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# COGNITIVE ASPECTS OF FRAKTAL MODELLING

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## *Abstract*

This article deals with stylistic convergence study in the aspects of cognitive linguistics and lingua-synergetics. The object of the research is fraktal modelling of textual spaces of stylistic convergence. The purpose of the study is to consider fraktal modelling of the textual space of stylistic convergence as a cognitive process. Fraktal models demonstrate sense development in converged textual spaces under the influence of the semantic attractor. Those senses represent cognitive features of certain concepts actualized by stylistic devices. The purpose of the study has determined the research methods, including the method of stylistic study (in revealing stylistic devices in the process of visual perception); the hermeneutical study method (in interpreting senses actualized by stylistic devices); the method of cognitive analysis (to state sense relations in converged textual spaces and to define the structure-forming principles of interconnection, opposition, development); the method of fraktal modelling (to reveal and to define the configuration of semantic textual space). The fraktal models "spiral", "letter X"/ "figure 8", "enclosed 8 figures" demonstrating the sense development in the converged textual spaces are described in the work. The material of the research includes textual fragments of I. Stone's works *Sailor on Horseback* and *They Also Ran*. Fraktal modelling gives a vivid picture of the concept represented by semantic fraktals actualized in the textual spaces of stylistic convergence. The process of fraktal modelling uses the cognitive mechanisms of profiling and topology as well as mental operations of understanding, solving some problems, thinking, perception, comprehension and others.

**Keywords:** Cognitive mechanisms, concept, fraktal modelling, semantic fraktal, synergetic interaction, stylistic convergence.

## 1. Introduction

Lingua-synergetic approach to studying the textual structure is reflected in the works of Ponomarenko (2017), Plotnikova (2011), Olizko (2015), Sergodeev (2016), Kovalenko (2017a, 2017b, 2017c, 2018) and others. The research of the text in the aspect of lingua-synergetics shows that different combinations of language means reflect the variety of sense-forming processes in our mentality that are non-linear, in other words, verbal structures bear the non-linearity of cognitive structures due to the associations involved in a speech-making process. Non-linearity means the dependence of a system on both inner and outer processes. And it enables the system to generate new senses which are not confined to pure addition of the senses of its components (Ponomarenko, 2017, p. 248). Besides, the scientists state that sense development in textual structures follows the principal of fraktality. Fraktal is understood as a structure consisting of the parts being similar to some extent to the whole. According to the scientists, fractal modelling allows studying and describing many linguistic phenomena and nonlinear semantic structures with a great degree of visibility (Ponomarenko, 2017). A fraktal is a model of an internally developing entity, based on the formation of structures characterized by self-similarity. The dynamic symmetry, regulating the relations between order and chaos, is the basis of fractal structures organization (Olizko, 2015).

## 2. Problem Statement

In spite of great scientists' interest in fraktals, the cognitive nature of fraktal modelling has not been studied enough. In this connection, it should be said that cognitive structures determine the functioning of language structures, grammar categories, styles and speech registers. Language as a cognitive mechanism provides an access to our mind (Boldyrev, 2016; Kolesov, 2017; Tichenko & Pastuchova, 2016; Yurovitskaya & Mitrofanova, 2017) and language structures are structures of thinking and our experience (Babenko & Babenko, 2019; Schulzhenko & Popovskaya, 2016). As a complex semiotic structure, the text inspires us to cognitive operations of its understanding and interpretation (Kremneva, 2017, p. 322). The subject of our study is the textual space of stylistic convergence, understood as a bunch of stylistic devices fulfilling the same stylistic function (Kovalenko, 2017b). In cognitive aspect, the senses represented by converged stylistic devices represent certain conceptual features. In lingua-synergetic aspect the semantic structure of the converged textual space is a fraktal structure with interrelated senses, actualized by stylistic devices (Kovalenko, 2017a). The sense interaction in the converged textual space can be visualized with the help of fraktal models (Kovalenko, 2017c). The aim of this article is to describe the cognitive aspects of fraktal modelling of sense interaction in the textual places of stylistic convergence.

