

Aleksandr Sergeevich Pushkin's *Eugene Onegin*: A Fractal Analysis

by

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Abstract

This paper is an attempt to provide a structural systematic analysis that teases out linguistic features in Aleksandr Sergeevich Pushkin's *Eugene Onegin*. Specifically, the work employs the mathematical concept of Fractal Dimension and Complexity Theory to explore the idea of spectrum progressing from more orderly to less orderly or to pure disorder reflecting the directness, immediacy, purity, simplicity, and spontaneity of Pushkin's style. This called for the utilization of the Pluridisciplinary approach that helped us to mix linguistics and mathematical approaches—more precisely, Linguistic Presupposition and Fractal Methodology. The results generated after a multi-paradigm numerical computer run suggest that the combination of negative and positive feedback loops, which form the basis of several African and Russian knowledge systems reflecting Pushkin's background, also form a key mechanism of general self-organizing systems in *Eugene Onegin*.

Introduction

A Google Internet search of the name *Eugene Onegin* at 4:17 PM on October 31, 2015 yielded approximately 456,000 results in 0.39 seconds. This means that the work is getting a great deal of attention. Yet, our laborious search yielded no deep structural systematic analysis that has extracted linguistic facets in the entire text, even though such potential exists. We attempt to fill the void in this paper. We utilize the mathematical concept of Fractal Dimension and Complexity Theory to examine the idea of spectrum progressing from more orderly to less orderly or to pure disorder in the text. This required the use of the Pluridisciplinary approach that allowed us to combine linguistics and mathematical approaches, specifically Linguistic Presupposition and Fractal Methodology. The MATLAB computer program was employed to analyze the data teased from the work.

Before discussing a sample of the works on *Eugene Onegin*, the research methodology upon which the present study is grounded, and the results generated from the MATLAB computer runs, however, it makes sense to end this section with a brief background and description of the features of the work for those readers who may not be familiar with it.

Generally described as a novel in verse, Aleksandr Sergeevich Pushkin's *Eugene Onegin* is a classic Russian literature whose eponymous protagonist has served as the archetype for many Russian heroes dubbed "superfluous men." The work was published as a series between 1825 and 1832. The first complete version was published in 1833 while the contemporary accepted edition is based on the 1837 version (Johnston, 1977; Leighton, 1977; Cravens, 2002; Torgovitskaya, 2009).

Eugene Onegin comprises approximately 400 14-line stanzas of iambic tetrameter of an unusual rhyme formula "AbAbCCddEffEgg," whereby the lowercase letters constitute the feminine rhymes and the uppercase letters comprise the masculine rhymes. The style is widely referred to as the "Onegin stanza" or the "Pushkin sonnet." Accordingly, Pushkin is characterized as "the undisputed master of Russian poetry" because of the virtuosity demonstrated in the prudent clarity of presentation, the natural tone and diction, and the original rhythm system of his work (Johnston, 1977; Leighton, 1977; Hofstadter, 1996; Cravens, 2002; Torgovitskaya, 2009).

In a moderately imaginative kind of Pushkin's likeness, the narrator tells the story with an erudite, innermost and enlightened tone. In order to elaborate on facets of this intellectual and social world, the narrator occasionally deviates a little from the plot. The approach yields well developed characters and an emphasis on the drama of the plot, the relative simplicity of the story notwithstanding (Johnston, 1977; Leighton, 1977; Hofstadter, 1996; Cravens, 2002; Torgovitskaya, 2009).



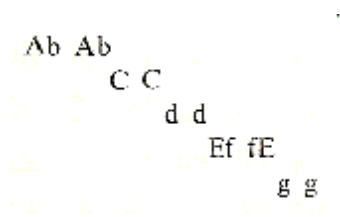
Review of Works on *Eugene Onegin*

As stated earlier, there are many book reviews and essays on *Eugene Onegin* in English and Russian. For the sake of brevity, we review in this section ten of these works—five from each language—with different genres. The following is a review of these works in the chronological order in which they were published.

The first effort of assessing the merits of *Eugene Onegin* is the 1913 statistical analysis performed by A. A. Markov in the Russian Language. He finds that in *Eugene Onegin* the probability of a letter being a vowel depends on the vowel preceding it or the consonant letter preceding it (1913:158).

In his latter English version, Markov (2006) performs a statistical analysis utilizing an extract comprising 20,000 Russian letters of the alphabet, excluding **Ь** and **’Ь**, in the work—from the entire first chapter and 16 stanzas of the second—to examine the connected serials that are either consonants or vowels. He postulates that there exists an unknown constant probability p that the observed letter is a vowel. He then counts through observation all of the consonants and vowels to delineate the rough value of p . While Markov’s essay is statistically grounded, it would have been stronger had the following been done: (a) use the entire work or a randomly generated representative sample of the letters, (b) theoretically ground the findings, and (c) discuss the linguistic meanings of the 20,000 connected trials investigated.

The researcher of symmetric compositions E. Etkind argues that Pushkin in *Eugene Onegin* conceived his work as a “monocrystal” and he himself jotted down the following formula: AbAbCCddEffEgg (1988:8-9), which is schematically represented as follows:



A delineation of the linguistic meanings that undergird the formula and the cultural motivation for the “monocrystal” approach would have been quite helpful for a deep-structural understanding of Pushkin’s work.



In her essay, Janet G. Tucker (1999) states that *Eugene Onegin* is a “prose work in poetic form” that is situated at the nexus of what divides or unites prose and poetry. She points out that the work’s distinction hinges upon both its “stanzaic rhyme” and its “situation or plot rhyme.” She then seeks to show the pattern of plot rhyme in the work in order to relate its rhyme to its other literary aspects and to assess its import. She discovers that the work is methodically carved up into cantos and stanzas. This finding leads her to argue that Pushkin naming his cantos “chapters” is a reflection of his amalgamation of aspects of prose and poetry. Nonetheless, she confesses that it cannot be determined whether the poetic or the prosaic aspects dominate in the work. Indeed, the descriptive nature of Tucker’s essay allows her to summarize information in a meaningful way, but it would not allow her to determine the dominance of a particular characteristic in the work since she does not quantify the qualitative attributes of the aspects embedded in it.

