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WEB-HYPertext AS A SELF-ORGANIZING SYSTEM: THE SYNERGETIC APPROACH

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The paper covers the issue of describing hypertext of the web-communication space in terms of synergetics theory. The authors claim that the notions of self-organization, chaos, bifurcation and attractor fully and naturally represent this complex phenomenon and its key features: nonlinearity, infinite data arrays, multi-level architecture, constant development and decentralized data management performed simultaneously by various subjects. Hypertext can be viewed not only as a way of physical data storage, but as a way of mind organization and functioning and as a way of reality representation. In the world of novel communication technologies, the concepts of materiality and virtual reality are rebuilt as the interplay between the physical structure of the text and its signifying strategies which can't be realized in the absence of a reader, who gradually evolves from a mere user into a creator.

Keywords: *synergy, synergetic approach, synergetics, self-organizing system, Internet, hypertext, hypertextuality, communication space.*

The issues of structure and functioning of electronic hypertext in the modern communication space are of great urgency due to the magnitude of the described phenomenon and its huge role in the genesis of post-industrial, or information society. The concept of hyperspace civilization where human intelligence coexists with artificial intelligence, and mind transfer is about to become a reality involves ubiquitous access to a unified electronic information space and engagement of each individual in a global communication “melting-pot”. In the world of computer technology, “print is flat, code is deep... Materiality is reconceptualized as the interplay between a text's physical characteristics and its signifying strategies” [Hayles 2004: 67].

We are witnesses of an amazing era where media have become the main “constructors of the social imagination, structures of thought” [Tapia 2003: 5]. Cutting-edge technologies have allowed the construction of a particular type of discourse which combines verbal and visual communication. There has emerged

a unique system of expression administered through the computer screen; every day the humanity is faced with a greater volume of data. Digital capacities ensure a faster flow of information and an almost unlimited access to knowledge. As a consequence, we see the concept of “mediacy” [Elmfeldt 2002] gradually replace what we used to denote as “literacy”: there is no need to remember great amounts of data if one can easily extract the necessary information from the Internet. While the notion of *textuality* is generally bound to print culture, *hypertextuality* goes far beyond the framework of text and can be viewed as “remediation” [Elmfeldt 2002], that is transferring the image into virtual reality via its multi-faceted and realistic representation. Exploring the space of hypertext may be considered not only an educational or communicational, but also an aesthetic practice.

There has long existed an idea that hypertext operates in a very similar way to how human brain does – in a series of networks, or associations, as opposed to a linear path. People tend to organize information in nonlinear associations between chunks of information. Since hypertext analogizes the way our minds normally work (that is, not in a straight line but in several dimensions at once), hypertext can be considered a thought machine [Beechhold 1988].

The whole matter started with what is commonly referred to as digital revolution, which “rests on the capacity of electronic bits to encode the information making up an image, a text, or a sound, using a simple binary principle”, so that it is easy to “manipulate, fragment, and connect these images, texts, or sounds”; due to discontinuity of data presented as numerical code, information is easy to process, store, restructure, fragment or join together, which “has given rise to a new logic in the production of symbols and signs, and new rules and networks for cultural exchange and communication” [Tapia 2003: 6].

Initially studied as the way of digital data organization, the notion of hypertext gradually spread onto describing non-linear reading tactics; then the focus of study moved on to multimodal perception peculiarities. “Digital production and the possibilities created for global interconnection and simultaneous discourse on-line... raised a series of new questions on the nature of reading and interpretation, and of communication and the very “status” of signs” [Tapia 2003: 6]. Surprisingly, computer hypertext matches all the criteria described by R. Barthes in his famous work *S/Z* concerning an ideal text: “the networks are many and interact, without any one of them being able to surpass the rest; this text is a galaxy of signifiers, not a structure of signifieds; it has no beginning; it is reversible; we gain access to it by several entrances... the codes it mobilizes extend as far as the eye can reach... the systems of meaning can take over this absolutely plural text, but their number is never closed, based as it is on the infinity of the language” [Barthes 1970 (transl. 1974), cited via Landow 2006: 2]. Finally, there came to be the idea of human knowledge

structured in the mind as hypertext, and the global virtual reality as a unified, continuous hypertextual space. Even Vannevar Bushs, whose article *As We May Think* (1945) is widely cited in connection with the birth of the term *hypertext* believed that hypertext is a natural reflection of the mind or (in the strongest form of this position) a model of the mind [cited via McKnight et al. 1992].