## 3. Research Questions

The following stages of fraktal modelling of the semantic space of stylistic convergence have been singled out in our research: 1) revealing stylistic devices (as a result of visual perception of stylistic convergence); 2) interpretation of senses actualized by stylistic devices and determination of the dominant sense; 3) defining the system of sense relations in the converged textual space and structure-forming

principles of interconnection, opposition, development (in other words, defining the means of synergetic interrelation of the constituents of the semantic structure); 4) taking the decision about the configuration of the semantic space and its graphic representation. Further, we shall deal with cognitive aspects of these stages of fraktal modelling in details.

## 4. Purpose of the Study

The purpose of the study is to consider cognitive aspects of fraktal modelling of the semantic textual space of stylistic convergence and to describe cognitive mechanisms and mental activities involved in the process.

## 5. Research Methods

The purpose of the study has determined the research methods, including the method of stylistic study (in revealing stylistic devices in the process of visual perception); the hermeneutical study method (in interpreting senses actualized by stylistic devices); the method of cognitive analysis (to state sense relations in converged textual spaces and to define the structure-forming principles of interconnection, opposition, development); the method of fraktal modelling (to reveal and to define the configuration of semantic textual space).

## 6. Findings

### 6.1. Transition from Visual to Semantic Space

The perception of the semantic space of the text at the very beginning is linear, then, in the process of reading, it is deformed and acquires a new measurement (Lukin, 2005, p. 224). The result of non-linearity is functional synergism (Ponomarenko, 2017, p. 248). Hence, it follows, that during fraktal modelling the process of revealing synergetic interrelation of the constituents of the semantic structure of the converged textual space can be defined as transition from visual to semantic space, resulting in functional synergism. It should be stated that similar senses in the semantic space of stylistic convergence can be drawn to each other while opposite senses can be pushed off from each other. To demonstrate this we shall study the following example from I. Stone's *Sailor on Horseback* devoted to Jack London. In his letter to Bessy Jack says:

> (1) *Finding myself anchored with a household, I resolved to have the compensations of a household, so I married and increased the weight of my anchor. But I never regretted it. I have been well compensated* (Stone, 1963b).

The metaphor *finding myself anchored with a household* actualizes the sense *for a sailor to marry means to through an anchor*; the sense *to have advantages when being married* is objectified by the metaphor *so I married and increased the weight of my anchor*; the metaphor *I have been well compensated* represents the sense *he has been satisfied having made the right decision to marry*. In this context we deal with a sustained metaphor, consisting of a number of words used metaphorically, which

actualize the concept A MARRIED SAILOR. Similar senses draw to each other, complementing each other under the influence of the semantic attractor (the dominant sense) *to have advantages when being married for a sailor means to be anchored successfully*. The structure-forming principle of self-similarity of senses is the principle of addition, giving more information to an explanation of something.

Now we shall see another example to demonstrate sense interaction of contrast:

*(2) Though people attest, thirty-five years later, that they appeared an incongruous couple – Bessie seemed middle-aged and matrony, Jack a vivacious young boy – everyone agrees that they lived together harmoniously compensated* (Stone, 1963b).

The image of Jack London is opposed to the image of his wife. Such opposition makes a contrast. In this case the senses represented by two antithesises *Bessie as middle-aged and matrony and Jack was a young vivacious boy; an incongruous couple but they lived together harmoniously compensated* are contrasted. The senses are opposed to each other under the influence of the semantic attractor *Jack and his wife have been an incongruous couple living together harmoniously*.

Perception of the textual space is impossible without image representation – the form of keeping information about visual images in our memory. The objects with which the sense development in the semantic fraktal actualized in the textual space of stylistic convergence is associated, serve as prototypes of fraktal models (in the first example such visual representation is a spiral, in the second context it can be the letter X or figure 8). So, we can say, that the graphic images of sense interaction in contexts (1) and (2), actualizing the concepts A MARRIED SAILOR (context 1) and AN INCONGRUOUS COUPLE (context 2), can be represented by fraktal models "spiral" (points to sense development) and "letter X" or "figure 8" (these models symbolize the balance of opposed parts).

