). Still, we must emphasize once more that these structures do not have an ontological character and are not something static that is mirrored throughout the various levels of culture in exact identity. It is merely one side of the broader cultural dynamics that is a constant search for balance between the need to change while maintaining its identity (cf. Lotman 2009: 1).

But how can we analyse these structures? To answer this question, we can also find inspiration in Lotman's works by bringing in the third principle – the idea of cultural universals. Throughout his academic path, Lotman searched for ways how to describe the workings of semiotic systems through various universal structural characteristics. Peet Lepik writes: "In his studies, Lotman has described various cultural universals: for example, the function that structures the beginning and end of cultural texts, the generative difference between communication and autocommunication, the semiosphere, the importance of honour and fame (in Russian culture),

the "vertical" isomorphism of the intellect, text and culture, etc." (Lepik 2008: 15). In his book *Universals in the Context of Juri Lotman's Semiotics* Lepik himself focuses on a particular type of universals, namely the universal communicative algorithms of the intellect which are textually realized as mythological, magical, religious, antithetic, and metaphorical code signals (Lepik 2008: 14–15).

In relation to describing the dynamics of complex cultural systems, the universals that deserve the most attention in my mind are the ones that are presented as opposing tendencies. It is this type of universals through which Lotman aims to grasp culture's strive to find a balance between stability and change – dynamics which is inherent to all complex systems. One of the most comprehensive attempts in providing such a description is presented, for example, in the article "The Dynamic Model of a Semiotic System" written by Lotman in 1974, but we can find similar separate attempts throughout his writings where he discusses static and dynamic relations in culture through describing opposing tendencies such as unity–plurality, internal–external, gradual–explosive etc. as cultural universals.

In regard to such binary descriptions, Semenenko has brought out that it is "important to distinguish between the two sides of this concept: binarism as, so to say, an intrinsic, ontological quality of any semiotic system and binarism as the principle of semiotic analysis and interpretation" (Semenenko 2012: 96) – for Lotman the value of such descriptions was definitely connected with the latter. In Lotman's works, such attempts seem to have primarily heuristic value, and while necessary for creating analysability, we should keep in mind that real life is always diverse. In his later works, Lotman defines binarism as "a principle which is realized in plurality since every newly-formed language is in its turn subdivided on a binary principle" (Lotman 1990: 124). As Semenenko suggest, the binary approach in Lotman's works as it is elaborated in the context of the "multidimensional character of culture can therefore be represented by a diagram where each of the main oppositions

is an axis with uncountable intermediate variants that in their turn can relate to other elements of the system" (Semenenko 2012: 97).

The different opposing tendencies, while on the higher level relating to static-dynamic relations, can, at the same time, influence various processes on different levels in culture. For example, the tendency towards either unity or plurality in culture could be connected to the self-description process and affect the ways how social cohesion is established in culture; or culture's orientation on the axis of internal-external can have an effect on its ability to tolerate indeterminacy as the quality of border area of semiotic systems and this can affect the extent to which ambivalence in meaning making processes is tolerated etc. Culture's orientation towards one or the other side of these oppositions is reflected in the structure of its texts. The more central the text is to culture's self-description (see, e.g., Lotman 2005 [1984], Lotman 1977 [1974]), the stronger is usually its capacity to constrain cultural processes disabling options that are connected with the other side of the axis of the oppositional pair and serve as an attractor which provides the patterns towards which meaning making in culture is drawn.

Bringing the three principles – textuality, isomorphism and universals – together for the analysis of the dynamics of complex cultural systems, we could propose that such an analysis would entail the following aspects:

1. The principle of textuality: the object of analysis would be a text (or multiple texts), meaning any cultural entity that is expressed, demarcated, and has a structure.
2. The principle of universals: the structure of the text could be analysed using the pairs of universal opposing tendencies (the selection of the oppositions would depend on the place and function of the text in culture, the aim of the research etc.). Through that, it would be possible to reveal towards which side of the axis of the oppositions the structure of the text is oriented and accordingly, which constraints this text imposes on meaning making.

3. The principle of isomorphism: based on the results of the analysis of the text, it is possible to draw connections with higher or lower level cultural phenomena that this text belongs to. It could enable us to analyse how the orientation of the text towards one or the other tendency can constrain the direction of the processes in culture on different levels.

