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**ELECTRONIC PROSE LITERARY TEXT: GENERATIVE  
ALGORITHMS AND FORMAL LIMITATIONS**

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*Abstract*

The article reveals the key aspects relating to the influence done by the formal limitations literature and some DADA techniques on the modern electronic prose literary texts. The basic types of the formal limitations, which were used in the combinatorial literature of the mid-XX century, can be easily integrated into an electronic literary discourse. The material for this research is the texts in English and in Russian introduced through and with different technologies and platforms. The research presents the general scientific methods of observation and description in combination with the method of a comparative analysis considering the language material and a complex linguistic text analysis, including a lingua-stylistic analysis. During analysis, it has been found that the most part of the electronic generative literary texts are technically improved samples of the formal limitations. However, the electronic environment gives to them the ambivalent status. Despite the fact that a surface level of poetic text has an open structure and arbitrary nature of linking components, an internal structure of each electronic sample text is predetermined. In each electronic literary generative text, there is a complex set of algorithmic limits whose final number leads to organizing a verbal level of a literary work. The basic marker, highlighting OULIPO (Ouvroir de literature potentielle) combinatorial technique, influences electronic literature, shows the rapid increase of texting data volume involved into the programmed generator work that is attributed to the use of artificial intelligence.

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## 1. Introduction

Visualized literature (pattern poetry) and avant-garde movements played a great role in the electronic literature appearance and its proliferation; they prepared the experimental ground to create a new type of a literary text and information technologies of XX century allowed to integrate this phenomenon in our life. However, avant-garde as a search for new literary forms was connected not only with the idea of denying or refusing the preceding literature tradition through postulating the technique of spontaneous automated writing covering a wide range of means to artistic expression but of touching a number of reality objects that have not been yet subject to artistic conceptualization.

The second avant-garde branch is connected with the literature of the formal limitations, combinatorial literature or “techne” in the structure of literary works which includes “the formal combination of text elements (letters, words, phrases, strokes, paragraphs), their rearrangements, combinations, repetitions, highlighting or deliberate elements absence” (Bonch-Osmalovskay, 2009). The formal limitations play the essential role in semantics of an artistic expression, probably this role is even greater than the absolute freedom in writing of an author. Not coincidentally, R. Keno, when visiting a surrealist’s club held by A. Breton, noted in his later years about the importance to follow the certain rules in creating an artistic work because the freedom in catching up with any impulse turns out into art slavery. “A classic who writes his tragedy, following some known rules, is freer than a poet who writes everything what comes to his mind and turns out to be a slave of others, following to unknown rules” (Bonch-Osmalovskay, 2009).

To pre-cybernetics attempts initiated in the area of the generative combinatorial literature there can be related the activity of OULIPO (Ouvroir de littérature potentielle), a French group, - Workshop of Potential Literature (fr.: OuLiPo, Ouvroir de littérature potentielle) (Kislov, 1997). This group was founded in 1960 in France with the aim to study the idea of creativity through limitations. The group united mathematicians and poets who were in a search for some new ways in literature development that was based not only on inspiration but either on some rules and limitations (grammatical, lexis, logical, limitation to form and size of a text and etc.). Therefore, this group is frequently referenced as a father of the electronic literature due to using the principles of George Boole and Fibonacci mathematics, whose works became the first towards computer-based reading technologies (Emerson, 2008). In 1981, ALAMO (L’Atelier de Littérature Assistée par la Mathématique et les Ordinateurs — Literature Workshop based on Mathematics and Computer) changed the status of the combinatorial literature putting it at the same level with the literary literature. All these facts led to rethinking of the algorithms used and to creating a new scientific approach in this sphere.

## 2. Problem Statement

The studies to a text nature, its semantics and functionality in the modern linguistics go far beyond the limited text’s structure. The verbal code is the essential one but far from being the dominant element in a polycode space of the modern communication, the increasing semiotic complexity of which is becoming one of the important tendencies. The phenomenon of the electronic literary text in research practice is being discussed relatively recently, the late of XX – beginning of XXI centuries. A relatively wide range of researchers can be referred to this scientific field (E. Aarseth, K. Hyleys, J. Murray, M. Ryan, L. Manovich,