Craig Cravens (2002) in his essay challenges Mikhail Bakhtin’s claim that Pushkin’s *Eugene Onegin* is a “typical novel,” albeit not refuting Bakhtin’s conclusions. Instead, Cravens seeks to reveal that “the situation is more interesting and complex than Bakhtin assumes” (2002:683) because Pushkin is able to develop comprehensive and veritable characters by masterfully using various forms of consciousness that are typical of the lyric. Pointing out that Pushkin wrote at a time before the great literary evolution of psychological Realism, Cravens asserts that Pushkin’s work is more lyrically-based than Bakhtin admits. Craven adds that Pushkin’s ingenuity hinges upon the fact that he was able to develop his characters as psychologically as possible within the scope of the prevailing literary tradition by dealing with the intrinsically “lyric” domains of author, narrator, and characters. Like Tucker’s essay, Cravens’ is also descriptive. While Cravens provides very useful information, he, nonetheless, employs no scientific approach to systematically compare his findings and conclusions against those of Bakhtin whose work he challenges.

In his review, Eli Bendersky (2005) declares that *Eugene Onegin* is a unique novel in verse and it justifies why Pushkin is “widely regarded as one of the brightest stars in Russian literature of the 19th century.” Bendersky characterizes the work as “poetry at its best” because, according to him, it comprises 14-line stanzas, with a rhyming in each stanza, and it is disciplined and powerful. He notes that it is the first poem he has thoroughly enjoyed because its rhythm flows into his head, since Pushkin employs the rhyming magisterially to represent the feelings of the characters and the overall pace of the novel. In terms of plot, Bendersky says that it is a relatively simple telling of a story of missed moments, a failed love, and the hypocrisy of Russia’s high society during the early 1800s. Also included in the novel, according to him, are the Russian scenery, the changing seasons, literature, society and human nature, all helping Pushkin to share his idea relatively stronger compared to other works. Like most book reviews, however, Bendersky’s is based solely on his perceptions, which are not grounded on any systematic approach.



In her thesis, Julia Torgovitskaya (2009) probes the all-embracing moral tenets in *Eugene Onegin* and the way they are communicated to readers. She goes on to examine how these tenets have been applied to other artistic and film reconstructions, their applicability throughout history, and their present-day essentiality. She then investigates the connection between art and society and how the manner a work is presented might be interpreted by the reader. Her major finding is that the impacts of the rhythmic and rhyming scheme in the work are as significant today as they were when it was written almost two centuries ago. Similar to other descriptive analyses of meaning and themes, however, Torgovitskaya’s thesis provides very interesting findings, albeit they are not systematically delineated to permit an investigator to assess their scientific import.

O. N. Grinbaum (2012) provides a deep rhythmic and expressive analysis of *Eugene Onegin* with the use of statistics. As a result, he establishes a close relationship between *Eugene Onegin*’s rhythmic and harmonic parameter stanzas and the principle of “Golden Section,” as well as the key frequencies of the human brain that coincide with the main types of feelings: love, sorrow, admiration, hate, envy and others. This laudable study would have benefited greatly from an analysis of the linguistic features that undergird the stanzas in the text.

K. V. Korotkova (2013) draws our attention to the connections among the structural elements in *Eugene Onegin* by using the Fibonacci number. With the help of Figure 1, he shows that the basic principle of the novel is the symmetry and parallelism. In the chart, the chapter 8 is connected by straight lines with chapters 3 and 5. This allows the reader to identify the role and relationships of the key chapters: 3, 5 and 8.

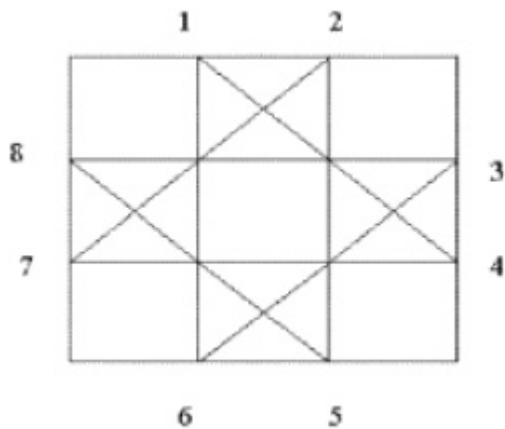


Figure 1: Korotkova’s Conceptual Framework of the Structural Elements in *Eugene Onegin*



According to Korotkova, in chapter 7, verse 55 is a Fibonacci number. Another Fibonacci number that he says is quite significant in the structure of the novel is 21. He adds that in each of the chapters are 21 stanzas, and the final line is crucial for heroes. Left unexplained in Korotkova's analysis, however, is why the straight lines among the other chapters in the chart are not key to a complete comprehension of *Eugene Onegin*.

Yuriy V. Shatin (2014) argues that the hidden driving force behind the *Eugene Onegin* strophe of the story is comprised of the events happening within it. He points out that the main factor is the collision of narratives beginning with non-narratives. He draws attention to the uneven distribution of non-narrative and narrative verses, chapter by chapter. He notes that the percentage of verses in which Pushkin is completely dissolved in the story and tells about personages ranges from 40% to 7%.

He adds that the ratio of Pushkin's angle of view on the heroes or, conversely, excluded from them are the following: I - 72: 28%, II - 93: 7%, III - 76: 24%, IV - 60: 40%, V - 89: 11%, VI - 83: 17%, VII - 78: 22% VIII - 80: 20%. He concludes that despite the uneven distribution, showing a different degree of involvement of Pushkin's fate in the protagonists, in total a fifth of all the stanzas is not related to the storyline (2014:139). A profitable rendering would have been a discussion of the linguistic processes that influenced Pushkin's point of view on the heroes which in turn influenced his approach.

In sum, the preceding works offer many valuable perspectives on *Eugene Onegin*. Nonetheless, none of them provides a deep structural systematic analysis of linguistic features that undergird the entire text. The present study, therefore, seeks to add to these works by filling this gap.

Research Methodology

The major challenge for us was how to transform the linguistic pragmatic or deep-level meanings in *Eugene Onegin* for mathematical modeling. As we stated earlier, this called for the utilization of the Pluridisciplinary approach that helped us to mix linguistics and mathematical approaches: more precisely, Linguistic Presupposition and Fractal Methodology. Furthermore, for the sake of transparency, it behooves us to state here that discussions of this methodology also appear in some of Abdul Karim Bangura's works listed in the references: 2012a, 2012b, 2012c, 2013a, 2013b, 2014, 2015a, 2015b, and 2015c. The following is a restatement of these techniques for those readers who may encounter difficulty accessing these works.



