

Analysis of Polyphonic Interanimation in Novels, a Support for Understanding Beyond ChatGPT Answers

Ștefan Trăușan-Matu^{1,2,3}, Alexandru Hossu⁴

¹ Politehnica Bucharest
313 Splaiul Independenței, Bucharest, Romania

² Research Institute for Artificial Intelligence “Mihai Drăgănescu” of the Romanian Academy
13 Calea 13 Septembrie, Bucharest, Romania

³ Academy of Romanian Scientists
54 Splaiul Independenței, Bucharest, Romania

⁴ Tudor Vianu National College of Computer Science
Ion Mincu 10, Bucharest, Romania
E-mail: stefan.trausan@upb.ro, hossu.alexandru@gmail.com

Abstract. This paper argues that, even if generative artificial intelligence, for example, ChatGPT, proved astonishing capabilities in generating texts, including scholarly-level answers at users’ prompts, it is not sufficient for replacing the need for reading and analysing at least some parts of the texts of novels. However, artificial intelligence can assist a reader or researcher in re-reading or reflecting about fragments in a complex novel. The paper presents the polyphonic perspective introduced by Mikhail Bakhtin, the polyphonic model and analysis method introduced by Ștefan Trausan-Matu and a natural language processing-based method for supporting the analysis. For exemplification of the method, it is presented the assisted identification and an analysis of the most relevant polyphonic fragment in the novel “The Brothers Karamazov”, written by Fyodor Dostoevsky.

Keywords: polyphony; interanimation; natural language processing; generative artificial intelligence; ChatGPT; polyphonic model

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1. Introduction

Natural language processing (NLP) has been probably the most challenging domain of Artificial Intelligence (AI), starting from its beginning years, and it still is, due to several reasons. First, natural language has complexities that

are not yet totally explained. Its usage is a faculty that only human beings have, no other living beings, even primates, being even close to utilize it. Therefore, its perfect handling in a computer application would be an argument for the total success of the AI aims. However, this aim is still away even now, when one of the most astonishing achievements in recent years is the generative AI (GAI) technology, exemplified by the ChatGPT system (OpenAI, 2023), based on GPT family of transformers (Brown et al., 2020). GAI has awesome performances in answering questions and generating text but sometimes it provides limited or even hallucinatory texts, like an example that will be discussed in a further section. Other problem is that, even if rapid and coherent answers are provided to difficult questions, AI technology based on artificial neural networks has basic limitations in giving explanations about their responses, the so-called explainable AI problem (XAI, see, for example, Longo et al., 2024; Miller, 2019; Sandu and Trausan-Matu, 2021). One last, but not less important argument, is that, especially now, the omnipresence of mobile phones and social networks and of the applications based on natural language processing has a crucial role in shaping our everyday life and even our minds. This fact is raising fundamental questions about ethics of AI (Huang et al., 2023; Trausan-Matu, 2020a).

Probably there will be many people saying now that by prompting ChatGPT or other GAI system we can get any information, we can generate on the spot any required text, essays and even novels. It seems that having such “intelligent assistants” we do not need any more to read any texts, we can ask ChatGPT to provide us a summary of them, even if they are novels with hundred or more pages. However, it should be clarified that the outputs of GAI are compilations of the existing texts in electronic format, they do not provide something new.

This paper argues that GAI is not sufficient for replacing the need for reading and analysing at least some parts of the original texts of novels. One argument is that reading immerses us in the life experience that usually novels capture and/or imagine, a fundamental dimension of this experience being the sequential time flow and the presence of interanimating points of view of characters, which can be very well described as a polyphony (Bakhtin, 1984), similarly to the experience of listening a musical piece by Johann Sebastian Bach. As a support for understanding complex weavings of ideas in novels, for re-reading important fragments and reflecting on them, humans can be assisted in a polyphonic interanimation analysis by AI, NLP tools, as in other

similar cases, discussed especially for analysing conversations (Trausan-Matu, 2020b).

The paper continues with a section discussing in more detail the idea of polyphonic interanimation analysis of discourse in novels. The third section presents an operationalisation of this analysis and its application for a particular novel. Conclusions are the subject of the final section.

2. Polyphonic interanimation

Among the various natural language human activities, probably the most complex are writing and reading long texts and especially literature: novels, essays, plays, etc. Literature is important from several reasons: it fuels imagination, encourages critical thinking, it can encourage empathy, it keeps the brain active and healthy, it improves concentration and focus, it is a powerful stress reliever (Soken-Huberty, 2023). Moreover, writing literature needs creativity, which is a specific human feature, together with imagination and empathy.