J. Rosario, Wardrip-Fruin, F. Boots, H. Monfort, S. Moltrop, E. Grieg, M. Portela, G. Gendolla, M.J. Schaefer and others). In Russian segment addressing studying the electronic texts is primarily directed to understanding the specificity of electronic communication, electronic discourse, and its genres (I. Vashunina, S. Orehov, N. Ahrenova, E. Galichkina, O. Lutovinova, O. Dedova, I. Rogozina and others). However, it is important to note that up to present there is no a comprehensive linguistic description of an electronic literary text, as well as, there are no approaches to understanding its essence that will take into account the complexity and multidimensional nature of it. On the one hand, this situation is explained with the ambivalent nature of an electronic literary text which, in terms of types is referred to polycode-natured texts because its structure is attributed with two features – verbal and non-verbal. This fact undoubtedly expands the field borders and leads this research into interdisciplinary field. On the other hand, an electronic literary text is a product of electronic communication, the analyses of which requires studying not only verbal data but either the way how information is presented in network and the nature of its transmission, the channel of perception through which a recipient receives and processes transmitted data, including a program code as well.

### **3. Research Questions**

The subject to study in this field is the basic principles for organizing generative algorithms and types to the formal limitations that are used in electronic literary texts.

### **4. Purpose of the Study**

The purpose of this research is to identify and analyze the basic types of the formal limitations used in electronic literary texts.

### **5. Research Methods**

In this research we use the general scientific methods of observation in combination with the comparative analysis methods geared at language material and linguistic analysis of a text. As our research considers the combinatorial literature as the immediate predecessor of the electronic literature (primarily in the methodology aspect), the samples and types of the combinatorial literature will be included into the analysis not in the chronological order as they appeared and developed in the culture history but in the way how they influence this or that type of electronic literacy texts formation. In the classification towards the types of the combinatorial models/samples of literacy texts we choose the main tenet based on mathematical formulas that was first introduced in the monography of T. Bonch-Osmalovskay “Introduction to Literature of Formal Limitations” (Bonch-Osmalovskay, 2009). The researcher divides all types of the formal limitations into: rearrangements, sequences, limits, matrixes, homomorphic transformations, topological structures and fractals. Not all types of texts that we meet in the combinatorial literature and the methods based on them, will be productive at the same rate in the electronic literature. However, the tenet describing the structure in terms of increasing a text size and its complexity we evaluate as effective.

## 6. Findings

The most important meaning for the electronic literature is in the technique of using different sequences (phonetic, ordinal, firm poetic forms, quantitative sequences in symbols in a stroke and others) in a literary text. To the ordinal sequences, in the first turn, we refer the literature tradition of abecedaries (alphabet-based poems) or alphabet-based texts, where the first letters of each verse are the same as letters ordered in an alphabet (Bonch-Osmalovskay, 2009). Abecedaries had a great popularity in the medieval period in clerical and secular literature. In XX century, this tradition is reborn due to the authors of OULIPO who were able to expand the limitation borders, starting from the alphabetic order to the digital formats, week days and months sequences and etc.

The electronic literature enlarges a range of the instruments that authors of the formal texts used allowing to do this or that formal limitation more vivid due to a program algorithm. The electronic abecedaries primarily differ from their printed predecessors with a text size, which can be significantly increased due to a computer capability to work with big data. Moreover, the operating memory of a computer allows to write in the data of a program algorithm much more formal limitations or their combinations in one literary text, compared with data volume that a person can process in his/her mind.

For instance, in the electronic abecedarium of G. Piwowski “Book of all words” (Piwowski, 2016) there are introduced the total number of tokens on the basis of 26 letter of the Latin alphabet, the endless list of which covers all words and all their possible variations (including even those which do not exist in the language). All words and variations in “Book of all words” are built in the alphabetic order whereas each follow-up element differs from the preceded one for one letter.

The verbal component “Book of all Words” is introduced actually with an unlimited list of words that starts with a word given by a recipient and meets the endless chain of combinations that can be built on its basis. The electronic format allows to implement a continually self-generated structure “Book of all Words”, a size of which is not possible to imagine in a printed format. Abecedarian tenet in “Book of all Words” is becoming not only the basic one in organizing and introducing a text but either the way of its limitation due to the use of tautograms. The author combines two formal limitations in the way when each follow-up word in “Book of all Words” differs from the preceded one for one (last) letter that is chosen with the program algorithm strongly in the alphabetic order. As the combination with all letters of an alphabet runs out in a word with the initial letter “A”, the algorithm switches on making up combinations with the initial letter “B” and so on.