Pluridisciplinary Methodology

Pluridisciplinary Methodology can be generally defined as the systematic utilization of two or more disciplines or branches of learning to investigate a phenomenon, thereby in turn contributing to those disciplines. Noting that Cheikh Anta Diop had called on African-centered researchers to become pluridisciplinarians, Clyde Ahmed Winters (1998) states that the Pluridisciplinary specialist is a person who is qualified to employ more than one discipline—for example, history, linguistics, etc.

The history of the Pluridisciplinary Methodology can be traced back to the mid-1950s with the works of Diop and Jean Vercoutter. The approach was concretized by Alain Anselin and Clyde Ahmad Winters in the 1980s and early 1990s. A brief history of this development with brief backgrounds of these four pioneers is retold in the rest of this subsection.

G. Mokhtar in his book titled *Ancient Civilizations of Africa* (1990) traces the development of Pluridisciplinary Methodology to the works of Diop and Vercoutter. Diop was born in Senegal on December 29, 1923 and died on February 7, 1986. He was a historian, anthropologist, physicist, and politician who investigated the origins of the human races and pre-colonial African culture. His education included African history, Egyptology, linguistics, anthropology, economics, and sociology. He is considered one of the greatest African intellectuals of the 20th Century. Jean Vercoutter was born in France on January 6, 1911 and died on July 6, 2000. He was a French Egyptologist.

According to Mokhtar, Diop and Vercoutter were in total agreement on the point that it is necessary to study as much detail as possible all the genes bordering on the Nile Valley which were likely to provide fresh information. Mokhtar notes that Vercoutter considered it necessary to give due weight to the palaeoecology (i.e. the ecology of fossil animals and plants) of the Delta and to the vast region which had been termed by other researchers the Fertile African Crescent. Mokhtar points out that Diop advocated tracing the paths taken by peoples who migrated westwards from Dārfur, reaching the Atlantic seaboard by separate routes, to the south along the Zaire Valley and to the north towards Senegal, on either side of the Yoruba. He adds that Diop also pointed out how worthwhile it might be to study Egypt's relations with the rest of Africa in greater detail than had been done, and Diop further mentioned the discovery, in the province of Shaba, of a statuette of Osiris dating from the 7th Century before the Christian era. Similarly, argues Mokhtar, a general study might be made of the working hypothesis that the major events which affected the Nile, such as the sacking of Thebes by the Syrians, or the Persian invasion of 522 BC, had far reaching repercussions on the African continent as a whole (Mokhtar, 1990:55).



Furthermore, according to Winters, two major scholars who have advanced the Pluridisciplinary approach by combining anthropological, historical and linguistic methods to explain the heritage of African people, constituting a third school of Africentric researchers (the first and second schools being the African American and the French-speaking African and African Caribbean, respectively), are Anselin and himself (Winters, 1998). Anselin teaches ancient Egyptian linguistics at the University of Guyana Antilles. He is an anthropologist and also the founder of the *Journal of Caribbean Egyptology*. Winters is a lecturer at Governor's State University at University Park in Illinois where he teaches curriculum design and research methods courses. He also is a 28-year teaching veteran of the Chicago Public Schools system.

Anselin is the author of three important Pluridisciplinary Africentric books—(1) *Samba*, (2) *La Question Puele*, and (3) *Le Mythe d'Europe*—and numerous articles. In *Samba*, Anselin demonstrates how the corpus of Egyptian hieroglyphics explains both the Egyptian civilization and the entire world of the Paleo-Africans. He also makes it clear that Kemetic civilization originated in the Fertile African Crescent and that Black African and Kemetic civilization at its origination was unified from its foundations in the Sahara up to its contemporary manifestations in the languages and culture of Black Africans.

In *La Question Puele*, Anselin examines the unity for Egyptian, West African and Dravidian languages, political traditions and culture. He also provides a detailed discussion of the “Black Ageans.” The findings comprise a thorough representation of the affinities between the Agean and Dravidian civilizations (Winters, 1998).

Winters is the only African American that attempts to confirm Diop's theories in relation to the genetic unity of the Egyptian, Black African, Elamite, Sumerian and Dravidian languages. Winters is mainly concerned with the unity of the ancient and new worlds' Black civilizations and the decipherment of ancient Black writing systems used by these Africans. This interest had led him to learn many languages, including French, Tamil, Malinke/Bambara, Chinese, Arabic, Otomi, and more (Winters, 1998).

Winters had used Diop's genetic model in his research by combining anthropological, linguistic and historical methods to confirm that the center for the rise of the originators of the Egyptian and Manding civilizations, the Magyar or Hungarian civilization, the Dravidian civilization, and the Sumerian and Elamite civilizations was the Fertile Crescent of the highland regions of Middle/Saharan Africa. He also explains how Blacks founded civilizations in the Americas and East and Southeast Asia. A major finding from Winters' work is that the ancestors of the Dravidian and Manding-speaking people seem to have left Africa at the same time around 2600 BC, and that these people founded civilizations in Europe, Elam, India and ancient China (Winters, 1998). It should be noted here that the Magyar or Hungarian civilization connection remains opaque.



Like Diop before him, Winters also discusses the African sub-stream in European languages, the conflict between African people and Indo-European-speaking people, and the loss of early African settlements in Europe to the contemporary European people due to natural catastrophes and wars around 1000 BC. Winters provides valuable source material for the elaboration of the African influence on European languages and those of East and Central Asia (Winters, 1998).

Winters had discovered that the Proto-Saharan people used a common writing system. He also was able to read the ancient inscriptions left by these people in the Sahara dating to 3000 BC. He was able to confirm this development by comparing the Manding and the Elamite languages, and the Sumerian and Dravidian languages. The evidence of a genetic relationship between the Manding languages, which Winters used to decipher the earliest Proto-Saharan writings and other languages spoken by the founders of civilization in India and Mesopotamia, led him to hypothesize that the writing systems used by these ancient founders of civilization could be deciphered. The utilization of Diop's linguistic constancy theory allowed Winters to confirm his own hypothesis and read the common signs used to write the Harapant, Minoan and Olmec scripts (Winters, 1998).

Winters' most significant finding is the cognate language of Meroitic. By employing the evidence presented by the Classical sources that the Kushites ruled empires in Africa and Asia, Winters is able to show that the cognate language of Meroitic was the Tokharian language spoken by the Kushana people of Central Asia. He has been able to decipher many Meroitic inscriptions by using the Kushana/Tokharian language (Winters, 1998).

According to Dani Nabudere (2003), Pluridisciplinary Methodology involves the use of open and resource-based techniques available in an actual situation. Thus, it has to draw upon the indigenous knowledge materials available in the locality and make maximum use of them. Indigenous languages are therefore at the center of the effective use of this methodology.