The next context from I. Stone's *They Also Ran* illustrates the configuration of the semantic space, which can be represented graphically with the help of the fractal model "enclosed 8 figures":

*(3) It is one of the more diverting humors among the stories of the Also Rans that the man who least understood the human nature of people, and least wanted to associate with them, should have the greatest understanding of their political spotlight in all American history. He was a lone wolf who, by the inexorable demand of the times, found himself at the head of a great pack* (Stone, 1963b).

The concept HE ALSO RAN is being actualized in this converged textual space. It tells us about S. Tieldon, who ran at the Presidential elections in 1876. The semantic fractal is formed by the senses objectified by two antithesises: (a) *the man who least understood the human nature of people, and least wanted to associate with them, should have the greatest understanding of their political spotlight*; (b) *he was a lone wolf who <...> found himself at the head of a great pack.* Under the influence of the semantic attractor *It was impossible to imagine Tieldon as a president* the senses opposed to each other are united into a whole. Such sense interaction can be represented visually by a fractal model "enclosed 8 figures", where each "figure 8" symbolizes a contradictory idea.

The semantic space of the text is considered as something abstract, while its visual representation is a visual metaphor (Lukin, 2005, p. 226). Hence, it follows, that a fraktal model representing sense

interaction in the textual space of stylistic convergence is a visual metaphor. In the cognitive aspect, a metaphor is a mental operation, the demonstration of the ability of a human thinking to make analogues, the result of generating and processing knowledge, when cognition plays the role of the processor (Babenko & Babenko, 2019). It proves that fraktal models are the result of the interpreter's cognition.

### 6.2. Integrity in Fractal Modelling

Integrity means inner organic interrelation of the whole and its parts in the perceived image and this is explained by the idea of gestaltpsychology, the idea of "catching" the most characteristic features of objects which can represent the whole (Lakoff, 1981).

In the case of the textual space of stylistic convergence it is the semantic fractal that plays the role of "the whole", while its constituents are senses actualized by stylistic devices. Here is an example from I. Stone's *They Also Ran* devoted to the people who ran for the post of the President in the USA:

*(4) The Democratic campaign was rich in courage, energy and faith; it was poor in only one ingredient, cash, the national fund not being over half a million dollars, of which Tilden himself had contributed a hundred thousand* (Stone, 1963a).

Stylistic convergence includes gradation *courage, energy and faith* and antithesis *the Democratic campaign was rich in courage, energy and faith, it was poor in cash.* It should be mentioned, that gradation in this context is part of antithesis. Sense interaction in the semantic fractal *the contradictory campaign of the democratic party* causes the iconic image of figure 8 in the reader's mind, the top loop of which represents the gradation row objectifying the sense *the campaign was rich in courage, energy and faith.* The low loop of the model "figure 8" represents the sense *the campaign was poor in cash.* The visual image of the semantic space of the stylistic convergence with the help of the fraktal model "figure 8" demonstrates the organic interrelation of the semantic fraktal *the contradictory campaign of the democratic party"* and its constituents.

### 6.3. Mental Activities Involved

Many scientists point to close relations between the processes of perception and thinking (Boldyrev, 2016; Druzhinin, 2017; Kozlova, 2018). Arutyunova (1999) states, that mental operations in the process of perception include identification (which is based on comparison with an image and finding out common features and differences), interpretation (which takes place when it is necessary to state sign relations, a kind of "reading") and implications (which are possible on the basis of causal, causative effect or other relationships) (p. 422). The specific feature of perception consists not only in its representation by language means but also by various peculiarities of their representation and functioning and it has always been the sphere of great interest for linguists of different schools.

One of the stages of fraktal modelling of semantic space of stylistic convergence consists of revealing synergetic sense interaction, which is an abstract notion, so it proves that fraktal modelling should be considered as a complex cognitive process. In text interpretation perception experience, motor representations, emotional experience, social background connected with the content of the text are

activated. Hence, it follows that fraktal models being a kind of "visual metaphors", reflect the conceptualization of mental entities according to the same way the objects of the reaality are perceived, inner implicit ties are being objectified under the influence of certain cognitive mechanisms, such as the mechanism of profiling (singling out structure-forming principle), the mechanism of topology (choosing an object with which the implicit sense ties are compared). When senses are organised according to the principle of opposition, the model "X shape" or "figure 8" is chosen, which is characterized by fan symmetry. When senses are organised according to the principal of development, the model "spiral" is constructed. Fraktal models represent the shape topology of the perceived object.