Understanding, imagination, and empathy are related to the life experience of every of us. Novels, the focus of this paper, describe experiences of life: “A novel is a narrative work of prose fiction that tells a story about specific human experiences over a considerable length” (Prahl, 2019).

Novels are supposed to be read (sometimes re-read), which is a time taking activity. Moreover, complex novels force us to reflect about the narrative, relations among characters, conflicts, etc. They may have a polyphonic structure (Bakhtin, 1984) like complex music pieces.

Systems like ChatGPT can provide summaries, as in Figure 1¹. Such summaries are in fact a kind of compilations of texts that fed the artificial neural networks (that are the machinery behind GAI) during their training phase (see Figure 2). Additionally, sometimes ChatGPT hallucinates, as in the answer that “The Brothers Karamazov” has Book XII but not Book XI! (see Figure 3), this problem being now a major subject of discussions and research in AI (Rawte et al., 2023).

¹ All the examples with ChatGPT used the 3.5 version (OpenAI, 2023).

You
Summarize "The Brothers Karamazov"

ChatGPT
"The Brothers Karamazov" by Fyodor Dostoevsky is a complex and profound novel that explores the intricacies of human nature, morality, faith, and the consequences of rejecting traditional values. Here's a concise summary:

Plot Summary:

The Karamazov Family:

- The novel revolves around the Karamazov family, particularly the three brothers: Dmitri, Ivan, and Alyosha.
- Fyodor Pavlovich Karamazov, the father, is a dissolute and unscrupulous man. His death becomes a central event in the narrative.

Central Themes:

1. **Faith and Doubt:**
 - Ivan, the intellectual atheist, and Alyosha, the novice monk, grapple with questions of faith, morality, and the existence of God.
 - Ivan presents the philosophical poem "The Grand Inquisitor," challenging traditional religious beliefs.
2. **Morality and Free Will:**
 - The novel explores the moral choices made by individuals and the consequences of free will.
 - Characters face ethical dilemmas, and their actions impact their own destinies.
3. **Fatherhood and Family:**
 - The relationship between fathers and sons is a central theme, revealing the impact of parental influence on character development.
 - The brothers' relationships with their father, Fyodor, are complex and fraught with tension.
4. **The Nature of Evil:**
 - The novel delves into the nature of evil and the presence of moral depravity within individuals.
 - Characters confront their own dark sides and grapple with the consequences of their actions.

Key Events:

- **Dmitri's Trial:** Dmitri is accused of murdering his father. The trial serves as a focal point for exploring guilt, innocence, and justice.
- **Alyosha's Spiritual Journey:** Alyosha, the youngest brother, undergoes a spiritual journey in the monastery, navigating the challenges of living a life of faith in a world filled with moral ambiguity.
- **Resolution and Redemption:** The novel concludes with Alyosha striving for a life of service and love, offering a message of hope and redemption.

Style and Structure:

- Dostoevsky employs a polyphonic narrative, presenting diverse voices and perspectives.
- The novel features philosophical discussions, psychological depth, and symbolic elements.

Conclusion:

"The Brothers Karamazov" is a rich exploration of the human psyche and the complexities of morality and spirituality. Its enduring significance lies in its profound examination of the human condition and the timeless themes it addresses.

Figure 1. A summary of "The Brothers Karamazov" generated by ChatGPT (OpenAI, 2023).

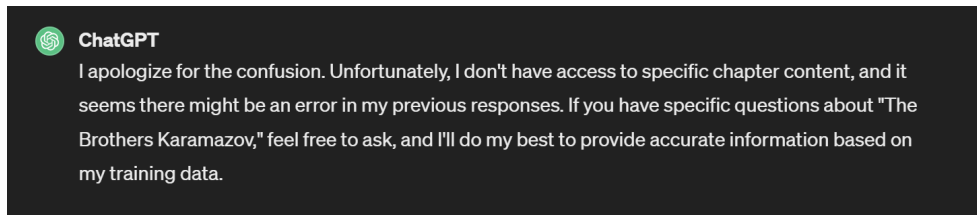


Figure 2. ChatGPT “recognizes” that it generates text from what it is trained (OpenAI, 2023)