What all this suggests, according to Nabudere, is that the researcher must revisit the indigenous techniques that take into consideration the epistemological, cosmological and methodological challenges. The researcher must be culture-specific and knowledge-source-specific in his/her orientation. Thus, the process of redefining the boundaries between the different disciplines in our thought process is the same as that of reclaiming, reordering and, in some cases, reconnecting those ways of knowing, which were submerged, subverted, hidden or driven underground by colonialism and slavery. The research should therefore reflect the daily dealings of society and the challenges of the daily lives of the people.



Towards this end, following Nabudere, at least the following six major questions should guide Pluridisciplinary research (2003:13):

- (1) How can the research increase indigenous knowledge in the general body of global human development?
- (2) How can the research create linkages between the sources of indigenous knowledge and the centers of learning on the continent and in the Diaspora?
- (3) How can centers of research in the communities ensure that these communities become “research societies”?
- (4) How can the research be linked to the production needs of the communities?
- (5) How can the research help to ensure that science and technology are generated in relevant ways to address problems of the rural communities where the majority of the people live and that this is done in indigenous languages?
- (6) How can the research help to reduce the gap between the elite and the communities from which they come by ensuring that the research results are available to everyone and that such knowledge is drawn from the communities?

The truism that indigenous knowledge is critical to Africa’s development prompted a workshop titled “Indigenous Knowledge Systems and Intellectual Property in the Twenty-First Century: Perspectives from Southern Africa” convened at the University of Botswana from November 26 to 28, 2003 which culminated into a book with the same title published in 2007 by the Council for the Development of Social Science Research in Africa (CODESRIA) based in Dakar, Senegal. The tenor of the workshop and subsequent book is that the twin themes of indigenous knowledge systems and intellectual property rights have moved to the center of academic discourse within the context of innovation and the commercialization of knowledge. This is because wealth is no longer reckoned in terms of physical assets alone. Unfortunately, the traditional imbalance between the North and the South, which has for long manifested itself mainly through trade, is replicated even in tapping intellectual property given to residents of the developing world who remain largely unable to define their property rights. Once again, the West exploits Africa and the rest of the developing world by expropriating indigenous knowledge systems and patenting them in the West (Mazonde and Thomas, 2007).



Similarly in the Russian Federation, a workshop titled “Traditional Knowledge and Modern Technology for the Sustainable Management of Dryland Ecosystems” was convened in Elista, Republic of Kalmykia from June 23 to 27, 2004 to discuss the imperative of incorporating best practices from indigenous knowledge systems into modern techniques. In her keynote address, Nina G. Ochirova, Director of Humanistic Research, noted that for 5,000 years, the northwestern part of the Precaspian was used for stockbreeding, a practice that was continued in the area as an inseparable part of the Russian empire during the 17th and 18th Centuries. She also pointed out that the Kalmyk people of the area adhered to a special system of rules and taboos in order to preserve the wildlife and the environment, and to harmonize the relationship between nature and the inhabitants (UNESCO, 2004). In fact, there is a special organization in Moscow named the Russian Resource Centre for Indigenous Knowledge (RURCIK) that coordinates activities geared toward promoting ways to use indigenous Russian knowledge systems in modern development practices. The organization subscribes to the belief that traditional knowledge is a pillar of medicine and health systems; a prerequisite for the successful implementation of human rights; a new global asset which is the very premise of progress; a catalyst for productive employment and improvement of sustainable livelihood systems in various local conditions; an intellectual property; a part of the consensual practice and norms that govern societies; a rich source of creativity and innovation; an important aspect of indigenous power and identity that is collectively owned, socially based, and continuously evolving; a complex system that does not consist of a simple list of technical solutions and be limited to a series of different applications that vary according to the results obtained; and a shared heritage common to all humanity (Kivu Nature, 2015).

The favored methodological approach for Pluridisciplinary studies is Hermeneutics: an open-ended approach that permits cross-cultural communication and exchange of ideas and opinions to promote understanding between all knowledge systems in their diversities. This philosophical-pedagogic approach hinges upon the acceptance of pluralism and cultural diversity. It stresses the need for the “fusion of historical horizons” (i.e. the universal history of a dialectical concept that results from the rejection of both objectivism and absolute knowledge), according to Nabudere, as the best way of transmitting understanding between different lived histories or experiences of different communities as the basis of their existence. It insists on both the cultural context and the historical contingencies of events as necessities for a true comprehension of the different lived experiences. Furthermore, the approach has its roots in the African/Egyptian mythical figure of Hermes, the messenger of knowledge from the gods to mortals and the interpreter of the divine message to humankind, and that is why Hermeneutics is named after Hermes (Nabudere, 2003:7-8).



Hermeneutics is to be employed on the premises that encourage self-directed learning, which engages with the knowledge, interests, and real life situations that learners bring to their learning situations. This notion of site-specific knowledge attempts to offer a corrective to the Eurocentric tendency of universalizing knowledge around Occidental centers and sites of knowledge which are privileged to the disadvantage of others, claiming to be the only sites of “rationality” and “scientific knowledge.” Recognizing the other sites and centers leads to a truly multi-polar world of global knowledge culled from all sources of human endeavor (Nabudere, 2003:8).

Linguistic Presupposition as the Unit of Analysis

As stated earlier, the unit of analysis for the present paper is linguistic presupposition, which can be defined as an implicit assumption about the world or background belief upon which the truth of a statement hinges. The linguistic presuppositions for this study are drawn out of the topics generated by Pushkin (the writer) in *Eugene Onegin*. The writer’s topics here are the a priori features, such as the clear and unquestionable change of subject focus, for defining types of linguistic presuppositions found in the text examined. While there are many other formulations of ‘topic’ from which to choose, the writer’s topics are employed for this paper because it is the writer of the text studied who had topics, not the text itself. The other formulations of ‘topic’ include sentential topics, discourse topics, presuppositional pools, relevance and speaking topically, topic boundary markers, paragraphs, paratones, representation of discourse content, position-based discourse content, and story—a discussion of these is beyond the scope of this paper. Thus, the notion of ‘topic’ in the present paper is considered as one related to representations of discourse content.

