UDC 81’111

FRACTAL THEORY OF DISCOURSE CONSTRUCTION: SOME HYPOTHETIC IDEAS

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This article analyzes selected methodological insights that fractal theory might provide for discourse construction. In particular, it focuses on the concept of fractals and, through this concept, how fractal structures similar to those used in the chaos and bifurcation theory might constitute the background of any language. Therefore, the aim of this article is twofold: a) to reintroduce a comparatively new concept – fractal – in a way that is consistent with the ontological and epistemological aspects of discourse; b) to prove that discourse can be programmed using self-similar patterns through the process of identifying recursive semantic components. Fractal theory is theoretically positioned as a methodology which can reveal regularity in the chaotic system of language being simultaneously a limiting factor and a generating tool. Fractal metaphor actualizes the fact that discursive reality is similar to other natural forms and processes irrespective of the scale of time and space. It provides methodological possibility to trace a connection between the facts of different systemic levels of discourse, including extralingual.

Keywords: *discourse, fractal, cognitive-synergetic paradigm, self-similar structure, recursive nature, irregularity.*

1. Introduction

One of the most promising interdisciplinary approaches which form a universal scientific paradigm is the theory of self-organizing complex systems or “synergetics”. This theory has gradually acquired the status of a particular methodological perspective, within which a constructive cross-disciplinary dialogue has been maintained by the representatives of scientific community. The basic ideas and concepts of synergetics are exposed to active interpretation and fruitful use in many areas of scientific knowledge (L. S. Pihtovnikova, T. I. Dombrovan, S. M. Jenikejeva, N. S. Olyz'ko, D. S. Hramchenko, S. P. Kurdjumov, V. I. Arshynov, D. S. Chernavskij, H. R. Maturana, P. van Geert etc.) [1, p. 151].

Widely popular in today’s world, the principles and methods of synergetics have gradually gone beyond the natural sciences, often without using the complex mathematical operations typical of these sciences. Appropriate specific terminology is entering the general scientific language, and the value of many concepts is often metaphorized and simplified, adjusting to the needs of specific areas of human knowledge. For humanities **the relevance** of this universal scientific paradigm lies in the fact that it explores the intersection points of inanimate and animate nature, intuitive and rational aspects of cognition.

Linguists could not help but notice the potential of synergetics, paying attention to synergy of language and speech, as well as text as an unbalanced condition of the system, which is structurally fixed. Taking into account the complexity of language nature – biological, physical, social and cultural – interdisciplinary studies have become dominant. The theoretical concepts, including self-similarity, iteration, dissipative structures, strange attractors and fractals have provided a particularly effective interpretative framework for being applied in linguistic studies. Besides, relativist scholars contend that discourse is not linear but in fact a dynamic process that constructs, reconstructs, reproduces and transforms society [2]. These considerations constitute the motivation for modern linguists to use the fractal structures similar to those used in the chaos and bifurcation theory. This fact, together with the seemingly simple procedure involved in fractal analysis, has led to the popularity of this methodology for discourse analysis.

In this regard, **the purpose** of the paper is to select methodological insights into the fractal theory of discourse construction. Achieving this goal involves the following **tasks:** 1) to reintroduce a comparatively new concept – fractal – in a way that is consistent with the ontological and epistemological aspects of discourse; 2) to prove that discourse can be programmed using self-similar patterns through the process of identifying recursive semantic components. **The object** of this study is discourse fractals, and **the subject** – the fractal paradigm of semiotic discourse dynamics.

We have used the following **methods**: a thesaurus analysis for disclosing the contents of fractal through dictionary definitions; a method of theoretical generalization and classification for presenting the basics of fractal theory of discourse construction; a discursive analysis to determine the recursive structure of semantic elements in the English discourse; a correlation analysis to analyze the interrelation of specific terminology from the spheres of synergetics and linguistics.