### 6.4. Interpreter's Experience Activation

The process of perception is greatly determined by the comprehension experience as well as cultural and social factors (Furs, 2017; Ruzhentseva, 2019), it means that the perception of the converged textual spaces is a creative process, which can be compared to a perception of works of art and as such it is characterized by individual perception. Here we deal with experience activation. To demonstrate the role of perception experience activation of the interpreter in fraktal modelling we shall see the following example:

*(5) He had spent a lifetime in the midst of frenzied battles, but all that had gone before was a gentle zephyr compared to the tornado that rocked him for this effort. <…> He was hanged in effigy. He stood alone, his paper failing beneath his eyes, his name and character reviled. He became the most execrated man in the United States* (Stone, 1963a).

Here the text is about a person who gave much money to release D. Jefferson, the president of southern states beginning the Civil war in 1861-1865. Semantic fraktal *being the most execrated man* is formed by the senses objectified by the following stylistic devises: (a) simile, interacting with a metaphor and allusion to a proverb (*to throw a rock at smb*) … *was a gentle zephyr compared to the tornado that rocked him for this effort* (the sense is *the battles he had to lead were like a soft breeze, now he was the target of violent and destructive wind*); (b) metaphor *he was hanged in effigy* (the sense is *he was hated*); (c) parallel constructions *his paper failing beneath his eyes, his name and character reviled* (the sense *his reputation was ruined, nobody supported him is actualized*); (d) hyperbole *he became the most execrated man in the United States* (the sense *people felt the greatest hatred of him is objectified*). The self-organization of senses, actualized by stylistic convergence, representing the concept AN EXECRATED CANDIDATE, is characterized by advancing or ascending continuous curve winding round a central point, so, the interpreter who knows the peculiarities of logarithmic spiral, easily associates such sense interaction with the model "spiral".

The interpreter who knows the meaning of sign X as a symbol of the unity of two opposing parts or the meaning of the sign 8 being divided into two counterbalanced parts, is sure to construct the fractal model "enclosed signs X" or "enclosed figures 8" to represent sense interaction in the following context:

*(6) Sometimes he had talked idealism without the men or guns to back up his words, but always he was a fighter who knew that there could be but one end to the conflict. If there is any truth in the charge*

*that he was partly responsible for the war, then it is equally true that he was partly responsible for the victory* (Stone, 1963a).

The stylistic convergence in the context includes two antithesises representing the hero as an idealist, a fighter both for war and for peace and at the same time as a person who is responsible for war and peace.  There is a contrast of two opposing notions*: idealist - a fighter*; *war - victory*. In lingua-synergetic aspect the textual space of stylistic convergence represents the semantic fractal with the following sense-constituents: *Greely was an idealist and a fighter at the same time; he was responsible both for war and for victory* which are attracted by the dominant sense *Greely was a contradicting political figure*. The concept A CONTRADICTORY POLITICIAN is being objectified. The fraktal model "enclosed signs X" or "enclosed figures 8" can be constructed to represent sense interaction in this context. These examples prove the idea that in fractal modelling perception experience is being activated.

## 7.    Conclusion

Thus, the process of fractal modelling of the converged textual space includes procession from linear visual space to non-linear semantic space during its perception. Synergetic sense interaction in the converged textual space can be represented with the help of fraktal models. Such representation gives the idea of a complex meaningful whole as a concept actualized by converged stylistic devices. Fraktal modelling is a cognitive process involving a number of intellectual operations (understanding, solving problems, thinking and comprehension) and cognitive mechanisms of profiling and mechanism of topology. The perception experience of the interpreter is activated. Cognitive approach to fractal modelling ensures more adequate understanding of the textual structure in converged texts.

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