In choosing the writers’ topic as the recording unit, the ease of identifying topics and correspondence between them and the content categories were seriously considered. Guiding this choice was the awareness that if the recording unit is too small, such as a word (or a letter of the alphabet as in Markov’s study), each case will be unlikely to possess any of the content categories. Furthermore, small recording units may obscure the context in which a particular content appears. On the other hand, a large recording unit, such as a paragraph, will make it difficult to isolate the single category of a content that it possesses. For the current paper, two methods were appropriate. First, there is the clear and uncontestable change of subject focus. Second, topicalization was found to have been used to introduce new characters, ideas, events, objects, etc.

Finally, in order to ascertain the reliability of the coding unit employed for the paper, attempts were made to show inter-coder reliability: that is, two or more analysts, using the same procedures and definitions, agree on the content categories applied to the material analyzed. Four Russian linguists comprising an expert in Russian Language and Literature and a team made up of a chair and two professors of a languages department, all of whom prefer to remain anonymous, were given Russian and English-translated copies of a sample of texts from *Eugene Onegin* to identify which statements express “order” or “disorder.”



Order is defined here as a condition of logical or comprehensible arrangement among the separate elements of a group; *disorder* is defined as a condition or place of confusion, mess, disturbance, disarray, or muddle. There were no differences between the four experts and us. This approach was quite useful for increasing our confidence that the meanings of the content are not heavily dependent on our analysis alone.

After identifying the presuppositions in the texts studied in terms of the topics identified, these propositions were placed into the two categories (*order* versus *disorder*) based on the bottom-up processing approach common in linguistic analysis for further examination. This involved working out the meanings of the propositions already processed and building up composite meanings for them.

Since the texts examined are a representation of discourse in a text, the level of analysis is naturally the written text. Text is used here as a technical term—in Gillian Brown and George Yule’s conceptualization: “the verbal record of a communicative act” (1983:6).

In order to ascertain the presuppositions and in *Eugene Onegin*, the test known as Constancy under Negation Rule was employed. This test is important because, following Gottlob Frege (1892/1952) and Peter Strawson (1952), presuppositions are preserved in negative statements or sentences. A researcher can therefore simply take a sentence, negate it, and see what inferences survive: that is, are shared by both positive and negative forms of the sentence. But because, as Stephen Levinson is quite correct in pointing out, “constancy under negation is not in fact a rich enough definition to pick out a coherent, homogenous set of inferences” (1983:185), the tests for presuppositional defeasibility (i.e. the notion that presuppositions are liable to evaporate in certain contexts) and the projection problem of presuppositions (i.e. the behavior of presuppositions in complex sentences) were also employed.

Consequently, in order not to necessarily presume the conclusions to be drawn, cues to the intent of Pushkin are ‘deconstructed.’ How, then, are these cues mapped out for the present paper? According to Herbert Paul Grice’s (1975) characterization of meaning_{nn} or non-natural meaning (which is equivalent to the notion of intentional communication), intent is achieved or satisfied by being recognized. A sender’s communicative intent becomes mutual knowledge to sender and receiver: that is, S knows that H knows that S knows that H knows (and so ad infinitum) that S has this particular intention. So following Roger Shuy (1982), it is necessary to begin by asking “What did the writer do?” Thus, it is clearly necessary to look at specific topics developed by Pushkin in *Eugene Onegin*. This is particularly true because, according to Wallace Chafe (1972) and Carol Kates (1980), the structure of intentions can neither be defined by the grammatical relations of the terms, nor the semantic structure of a text. Therefore, mapping out the cues to the intent of the Pushkin contained in the text analyzed called for: (a) identifying communicative functions, (b) using general socio-cultural knowledge, and (c) determining the inferences made.



Fractal Methodology

It is only logical to begin any discussion of Fractal Methodology with a definition of what a fractal is. As Bangura states in his book titled *Chaos Theory and African Fractals*, the concept of fractal remains inexplicably defined (Bangura, 2000:6). This shortcoming is pointed out by Philip Davis as follows, albeit he himself does not provide an explicit definition: “I consulted three books on fractals. Though there were pictures, there was no definition” (1993:22). The following is a small sample of the various ways the concept of fractal has been described as provided by Lynn Steen:

The concept of fractional dimension, or fractals, was developed in order to describe the shapes of natural objects....An interesting property of fractal objects is that as we magnify a figure, more details appear but the basic shape of the figure remains intact (1988:409).

In addition, according to Steen,

The word fractal—coined by (Benoit B.) Mandelbrot—is related to the Latin verb *frangere*, which means “to break.” The ancient Romans who used *frangere* may have been thinking about the breaking of a stone, since the adjective derived from this action combines the two most obvious properties of broken stones—irregularity and fragmentation. The adjectival form is *fractus*, which Mandelbrot says led him to fractal (1988:420).

Furthermore, as Steen points out, “Fractal dimension (is) a measurement of the jaggedness of an object” (1988:413).

Keith Weeks (in Hargittai and Pickover, 1992) states:

[J. E.] Hutchinson laid the foundations of a certain concept of self-similarity, the basic notion being that of the object made up of a number of smaller images of the original object, and so on ad infinitum, typically resulting in detail at all levels of magnification, a trait commonly associated with objects referred to as *fractals* (1992:107).



From the preceding descriptions, Bangura (2012a, 2012b, 2012c, 2013a, 2013b, 2014, 2015a, 2015b, and 2015c) ventured to offer a general definition of a *fractal* as a self-similar pattern: that is, a pattern that repeats itself on an ever diminishing scale. Leonid A. Zhigun has also defined *fractal* as “an independently operating structural unit of the organization, repeating in itself its features” (2012:108). He points out that this is a kind of isomorphism and the most obvious example of a fractal is a recording of the music notes. It combines three phenomena: (1) the [writing](#) of characters, (2) the sound of sounds, and (3) the process of playback of sounds. He adds that it is very close to poetry.

As for Fractal Methodology, more popularly referred to as Fractal Analysis, itself, with its applications in the social sciences, Clifford Brown and Larry Liebovitch in their work appropriately titled *Fractal Analysis* (2010) published as part of the Sage Publications Quantitative Analysis of the Social Sciences series have a succinct exposé on the subject. The rest of the discussion in this subsection is based on their work.

Brown and Liebovitch begin by stating that several early applications of fractal mathematics emerged in the social sciences. These works include Vilfredo Pareto’s 1897 study of the distribution of wealth; Lewis Fry Richardson’s 1948 and 1960, but published posthumously, study of the intensity of wars; and George Zipf’s 1949 studies of the distributions of word frequencies and city sizes. Brown and Liebovitch argue that while these ideas were known by experts in the field, they were isolated, quirky concepts until Mandelbrot developed the unifying idea of fractals in the 1970s and 1980s. Since that time, however, in spite of the fact that Zipf and Pareto’s distributions represent fractal distributions, social scientists have lagged behind the physical and natural sciences in utilizing fractal mathematics in their works (Brown and Liebovitch, 2010:ix).