2. Fractal

Fractal dimension of the universe was launched by mathematical investigations. A famous mathematician B. Mandelbrot coined the term 'fractal' – taken from the Latin 'frāctus', meaning 'broken' or 'fractured' – to describe irregular, geometric patterns in nature [3, p. 18-31]. J. Feder provided quite a good definition of fractal, calling it "a shape made of parts similar to the whole in some way" [4, p. 11]. This represented a departure from pure mathematical concepts of theoretical fractional dimensions and their corresponding characteristics of determinism and predictability, giving us a clue to fractal discourse.

Invariant nature (fundamental property of geometric regularity) characterizes many structures of the material world. It is a special form of symmetry with its integrity fragments being structurally similar. Fractal dimension gives a very compact way of describing objects and processes. Fractal is a transitional quasi-stable condition of a system, characterized by chaotic and unstable nature, which gradually evolves into a stable orderly whole. This network formation exists among self-similar objects and endlessly repeats itself at different levels. Fractal system increases according to the development set by the algorithm, sharing and growing again. These processes take place, forming a set of systems, subsystems and supersystems similar to each other.

Fractal is determined as a result of modelling, which allows judging the quality of the entire set of parts with the help of a limited number of elements within the observed complexity level. Fractal dimension of any figure serves as a quantitative characteristic of its critical feature, particularly, filling the space. Herewith at any hierarchy level fractals are subject to the same regularities regardless of the scale of time and space. It is also believed that fractality is a manifestation of form and structure isomorphism of system objects [5, p. 19; 6, p. 14].

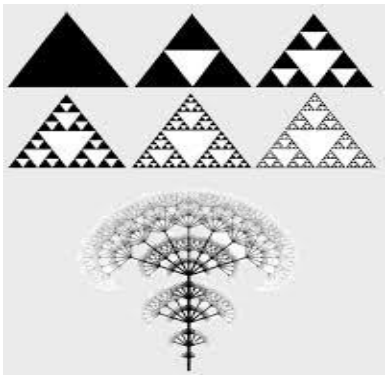

Figure 1 - Fractal structure

These statements make it possible to assume that in modern transdisciplinary scientific paradigm fractal occupies a central place, being a universal measurement model that has been constantly evolving and creating self-similar structures from each point of its development (Fig. 1).

The simplest fractals are usually depicted in the form of a tree (see Fig. 2). More complex models are spiral-shaped, star-shaped fractals, etc (see Fig. 3).