5. For conclusion

It is important to note that Lotman himself does not develop these oppositions into a unified system of cultural universals and does not connect it explicitly to the idea of constraints in the way done in the last part of the article. It is also relevant to emphasize that, as in all qualitative research, the way the universals are used for particular analysis and how they are connected with the dynamics of complex cultural systems always depends on the context and will inevitably entail the aspect of choice based on researchers' intuition. Analysing the "rules" that govern complex cultural systems cannot lead us to exact predictions of cultural development; after all culture as a thinking system does not abide by the same regularities as, for example, the weather. What it can offer, however is to enhance our understanding of the complex interrelations of our mind, text, and cultural processes. While cultural complexity cannot be managed according to the linear logic of cause and effect, this does not mean that such analysis could not entail a pragmatic function. Jüri Engelbrect has brought out four ways how complexity thinking can elucidate real life policy making according to him: (a) while complexity approach cannot predict specific events, it can identify and analyse trends and probabilities; (b) though cause and effect in complex systems are distributed, intermingled, and not directly controllable; complexity science can offer many insights into finding and exploiting desirable attractors; identifying and avoiding dangerous tipping points; and recognising when a system is in a critical self-organising state; third; (c) although deterministic quantitative prediction is not generally

achieved, the elucidation of the reasons for complex behaviour is often more important for comprehending otherwise puzzling real-world events; (d) understanding the basic ideas of the complexity of the world together with its unpredictability enables to achieve a change in the mindset which is necessary in order to tackle complex problems (Engelbrecht 2021: 17). In the light of these aims of complexity science, I would argue that developing Lotmanian semiotics further for analysing complex cultural dynamics would make an important contribution for achieving these goals.

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Notes

[1] The reason why the authors of this article use the term "complex adaptive systems" and not just "complex systems" is connected to their focus on ecosystems and explained in the following way: "In a special landmark edition of the journal *Ecosystems* (1998), Hartvigsen et al. argued that although systems theory had been widely applied in the field of ecology, the analytical limitations of traditional systems approaches meant that the influence of processes of adaptation in ecosystem dynamics had been overlooked. By characterizing ecosystem dynamics as complex adaptive systems (and not only as complex systems), researchers were given the tools to incorporate variability (biodiversity) and adaptation in analyses of ecosystem interaction" (Preiser et al. 2018). In the context of the present article, I will use CAS and complex systems as synonyms.

[2] Authors whose works were used in generating this typology: John Holland (1995); W. Brian Arthur, Steven Durlauf, and David Lane (Arthur 1988, Arthur et al. 1997); Simon Levin (1998, 2005); Paul Cilliers (1998); Dominique Chu, Roger Strand, and Ragnar Fjelland (2003). It is important to note that this overview includes both authors who deal with the so-called "restricted complexity" as well as those who deal with "general complexity". The difference between these two is explained in part 4 of the article.

[3] In Lotman's works, the idea of nestedness is manifested in the principle of "vertical isomorphism of culture", referring to the "analogy of the principles of structure and functioning, as well as mutually exchangeable functionality" (Lepik 2008: 17) of semiotic entities at different levels.

[4] Lotman distinguishes three classes of intellectual objects that share such structure: individual consciousness, artistic text, and culture as collective intellect (Lotman 2004 [1981]: 585).

[5] It is possible to differentiate between 3 types of systems: isolated, closed, or open. As Byrne and Callaghan explain: "Isolated systems exchange neither energy nor matter with their environment; closed systems exchange only energy; open systems exchange both energy and matter" (Byrne and Callaghan 2014: 25–26) and in the case of living systems, also information.

[6] A similar distinction was also proposed by David Byrne (2005) who differentiated between "simple and complex" complexity. However, Morin's categorization has become widely accepted and used in the field of complexity research.

[7] Engelbrecht also brings out some research in the field of complexity that has considered values as attractors in complex systems (see, e.g., Tachella et al. 2012, van den Hoven et al. 2012), but does not elaborate in depth how exactly such analysis in social sciences could be conducted, but primarily marks it as a path of further investigation.

[8] Around the same time in 1970 Lotman publishes a short theses about the concepts of "shame" and "fear" as two central constraints in culture (Lotman 1970: 98) where he writes that the understanding that culture can be seen as system of constraints has become generally accepted in spheres of ethnology and sociology after the works of Claude Lévi-Strauss.

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