Brown and Liebovitch observe, however, that in recent years, the application of fractal mathematics by social scientists in their studies has grown exponentially. Their variety, they note, has expanded as rapidly as their numbers. They cite the examples that fractal analysis had been employed by criminologists to investigate the timing of calls for assistance to police, by sociologists to investigate gender divisions in the labor force, and by actuaries to study disasters. The surprising range of fractal phenomena in the social sciences led Brown and Liebovitch to call for a comprehensive survey that would investigate the common threads that unite them, thereby leading to a broader understanding of their causes and occurrences (Brown and Liebovitch, 2010:ix).

According to Brown and Liebovitch, if a researcher has rough data, strongly nonlinear data, irregular data, or data that display complex patterns that seem to defy conventional statistical analysis, then fractal analysis might be the solution to the researcher. They posit that the non-normal and irregularity of so much of social science data apparently are the result of the complexity of social dynamics. Thus, for them, fractal analysis offers an approach for analyzing many of these awkward data sets.



And more important, they note, the method also offers a rational and parsimonious explanation for the irregularity and complexity of such data. They insist that the data are not behaving badly; instead, they are simply obeying unexpected but common rules of which we are unaware (Brown and Liebovitch, 2010:1).

Brown and Liebovitch go on to conceptualize fractals as “*sets* defined by the three related principles of *self-similarity*, *scale invariance*, and *power law relations*.” They postulate that when these principles converge, fractal patterns form. They note that the statistic called *fractal dimension* is employed to capture the essential characteristics of fractal patterns. They add that much empirical work in fractal analysis focuses on two tasks: (1) showing that fractal characteristics are present in a particular data set and (2) estimating the fractal dimension of the data set. They also mention that there are various techniques for implementing these two tasks (Brown and Liebovitch, 2010:2), the discussion of which is beyond the scope of the present paper. Nonetheless, it is necessary to provide brief definitions of the preceding five italicized concepts based on Brown and Liebovitch’s work for the sake of clarity. The significant fact about *sets* is that almost all data sets can be fractal: that is, points, lines, surfaces, multidimensional data, and time series. Since fractals occur in different types of sets, various procedures are required to identify and analyze them, with the approach hinging upon the kind of data (Brown and Liebovitch, 2010:2-3).

Brown and Liebovitch define *self-similarity* as a characteristic of an object when it is composed of smaller copies of itself, and each of the smaller copies in turn are made up of yet smaller copies of the whole, and so on, *ad infinitum*. The word *similar* connotes a geometrical meaning: that is, objects that have the same form but may be different in size (Brown and Liebovitch, 2010:3).

Scale invariance for Brown and Liebovitch refers to a thing that has the same characteristics at every scale of observation. Thus, when one zooms on a fractal object, observing it at ever-increasing scale of magnification, it will still look the same (Brown and Liebovitch, 2010:5).

According to Brown and Liebovitch, *power law relations* denote the rule that for a set to achieve the complexity and irregularity of a fractal, the number of self-similar pieces must be related to their size by a power law. Power law distributions are scale invariant because the shape of the function is the same at every magnitude (Brown and Liebovitch, 2010:5).

Finally, Brown and Liebovitch characterize *fractal dimension* as the invariant parameter that characterizes a fractal set. An analyst uses the fractal dimension to describe the distribution of the data. It is akin to having a “normal” set of data and using the mean and variance to describe the location and dispersion of the data (Brown and Liebovitch, 2010:15).



Analysis

The version of *Eugene Onegin* employed for gleaning the data analyzed in this section is that of Vladimir Nabokov who has been widely acknowledged to “reproduce the exact meaning” of the text (see, for example, Johnston, 1977; Leighton, 1977; Cravens, 2002; Torgovitskaya, 2009), with a new translation by Charles Johnston (1977), despite the criticism of a few reviewers (e.g., Wilson, 1965; Hofstadter, 1996). It should be noted here that the work has been translated into English over 40 times (Fry, 2012) and has also been translated into French, German, and Italian, and most probably in other languages as well.

Before engaging in the fractal analysis of the data generated from *Eugene Onegin*, we will begin with a discussion of the descriptive and inferential statistics employed to analyze them first. Before computing the univariate and bivariate statistics to do the descriptive and inferential analyses of the data teased out of the text, as we stated earlier a two-dimensional ad hoc classificatory system was developed within which the data were categorized. The first of these categories entails the presuppositions of *order* which we defined earlier as presuppositions that suggest a condition of logical or comprehensible arrangement among the separate elements of a group. This type of presupposition is triggered by presuppositional discourse stretches such as “I prize the attention of my friends,” “your soul displays, in holy dreams, in simple but sublime reflection, in limpid verse that lives and gleams,” “My uncle—high ideals inspire him,” and “Let others learn his example!” (Pushkin, 1977ed:7, 13). The second category encompasses presuppositions of *disorder* which we also defined earlier as presuppositions that suggest a condition or place of confusion, mess, disturbance, disarray, or muddle. This type of presupposition is triggered by presuppositional discourse stretches such as “Heedless of the proud world’s enjoyment,” “But God, how deadly dull to sample sickroom attendance night and day and never stir a foot away!,” “And the sly baseness, fit to throttle, of entertaining the half-dead,” and “When will the devil come to you” (Pushkin, 1977ed:7, 13).

After computing the descriptive and inferential statistics, the data were then plotted for oscillations between *order* and *disorder* in Pushkin’s note “To Peter Alexandrovich Pletnev,” “Tatyana’s Letter to Onegin,” “The Song of the Girls,” Onegin’s Letter to Tatyana,” and the 371 stanzas in the eight chapters of *Eugene Onegin*. This technique made it possible to show visually the attractor reconstruction for the various topic shifts in the texts. It should be mentioned here that some of the statistics in the tables that follow have been rounded off to the nearest tenth for easy understanding.

As shown in Table 1, a total of 2,750 topic shifts were teased from the text. Of these, we categorize 1,549 or 56 percent as presuppositions of *order* and 1,201 or 44 percent as presuppositions of *disorder*. The mean for the *order* category is about 4 presuppositions, with a standard deviation of approximately 3 presuppositions; the mean for the *disorder* category is approximately 3 presuppositions, with a standard deviation of about 2 propositions.