In addition to the original authors’ program algorithms in the electronic literature bots (special programs fulfill different tasks, automatically and within a schedule through interfaces intended to human users) are used with the aim to create abecedaries. For instance, the twitter-bot “Every word” A. Parrish (Parrish, 2016) was automatically adjusted to publish words from a dictionary in the alphabetic order during 7 years, since 2017 – 2014. For this period, he collected more than 100,00 subscribers. All words published in the twitter “Every word” turned out automatically into the separate electronic objects due to the unique URL-address (unified locator/ location determiner), that was particular for each twitter. Consequently, readers could publish them in their own page or forwarded them (as re-twit) to their friends and subscribers. Many publications of “Every word” generated separate and sufficiently large “discussion lines”.

It is worth mentioning that a significant volume of texting data engaged into program algorithms operation of the electronic generative abecedaries lead to incapability of a reader to comprehend or see the whole text of the abecedary because of the impossibility to place it on a computer monitor or in any other mobile device, compared to its printed predecessors. A recipient always sees only a fragment of an electronic text of such a format (separate tweet or fragment able to be placed within the monitor frames). In case if navigation allows to replacing within one program or archived record, a reader has an opportunity to look through some text fragments by inquiry.

Well represented in the electronic literature the works which underpin in their structure on determined poetic forms (rondeaux, ballades, sonnets, triolets, tiercets, sestinas and others), gained particularly wide spread in the medieval poetry. According to T. Bonch-Osmalovskaya the firm forms “are developing in a particular epoch and possess the tradition taste, form and play – in the epoch of transmission from the antiquity to medieval, in the epoch of late medieval and Baroque, in Silver Age of Russian Poetry and in present time. In these times the demand to find new forms is acutely felt (...) in new formal reinforcing, in formal experiment, in case of acceptance in the literature, is becoming a tradition, a new form without which later it is not possible to imagine the literature (rhyme) or finds itself on the periphery, into the marginalized area covering curious, saloon and childish poetry (acrostic)” (Bonch-Osmalovskaya, 2009).

The technique for versification in electronic poetic texts based on the firm forms allows to create, according to K. Funkhouser, “sense illusion” in generative works (Funkhouser, 2008). For instance, in an electronic combinatorial text “Triolets” P. Braffort (Braffort, 2016), texts are generated on the triolet firm form base. Triolet is “firm poetic form consisting of 8 strokes per 2 rhymes, whereas, the first verse in mandatory order is repeated in the fourth and seventh ones but the second verse – in the final stroke”. (Knigin, 2006). All repeated strokes of the generated content are strictly fixed due to the work of the author’s code mechanism and this ensures more difficult combination for poetic texts we gain than a simple triolet. In order to achieve the accuracy in representation of a rhythmical picture, an author accepts some variations in a phonetic transcription for some word-forms, for instance, ballet as BA-let. In each generated triolets there is a text coherence, which is achieved through a rhyme-scheme (abaa abab) and the cohesion of lyrical characters. The cohesion of an image structure is built, in its turn, on the base of chorus in the first, second and seventh strokes of a triolet.

The character feature of sonnets, triolets, and others, generated with the help of a program algorithm based on the firm poetic forms, is the meaningful absence of any punctuation. Although, for instance, the punctuation in a classical triolet, particularly full stops, was firmly determined by the French treatises in the epoch of “forms strengthening” (full stops, segmenting that a sentence ends in a triolet, should be after the second and the fourth strokes and in the end of a work as well). However, P. Braffort neglected this division, even more, he omits this punctuation. It can be explained with the specificity of code-based organization, which is in a random token choice for stroking, can not cope with the segmentation of sentences in the way to keep the sense cohesion of a phrase. Partially the accents in syntactical division of the generated poetic texts, can be done with capitalization, the use of which is also strongly fixed.

The analogue approaches, which are based on the firm poetic forms under a program algorithm, are used in works “Dizains” (Benabou, 2016), “Poet” (Rudolf, 2016), “SEIKA NO KÔSHÔ” (Campana, 2016),

«Contemporary Japanese poetry generator» (Shinonome, 2016), «Cyberliterature» (Barbosa, 2016) and others. Generative combinatorial algorithms are becoming at the same time an artistic method and a work, where at the nexus of possible senses are revealed potential possibilities of a language used in the literacy literature. A computer here is becoming sort of open semiotic system, objecting the dialectic cohesion of the opposites existing between the virtual reality and the reality and a means able to enlarge the perceptive abilities of a human being.