Summaries provided by ChatGPT or other similar systems cannot replace the personal, subjective experience of reading a novel. Moreover, as mentioned, sometimes it is needed to re-read, to reflect about some text fragments for a better understanding them, which can be aided by analysing them from a different perspective. In this paper, is considered the polyphonic perspective introduced by Mikhail Bakhtin (and mentioned even by ChatGPT: “Dostoevsky employs a polyphonic narrative, presenting diverse voices and perspectives”, see Figure 1) and an NLP-based method for supporting the analysis is presented. He emphasized that everything in life is a polyphony of voices that weave following counterpoint rules “*everything in life was dialogue, that is, dialogic opposition*” (Bakhtin, 1984). Therefore, Bakhtin considers that a polyphonic novel can best express life, and Fyodor Dostoevsky was a master in this sense.

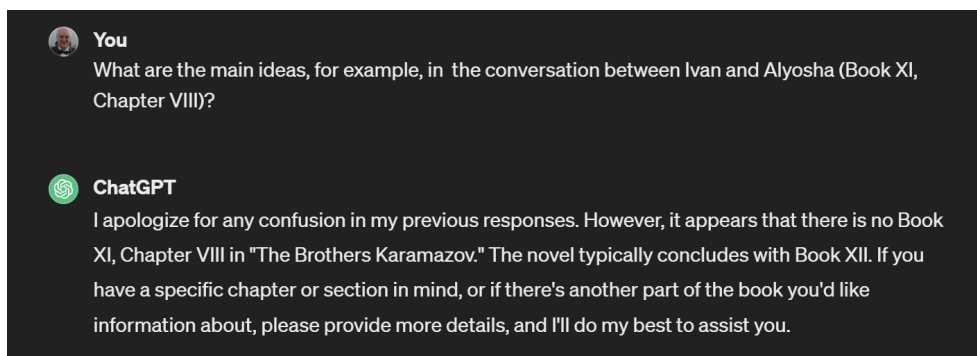


Figure 3. A hallucination of ChatGPT (OpenAI, 2023)

Polyphony is a concept from music composition. In fact, between music and language are many links (Trausan-Matu, 2020c), including rhythm (Balint et al., 2016) and the need of attractivity (Trausan-Matu, 2020c). A

polyphonic musical piece has several melodic lines (“voices”), which may start from a given theme but are independent, they enter in series of dissonances solved by consonances that generate a complex weaving and are similar to creativity generation processes (Csikszentmihalyi, 1996). There were introduced several rules of counterpoint (“point-versus-point” – “note-versus-note”) in order to assure that the melodic lines develop in an independent way, that they are not one voice being only an accompaniment of another (for example, when one melodic lines goes up, the other goes down).

Starting from Bakhtin’s ideas, Trausan-Matu introduced the polyphonic model of discourse, which was operationalised and used for analysing textual discourse in several cases, manually or aided by NLP, especially in collaborative chats in educational settings: Computer-Supported Collaborative Learning (Trausan-Matu, 2020b), social discourse building, and creativity fostering (Trausan-Matu, 2023).

The polyphonic model of discourse extends the concept of voice from being associated only to the utterances (either verbalised or only thought) of a particular person. A voice may be, in addition, an idea, a topic, a subject or thread of discussion, which enter in counterpoint weavings with others. Voices interanimate through divergences (dissonances) that drive to convergences (consonances).

Therefore, in the polyphonic model of discourse the main components are voices and interanimations. For easing the modelling process, NLP techniques can be used. There are several steps that should be followed:

1. Identify the main voices in the text, that means both persons and ideas. Persons may be identified by reading or by using NLP to find the most frequent proper nouns in the novel. Ideas can be detected also by NLP techniques by identifying the most used words (usually nouns) after eliminating the so-called stop-words (most frequent words, which do no bring content, e.g. ‘the’, ‘a’, ‘on’, etc.), extracting words’ roots (to consider, for example, starting from the example in the next section, that ‘murder’ and ‘murderer’ are the same voice) and linking semantically similar words (for example, ‘murder’ and ‘kill’ in the example from the next section).
2. Detect connections and/or relations among voices (words) either manually, by reading or using NLP.

3. Identify patterns of interanimation (Trausan-Matu, 2020b). A pattern of interanimation involves the presence of at least two voices at a limited distance in text. Cue phrases (for example: 'but', 'yet', etc.), if present, might suggest the presence of a divergence or convergence.
4. Find fragments in which patterns of interanimation occur repetitively, in a kind of rhythm.