The range for the *order* category is 32 presuppositions and that for the *disorder* category is 21 presuppositions, reflecting the topic shifts in both categories in “Tatyana’s Letter to Onegin,” while the variance for *order* is about 8 presuppositions and that for *disorder* is approximately 6. This means that there are more, albeit not statistically significant, topic shifts for presuppositions of *order* than there are of those for *disorder*. Moreover there are, but also not significant variations, between the topic shifts for the two categories as can be gleaned from the ranges and variances.

Table 1: Univariate Statistics by Types of Presuppositions in *Eugene Onegin* (N = 2,750)

Statistics	Order	Disorder
Sum	1,549	1,201
Percentage	56%	44%
Mean	4.13	3.20
Standard Deviation	2.81	2.36
Range	32	21
Variance	7.90	5.55

Source: Self-generated data from *Eugene Onegin* and computed by using MATLAB

From Table 2, it can be seen that there is a statistically significant difference between the topic entries for *order* and those for *disorder* at the 0.0001 level. There is, however no statistically significant correlation between the two dimensions at the 0.05 level.



Table 2: T-Test: Paired Samples Test and Correlation

Pair 1: Order-Disorder	Paired Differences
Mean	0.93
Standard Deviation	3.66
Standard Error Mean	0.19
95% Confidence Interval of the Difference	0.56
Lower	1.30
Upper	
t-Statistic	4.91
Degrees of Freedom	374
Significance (2-tailed)	0.0001
Pair 1: Order and Disorder	Paired Samples Correlation
Correlation	0.005
Significance	0.919

Source: Self-generated data from *Eugene Onegin* and computed by using MATLAB

Also, as can be seen in Figure2, the data are plotted in a phase space. While the vectors show no direction, as they do not appear to rise and fall, the plot is neither an orderly periodic oscillation (with two outliers reflecting “Tatyana’s Letter to Onegin” and “Onegin’s Letter to Tatyana”), nor is it simply a random scattering. There is structure here, suggesting that this could be a slice through a higher dimensional attractor. Would this higher-dimensional attractor correspond to a cognitive structure in the minds of Pushkin? Or, since we were the “signal director” for these data, would it be better to think of them as a “socio-cognitive” structure created through the interaction between Pushkin and his targeted audience? This question is imperative because there are at least two levels in which *order* and *disorder* are contrasted in the document: (1) orderly and disorderly events come and go within the statements and (2) Pushkin produces meaning at a higher level of orchestration.



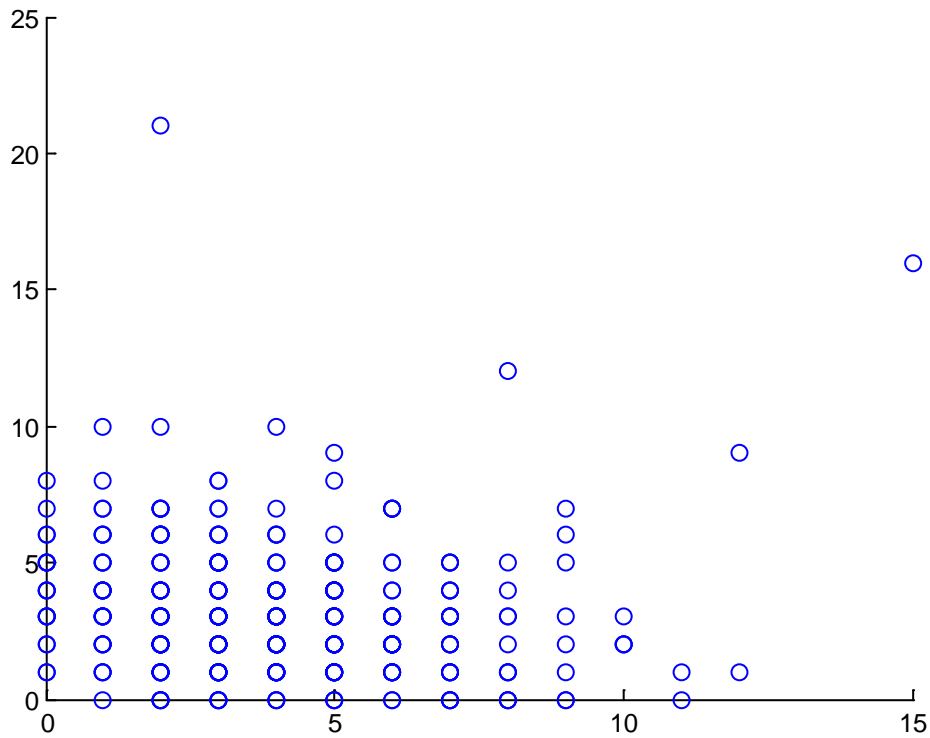


Figure 2: Phase Space Portrait Mapping Presuppositions of Order and Disorder
 Source: Self-generated data from *Eugene Onegin* and computed by using MATLAB

Furthermore, Figure 3 is the log-log plot (or log-log graph) generated to represent the observed units described by the two-dimensional variable encompassing *order* (y) and *disorder* (x) as a scatter plot/graph. The two axes display the logarithm of values of the two dimensions, not the values themselves. If the relationship between x and y is described by a power law,

$$y = x^a;$$

then the (x, y) points on the log-log plot form a line with the slope equal to a . Log-log plots are widely used to represent data that are expected to be scale-invariant or fractal because, as stated before, fractal data usually follow a power law. A logarithm is an exponent. It is illustrated in the following definition:

For $b > 0$, $b \neq 1$ and for $x > 0$,

$$y = \log_b x \text{ if and only if } b^y = x$$



Thus, since a logarithm is an exponent, it is easy to use exponent laws to establish mathematical generalizations.

Figure 3 illustrates the fractal dimension of the two-dimensionality of the variable. The binary logistic statistics reveal that the relationship between the two dimensions is not statistically significant at the 0.05 level. Visually, the text essentially moves halfway across the spectrum—it typically moves from periodic fractal, rather than stretching all the way to pure order or disorder. Thus, the results generated after the MATLAB computer runs suggest that the combination of negative and positive feedback loops, which form the basis of several African and Russian knowledge systems—as Ron Eglash (1999), Elena Kulinich et al. (2015) and Vera A. Fedotova (2015) suggest, also form a key mechanism of general self-organizing systems discussed in *Eugene Onegin*. Indeed, Pushkin’s framing of the issue in his text is reminiscent of African and Russian ways: i.e. despite the challenges and hardship, his thought process never became completely disorderly.