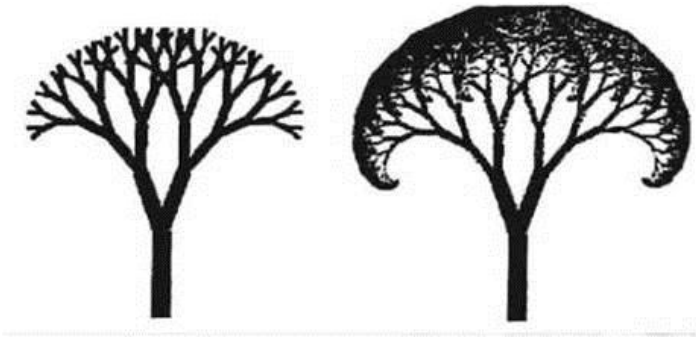

Figure 2- Tree-shaped fractals

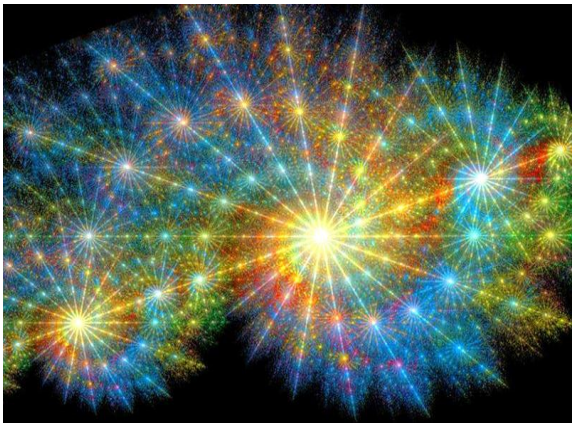

Figure 3 - Spiral-shaped and star-shaped fractals

In real life fractal idealization is limited for technical and other reasons: we can not fix endless fractal fragmentation on paper or on the screen, being able to imagine this process only mentally. Nature creates trees and their roots only in the form of a limited part of the fractal. The same can be applied to language: no matter how 'fractal' could morphological constructions seem, their structures are not fragmented further than into morphemes. It is also observed that theoretically and practically fractals can be not only flat like patterns, but multidimensional [7, p. 116-117]. Like Mandelbrot's coastline, the concept of meaning is complex, dynamic, and 'fractured'; an "elusive notion that slips between the fingers of one who wants to grasp it" [3, p. 25]. It should be added that fractals are not based on identity, but on approximate similarity of the whole and its parts in space and time, so they are pretty convenient tools to describe the phenomena devoid of some regularity and order. In short, fractal systems in nature tend towards infinity, and this property can be found in discourse.

3. Discourse fractals

Language is a classical example of ontologically and epistemologically complex and irregular phenomena, and it is fractal dimension that can be useful for its analysis. In philology, the theory of fractal movement offers a universal model describing linguistic features; what is more, modelling is used to explain and generate the utterance [6; 7; 8]. Fractal modelling allows us to analyze language and speech processes, irregular structures in discourse with a high degree of visibility. In reliance on this thought, we can assume that the idea of fractal geometry constitutes the background of language.

For example, the alphabet of Indo-European languages is based on an alphabet with a certain number of letters that have no meaning unless they are combined into words. Euclidean geometry similarly consists of only a few elements (line, circle, etc.), of which complex objects are made to have some sense geometrically. The analogy can also be made with the family tree of the world languages where the basic point of evolution is the proto-language. While using this model every vector of "the joint" is generally described both in synchronic and diachronic aspect. It should be mentioned that the introduction of fractal dimension of semiosis process in general and linguistic sign in particular becomes possible by combining the postulates of triadic sign structure and sign production and perception under the simultaneous principle of similarity and difference.

The sequence of language levels in the process of evolution is repeated in ontogeny. The data of empirical observation show that a child begins his/her language development at the proto-language stage which combines a number of sounds and gestures that occur randomly and are not based on the words of mother language [9, p. 126]. This fact suggests the idea that as a result of ontogeny human mind always reproduces a reduced structural copy or fractal of the socio-cultural language invariant, wherein repetition occurs in the principles, and variation concerns individual cases.

The most obvious manifestation of language fractality is its structural self-similarity. Language is an abstract system of signs, where each unit consists of lower level units and is, in its turn, a 'building block' for higher level units. Besides, interlevel relations of units (phonemes and morphemes, morphemes and words, words and phrases) are homotypic. It also concerns intralayer distribution: morphemes, lexical units, phraseological units repeat the nature of syntagmatic relations of phonemes [10, p. 3]. It must be noted that this self-similarity is not absolute and one hundred percent: only average and statistical characteristics are reproduced.

Phase transition in language system is explained from fractal perspective, being considered on the examples of 'string-like arrangement' of subordinate clauses (each clause contains repetitions, demonstrative and determining pronouns, forcing us to accept the structure as self-similar). The use of verb tenses is also accounted in fractal paradigm (if you place all time expressions of one verb according to increasing complexity, such a speculative scale is of fractal type); the same can be said about fractal concurrence of rhymes and metrical schemes in poetic texts [7, p. 119-122].

Involving fractal geometry to the analysis of word formation system, the researchers present it as a huge 'macrofractal' structurally similar to 'microfractals' – integrated microsystems of word formation. In this case microfractals of word-building patterns and families of words are considered to be relatively autonomous stereoscopic objects isomorphic according to the structural principles of each type of word-building microsystems. Each element of such a microsystem has the potential to produce new units, consequently completing and developing it [6, p. 14-16]. Fractality is also used to describe the development models of English language covering several levels: word formation, phrase construction and complex sentences. It is believed that the basis of this phenomena is formed by a similar subject-predicate structure [8].