Hypertextuality is at the same time a quality, a state of being and a potential [Elmfeldt 2002]. Internet communication space can be viewed as a single whole, a huge complex system with a multi-dimensional architecture, constantly changing and developing. In this respect, as a theory best applicable to describe this unity we see the concept of synergetics. This aspect of hypertext analysis was revealed a few years ago (see [Butorina 2011; Fuchs 2005]) and requires further elaboration.

There is an opinion proposed by P.B. Andersen that World Wide Web is a novel type of self-organizing technical system because its functioning is based on recursive processes between clients and servers, where chaotic browsing processes strive for identifiable attractors (some web pages that are well indexed in search indexes or have a good design); bifurcation takes place when new WWW attractors come and old ones become out-of-date; self-reference is created by the syntactic structure of URLs and by Web spiders; there exists a self-similar structure of the WWW that is based on client-server communication; self-repair occurs due to the updating of links and the deleting of dead links by spiders; so, generally speaking, the Internet is differentiated into subsystems, it is dynamic and can't be controlled by one central intentional agency, and it can itself strongly facilitate its own reproduction, development, and repair [Andersen 1998, cited via Fuchs 2005].

Thus hypertext as a complex and multidimensional phenomenon can be viewed in terms of synergetics. It is a theory of evolution and self-organization, which explains some principles of nonlinear functioning of complex systems. According to this theory the future is open and unpredictable, it has a spectra of possible future states, that can be determined by attractors and represent complex evolutionary processes.

The term *synergetics* (from Greek: “the theory of collaborative action”) was introduced into the scientific use by one of the creators of this approach – Hermann Haken, who specialised in the physics of lasers. He introduced two meanings for this term. On the one hand, this is an approach that considers the formation of new properties, qualities, strategies in complex systems, the elements of which don't possess them. On the other hand, it is an approach that requires mutual creative and collaborative activity of natural scientists, humanitarians, technologists and managers. H. Haken discovered that the simplest nonlinear models of many complex processes in different fields of science are the same, including humanitarian sciences [Haken 2005].

H. Haken describes synergetics as the science of “general laws or principles” governing the processes of “cooperation, collaboration” of elements

of any systems – “from molecules and liquids to human individuals and societies” [Haken 2000: 12].

Nowadays, there is a tendency to view the world as an integral system represented by the interaction of man and nature. Environmental, social and economic crises have become common for our century. Considering these facts, the scientists have to solve the tasks “sinergo” (from Greek “acting together”), within the framework of interdisciplinary research.

The synergetic style of scientific thinking includes a predictable, evolutionary vision of the world, which rapidly developed in the XIX century. Concepts and ideas of the self-organization theory are reflected in such areas as the theory of dissipative structures, the theory of deterministic chaos, the theory of catastrophes.

Synergetics focuses on universal mechanisms of complex systems featuring self-organization of any type, including social ones. Synergetic models of self-organization view society as a non-equilibrium system of a special type, the stability of which is provided by the interaction of external and internal factors. Even politics and economics are viewed in the context of the synergetic paradigm.

The theory of dynamic systems is also used in medicine. Concerning the neurophysiological mechanisms of brain activity studied in neuro-synergetics [Knyazeva, Kurdyumov 1994]. It is stated that the main principle of synergetics can be applied to brain activity – the subordination of all elements of a complex system to the most unstable element – order parameter.

Synergetics gives a simple description of complex systems and provides an understanding of complex events at the level of universal tendencies, concerning the possible way of development and evolutionary processes. The key concepts of synergetic are: chaos, open nonlinear systems, bifurcation attractors, fractality (self-similarity).

Nonlinearity is one of the fundamental concepts of the synergetic paradigm. “Nonlinearity presupposes the possibility of super-rapid development of processes in the system at certain stages of its evolution” [Kurdyumov 2005: [http](#)]. The system is nonlinear, if at different times, under different external influences, its behavior is determined by different laws. The nonlinear system has stable and unstable stationary states.