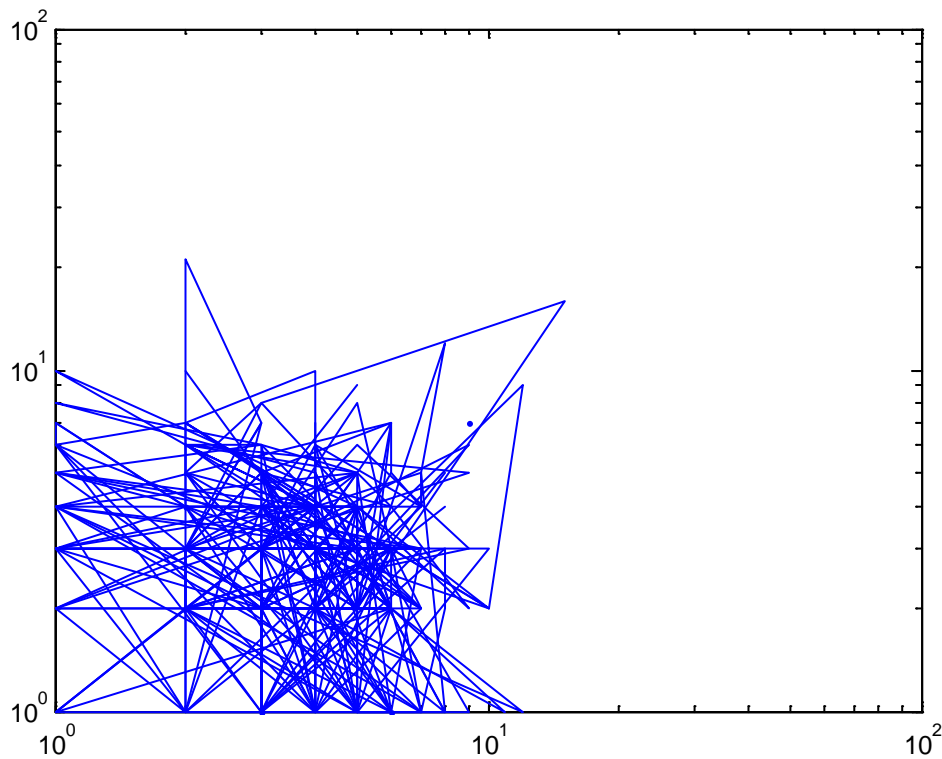


Figure 3: Log-log Plot Order vs. Disorder in *Eugene Onegin*

Binary Logistic: $y = 4.110 + 6.300 + 0.062 [y = \beta_0 + \beta_1x + \varepsilon]$

$R^2 = 0.0001$; $p = 0.919$

Source: Self-generated data from *Eugene Onegin* and computed by using MATLAB



Moreover, while some authors have pointed out that Pushkin's attitude towards the Russian establishment was rebellious and satirical, even though like his hero in *Eugene Onegin* he was a man of fashion and lived in the highest society (e.g., Wilson, 1965; Johnston, 1977; Nabokov, 1985; Tucker, 1999; Bendersky, 2005; Torgovitskaya, 2009; and Fry, 2012) and, thus, one would expect to see more topic shifts of *disorder* in the book, the preceding ontological results, however, also make it axiomatic to suggest that Pushkin's presentation of ideas in *Eugene Onegin* is gnoseological. From an African-centered perspective, according to late Guinean President Ahmed Sékou Touré, in his essay titled "A Dialectical Approach to Culture," gnoseology refers to the positive-intuitive thinking that is driven by the African's spiritual mind (1989:7). Indeed, Touré considers Black revolutionaries to have promoted an evolution of progressive qualification of reason that privileges gnoseology, which facilitates "the transition from ignorance to an increasingly deeper and more exact degree of knowledge" (1989:14). Thus, Touré argues that "Any anthology of African culture tending to situate it outside the realm of reason, of rational thought, of the law and of gnoseology tends to down-grade it and deviate it from its true end, which is to qualify mankind, and sacrifices it to the myth of singularity and specificity" (1989:14).

From a Russian-centered perspective, V. V. Solov'ev states that gnoseology is a component of a philosophical construction that revolves around the eternal problems of anthropology, cosmology, and metaphysics (see Mjør, 2011:285). Boris G. Kapustin distinguishes three fundamental types of politico-philosophical ideas of liberalism: (1) gnoseological, (2) ontological, and (3) technological. The classification makes it possible for him to delineate the different historical stages in the notion of liberty and peg them to the three types. The gnoseological type, which undergirds Russian liberty, is a reflection of the activities of individuals based on their comprehension of some fundamental principles that underlie their inclination and preparedness to consent to an adjured communal life (see Kaehne, 2007:97).

Conclusion

The data gleaned from *Eugene Onegin* made it possible to explore a phase space created by two dimensions: (1) *presuppositions of order* and (2) *presuppositions of disorder*. This was done to investigate the possibility that a fractal structure could exist in the literary dynamics that drive the narrative, similar to the ways that fractal structure exist in attractors for certain nonlinear physical systems. The substantive findings, as stated earlier, reveal that it is indeed possible to generate a phase space portrait in which data are mapped to a structure that has the kind of mix between periodic and random variation that we would expect from chaotic dynamics. This is not conclusive proof by any means—a full experiment would need to compare the results from several readers and look at other such presuppositions. But it does suggest that this kind of analysis could be extended further to investigations of literary dynamics.



If our speculation concerning this phase space portrait is correct—if there is indeed an underlying structure that could be characterized by fractal variation, this is noteworthy in that it could be a commonality within at least some bodies of African and Russian literatures. Further experiments would be needed to test this hypothesis. Nonetheless, as Kofi Nyidevu Awoonor (1990) and Bangura (2002) posit, the African life concept is holistic—i.e. it is based on an integrative world view. All life to the African is total; all human activities are closely interrelated. This has as its underlying principle the sanctity of the person, her/his spirituality and essentiality. This essentialist view of the person confers value to her/his personhood. All else—her/his labor and achievements—flow from this value system. Even personal shortcomings cannot invalidate it. As Leonid A. Zhigun (2014, 2015a & 2015b) also points out in the case of Russia, conditions found to be attractive require not only the expansion of economic satisfaction, but psychological relations as well; dealing with major societal issues calls for an equilibrium model that is multiplex in nature; and stimulating additional remunerations in the form of prizes and awards have a negative impact on employee productivity.

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