The structural self-similarity of language is also considered by the representatives of cognitive approach in linguistics: while deploying speech and mental structures in space, some topological configuration of their part interposition is repeated. In particular, using fractal ideas, researchers are trying to answer the question of how the informative system of thought can be structured, being the basis of linguistic signs of different levels (from word to text). It is assumed that the basic Thing frame ("SB/STH is THAT MANY-quantity", "SB/STH is SUCH-quality", "SB/STH exists SO-mode of being", "SB/STH is (exists) THERE-place", "SB/STH exists THEN-time") has fractal properties, together with the complex pattern where the Thing frame is integrated into the Identification and the Possession frames [11].

Some scholars speak in terms of two related concepts: 'discourse fractality' and 'discursive space'. Discoursive space is some logical environment in which certain

discourses co-exist, wherein logical environment is an abstract extension or continuum. It is formed according to fractal principle – the principle of self-similarity, iteration and recursion of discourse-fractals, filling the common discoursive space. The most stable fractal systems are characterized by multidimensionality and infinity of self-similar discourse-fractals [12, p. 132]. In our view, such a distinction is not advisable because a certain abstract logical extension or continuum is the discourse itself which has its own space, and it is more rightful to talk about the hierarchy of discourse-fractals and their typology.

From these studies we can conclude that the unity of language and discourse together with hierarchical ordering of all placed substructures is provided with the help of telescopic organization according to the principle of component nesting. This allows folding the discourse structures into retractions of various sizes (words, phrases, statements) relatively easily. Any discourse act includes a feedback circuit that involves the addressee and as a result completes information circulation in the addresser's cognitive space. The meaning of a separate sentence can include the meaning of the previous text, summarizing it or containing the scheme of further plot development, anticipating it. In other words, the procedure of fractal recursion lies in the background of all the discursive construction.

Recursion is the way of organizing a complex system of discourse in which a set of basic subsystems is singled out; in the process of its functioning the system is capable of creating an unlimited number of basic system copies, interacting with them, and, if necessary, destroying them; complex system operation means functioning of active copies of basic subsystems; when copies are requested, the system change is acceptable, which is determined by the situation at the time of request. On the one hand, by creating its copies, a recursive system has an opportunity of unlimited growth and complexity; on the other hand, this complexity is orderly and defined by local functioning rules.

In what follows, the recursive structure is characterized by semantic repetitions, the lack of information being not typical for them, because the addressee's state of thoughts changes herewith. Each new interpretation makes it possible to attract practically unlimited number of semantic elements related to the dominant meaning. Thus, the self-similarity property creates coherent discourse perception, providing the principle of unity in diversity:

*John glanced warily at Chett, standing beside the door, his boils red and angry. "**He could help you**," he said quickly. "He can do sums, and he knows how to read and write. I know Chett can't read, and Clydas has weak eyes. Sam read every book in his father's library. He'd be good with the ravens too. Animals seem to like him. Ghost took to him straight off. There's a lot he could do, besides fighting. The Night's Watch needs every man. Why kill one, to no end? Make use of him instead."* [13, p. 436].

At certain points the behaviour of discursive structures may vary significantly influenced by asymmetric distribution of fluctuations and random direction coincidence of their movement. The change of set parameters of discourse system can lead to the emergence of new structural modifications. It should be noted that the structural models of discursive systems evolve and change at different stages in different ways. This fractal paradigm of discourse semiotic dynamics provides the fact that the final status of discursive system depends on infinite communicative interactions more than on initial conditions and goals of communication participants.

4. Conclusion

It is significant that the theory of fractals can reveal regularity in the chaotic system of language (it is a chaotic, spontaneous system, because it can not be fully formed and set) being simultaneously a limiting factor and a generating tool. The extraordinary diversity of states in any language system can be reduced to some standardized models – fractals structures and fractal processes. This strategy greatly simplifies the process of scientific cognition in linguistics. According to a nicely put and very fitting phrase of L. S. Pihtovnikova, fractal principle in language and speech acts as a kaleidoscope, turning asymmetry in linguistic phenomena into symmetry, and the other way around [7, p. 124].

Arguably, discursive fractals are given a number of features that allow us to include them into the core of cognitive-synergetic linguistics paradigm. These features are the following:

– complexity and dynamism;
– recursive nature;
– holographic nature (information about the whole is contracted in every part, and the whole possesses information about its every part);
– feedback existence;
– absence of the need for external space, and self-movement localization inside discourse;
– belonging to the category of singlularity with a simultaneous fractional dimension;
– the possibility of entry and exit from any point;
– irregularity.