The idea of nonlinearity is applied in various areas. The concept of nonlinearity includes multivariance, alternative choice of evolutionary pathways and irreversibility. “Nonlinear systems are affected by random influences caused by disequilibrium, instability. They are subject to accumulation of fluctuations (random deviations) and bifurcations, spontaneous changes in the open environment. Nonlinear thinking becomes a characteristic feature of modern mankind. Nonlinear processes are extremely difficult to predict, because their development is due to the randomness of the choice of the path at the time of bifurcation” [Kalinin 1994: 148–161].

The Internet system has a chaotic nonlinear character. The connections and interactions between networks take a great variety of forms. As Yi Lin and his co-authors suppose, the web pages, applications, thoughts and users are randomly scattered all over the Internet. Though, mainframe systems and networks are organized through TCP/IP and hyperlinks [Yi Lin et al. 2012]. Serving as attractors of a chaotic Internet system, hyperlinks and hypertext organize the web space and facilitate the finding of information. Also, the parts of the Internet mutually affect one another, rely on one another and interact on one another. For example, when a problem attracts everybody's attention, a huge number of web pages, which are interested in the problem and are scattered over the entire Internet, will spontaneously and repeatedly interact with one another by using hyperlinks.

Fuchs highlights that self-organizing systems involve certain degrees of freedom, chance, unreducibility and indeterminacy. He states that we can speak not only about networked technologies, but also about networked communication, knowledge, human values, and culture. Self-organization of the WWW is mediated and enabled by human agency, human communication at a distance is mediated and enabled by the technological structure of the Internet. In his article "The Internet As A Self-Organizing Socio-Technological System" Fuchs notes that there were claims that the WWW could develop into a "super-brain" or "associative memory" if learning algorithms could be generalized in such a way that the WWW permanently learns from its users. The advantage of this "super-brain" would be that one could use the unlimited knowledge and intelligence of others in order to solve problems [Fuchs 2005].

Nevertheless, even though the WWW is a giant storage mechanism of human knowledge, but it's not the brain itself. It is the communication of users via the Internet which creates new search results, human activity turns the Internet into a self-organized system with its own laws and conditions. In connection to this there has emerged a peculiar tendency to view electronic hypertext not only through its structural analysis, but on the contrary – by measuring and modeling the users' characteristics rather than the formal shape of the text.

Researchers claim that the Internet is, first of all, adaptive to the user: the structure of e-hypertext networks is based on the work of specific systems that filter, tailor, and enhance the content of online data resources to better fit the needs and interests of the user [Bollen, Heylighen 1998]. We can observe a gradual evolution of *reader* → *user* → *creator*. The user not only browses infinite webpages of the Internet, but modifies them according to one's free will. Each minute decision of the user (upon where to click next, or to place a "like", or post a comment) can be seen as a bifurcation point in the existence of electronic hypertext, where its state of equilibrium is being modified by the actions of the human navigator.

As much user-determined is the notion of the *semantic attractor* in hypertext. Generally a semantic attractor can be presented as a certain dominating sense of the text, towards which all the other senses and constituents gravitate – that makes its essence similar to that of a semantic field nucleus [Hajdarova 2008]. Research shows that the most powerful attractors – nodes that have got the greatest number of incoming links – are generally associated with a wider list of lexemes in the human mind. Experiments have demonstrated that “all paths would end up in a cluster of semantically related, strongly cross-linked nodes, forming an approximate attractor for the network”... in the meantime, “nodes outside the attractor would get little chance to learn and thus remained poorly connected” [Bollen, Heylighen 1998: 205].

To summarize the given theoretical theses, we claim that web-hypertext is genuinely a self-organizing complex system which development is perpetual and unpredictable with numerous determinants (both digital and non-digital), but the meta-determinant is still the human, or the humanity, whose mind structure this virtual reality represents. Nevertheless, we can't assume that this product of human activity is fully in our control: order and chaos coexist harmoniously in hypertext communication space while independent self-learning search engines manage its structure with considerably low human interference.

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