Apart from the firm poetic forms in the electronic literature there are the formal limitations based on a strictly determined number of symbols in a stroke (syllabled and verbal snowball, *слоговой и словесный снежный ком*, pattern poetry and others). In addition to it, there are used the authors' limitation-based models, partially derived more difficult techniques of OULIPO formal limitations (Boolean mathematics, art-grammar and hetero-grammar verses). For instance, the generator of poetic texts «Frequency» (Rettberg, 2016) creates poetic works by using not only the Shakespeare and Petrarch sonnet principles, syllabled scheme haiku, OULIPO techniques «word ball», but also by using several authors' schemes for versification («Two towers», «Foursquare», «Doubling»). Scheme Two Towers is intended to place a poetic text in two-verse format, where each one has a strictly limited number of symbols, with spaces. With scheme Foursquare a poetic text is constructed on four quatrains, where in each one a number of symbols to be used are strictly determined (with spaces as a zero symbol or a symbol of meaningful absence).

One more mathematical model that impacted on the combinatorial literature is Boolean algebra (algebra of logic or algebra of sets). The math notion of «sets» is reflected many times in culture (literary literature and theater). From the point of a common structure this method is used in electronic literary texts, where the generated content is formed from the sets pre-selected by an author. For instance, in generator «Camel Tail» (Tempest, 2016) published poetic texts consisting of four rhymed verses are the options for an automated verses selection that is done from the corpus of all lyrical ballades of music band «Metallica» (*American metal-band, founded in 1981*). As a result of such combinations a new subset appears – generated poetic texts with Camel Tail, where new features, characterizing the band themes and tunes, appear. The analogue model is used in generators as Poem.exe (Cooke, 2016), Mastering the Art of French Cooking and Systems Theory (Lin, 2016), Station 51000 (Sample, 2016) and others.

Apart from words sequences in a text, organized according with different models – firm poetic forma and combinations, elements of which are replaced with different means – in the literature of the formal limitations we find an interactive literary text that has been gained its methodological base. OULIPO members called these texts «tree-model texts»; it was assumed that «the elements sequence can be selected by a reader from some options and this choice determines the further action» (Bonch-Osmalovskay, 2009).

Before OULIPO experience, literary works with an alternative end had been known in the world literature (Cortazar, 1963; Fowles, 1969). However, these authors were the first who developed the method allowing to create a literary work with multi-ending plot (three or more endings). At the beginning of 60th of XX century P. Braffort and F. Le Lionne shaped a new conception for a literary text – a text with graphs. «A text with graph is meant, by OULIPO opinion, a text built with a branch-based scheme, when a reader is able to choose himself a way for further reading» (Bonch-Osmalovskay, 2009). In a later time, the model «text based on graph» will command a wide implementation in printed literary texts modelled on «choose

your adventure' or 'Book-game' (CYOA literature, 'choose-your-own-adventure'). Book-game is a literary work that allows a reader to participate in plot formation. In an electronic book-game a reader is offered to be a main character (or one of the characters) and, depending on decisions taken or situations they find themselves, a reader is moving between a book chapters.

In the electronic literature this type of a literary text gains optimal opportunities to visualize the auctioning for a reader and to have the absolute scheme enabling an author to combine narration fragments. The modern software applications (Twine (Klimas, 2017), Inform 7 (Inform, 2015), Choicescript (Choicescript, 2018), Inklewriter (Inklewriter, 2018), Ren'Py (Ren'Py, 2018) and others) allow an author, who is not skilled in computer programming, to create literary interactive texts modelled on branching structure. These texts can be of different size and with variety number of links in text's fragments.

## 7. Conclusion

In the modern digital world undoubtedly there are a great number of opportunities for implementation of generative combinatorial algorithms. Invention of a program code made possible develop a system capable at generating a literary text independently of an author. And the Internet created the borderless environment for creative experiments and the opportunity to share with them.

Visualized poetry, literature tactics of DADA, OULIPO activity generate the idea of the semiotic equality for all components of a literary texts (verbal content, its graphical representation, visual and audio images integrated in it). The key marker, accenting OULIPO technique influence on the electronic literature, is rapidly increasing volume of texting data engaged into the work of a program generator, which is attributed with the use of artificial intelligence. The second but not less important feature is the opportunity to use a combination of techniques towards texts generating, in particular, to build up different types of texting sequences in combination with different techniques aimed at limiting it in size.

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