As we have revealed above, fractal theory can be a special methodological approach, which enables us to program discourse as a complex multi-level system, using self-similar patterns through the process of identifying recursive semantic components. However, fractal analysis is not a procedure of logical simplification or information compression. It is a describing procedure of discursive aspects (diverse in complexity) through a series of rather simple metaphoric models.

Thus, having mastered the doctrine of systematicity, we can make a logical transition to the development of cognitive-synergetic linguistic paradigm which synthesizes empirical and theoretical material together with research results in the areas of comparative, structural, cognitive, functional, and pragmatic paradigms. The development of discourse presupposes evolutionary principle of unity and interdependence of all things existent in their self-motion from parts to the whole, from simplicity to complexity. Fractal metaphor actualizes the fact that discursive reality is similar to other natural forms and processes irrespective of the scale of time and space. It provides methodological possibility to trace a connection between the facts of different systemic levels of discourse, including extralingual. The core statement is also the idea that fractal principle plays an important role not only in the construction of discourse, but in the verbalization of concept. The latter can be a major theoretical construction of cognitive-synergetic linguistic paradigm being **the prospect** of our further research.

ФРАКТАЛЬНА ТЕОРІЯ ПОБУДОВИ ДИСКУРСУ:
ДЕЯКІ ГІПОТЕТИЧНІ ІДЕЇ

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У статті проаналізовано окремі методологічні напрацювання фрактальної теорії, що використовуються в побудові дискурсу. Зокрема, основна увага приділяється терміну "фрактал" і, відповідно, розумінню того, як фрактальні структури, використовувані в теорії хаосу й біфуркацій, можуть складати підґрунтя будь-якої мови. Відтак, мета цієї статті має два аспекти: а) узгодити порівняно нове поняття – фрактал – з онтологічними й гносеологічними характеристиками дискурсу; б) довести, що дискурс може бути запрограмований за допомогою самоподібних моделей через процедуру ототожнення рекурсивних смислових компонентів. Показовим є те, що теорія фракталів дозволяє виявити закономірність у хаотичній системі мови, постаючи одночасно обмежувальним чинником і генерувальним інструментом. Фрактальна метафора актуалізує той факт, що дискурсивна реальність подібна іншим природним процесам і формам безвідносно до масштабів часу й простору. Вона надає методологічне підґрунтя для встановлення зв'язку між фактами різних системних рівнів дискурсу, включаючи екстралінгвальні.

Ключові слова: *дискурс, фрактал, когнітивно-синергетична парадигма, самоподібна структура, рекурсивність, нерегулярність.*

ФРАКТАЛЬНАЯ ТЕОРИЯ ПОСТРОЕНИЯ ДИСКУРСА:
НЕКОТОРЫЕ ГИПОТЕТИЧЕСКИЕ ИДЕИ

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В статье анализируются отдельные методологические наработки фрактальной теории, используемые в построении дискурса. В частности, основное внимание уделяется термину "фрактал" и, соответственно, пониманию того, как фрактальные структуры, используемые в теории хаоса и бифуркаций, могут составлять основу любого языка. Следовательно, цель этой статьи имеет два аспекта: а) согласовать сравнительно новое понятие – фрактал – с онтологическими и гносеологическими характеристиками дискурса; б) доказать, что дискурс может быть запрограммирован с помощью самоподобных моделей через процедуру отождествления рекурсивных смысловых компонентов. Показательно, что теория фракталов позволяет выявить закономерность в хаотической системе языка, являясь одновременно ограничивающим фактором и генерирующим инструментом. Фрактальная метафора актуализирует тот факт, что дискурсивная реальность подобна другим природным процессам и формам безотносительно к масштабам времени и пространства. Она дает методологическое основание для установления связи между фактами различных системных уровней дискурса, включая экстралингвальные.

Ключевые слова: *дискурс, фрактал, когнитивно-синергетическая парадигма, самоподобная структура, рекурсивность, нерегулярность.*

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Received : November, 2, 2016