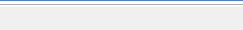
3. A polyphonic interanimation analysis of a novel

For exemplification of the ideas introduced above we have analysed several novels that are considered to have a polyphonic discourse structure. Herein we will present one such analysis, of the novel "The Brothers Karamazov", written by Fyodor Dostoevsky (1880/2009), which is also analysed by Mikhail Bakhtin in presenting his polyphonic theory (Bakhtin, 1994). Our aim is to identify at least one text fragment that has the potential to have a strong polyphonic weaving and to analyse it. Re-reading and analysing such a fragment might bring important insight on the novel.








For the analysis, we followed the steps presented in the previous section. For the first step, the two categories of voices, characters and concepts, were detected using KH-CODER (2024). For persons we considered only the first 6 and for concepts only the first 7 most frequent apparitions (see Figure 4 a and b).

For the second step of analysis, two other facilities of the same KH-CODER system were used: "coding crosstab" (Figure 5) and the co-occurrences of words (Figure 6). The first facility allowed to identify the distribution of character voices in the novel. The result is that all Alyosha, Mitya, Ivan, and Smerdyakov are the most present in Book XI (Figure 5 a).

From Figure 6 it is seen that there are two relevant clusters of the ideas type of voices considered in Book XI: one containing 'money' and 'murder' and a second containing 'heart' and 'mind', together with the 'voice' of 'God'. In the same map there is also the cluster that includes Ivan, Smerdyakov, Alyosha, and Dmitri (Mitya). The conclusion is that 'murder' and 'money' are most co-present in connection with two other main voices, Ivan and Smerdyakov in Chapter VIII (Figure 5 b).

- List				
#	Word	POS / Conj.	Frequency	
1	Alyosha	ProperNoun	1242	
2	Mitya	ProperNoun	916	
3	Ivan	ProperNoun	715	
4	God	ProperNoun	417	
5	Dmitri	ProperNoun	380	
6	Smerdyakov	ProperNoun	377	
7	Grushenka	ProperNoun	364	
8	Fyodorovitch	ProperNoun	344	
9	Fyodor	ProperNoun	301	
10	Pavlovitch	ProperNoun	301	
11	Ivanovna	ProperNoun	222	
12	Katerina	ProperNoun	212	
13	Kolya	ProperNoun	211	
14	Rakitin	ProperNoun	198	

a.

- List				
#	Word	POS / Conj.	Frequency	
1	money	Noun	296	
2	heart	Noun	248	
3	life	Noun	242	
4	mind	Noun	154	
5	word	Noun	142	
6	chapter	Noun	96	
7	murder	Noun	96	

b.

Figure 4. The main voices (a. – characters, b. concepts)

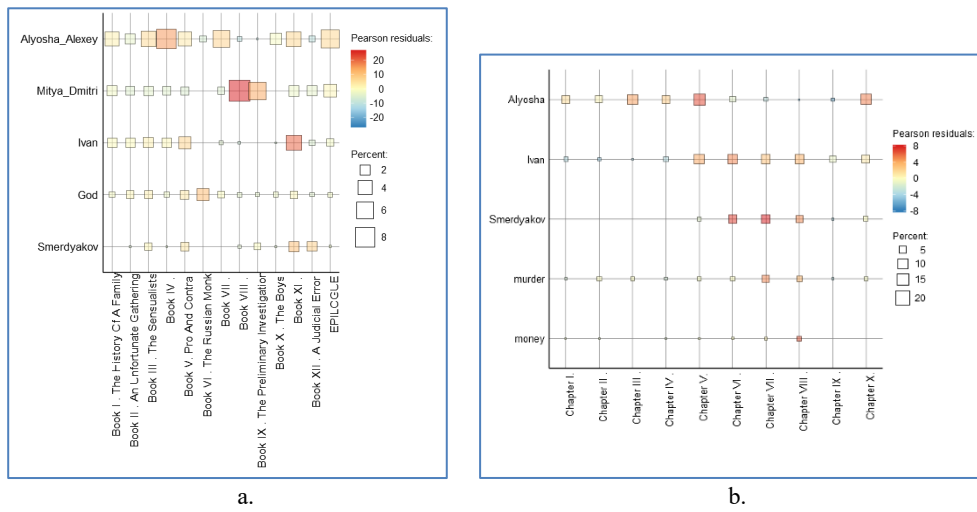


Figure 5. Distribution of some voices in the books of the novel (a.) and in the chapters of Book XI

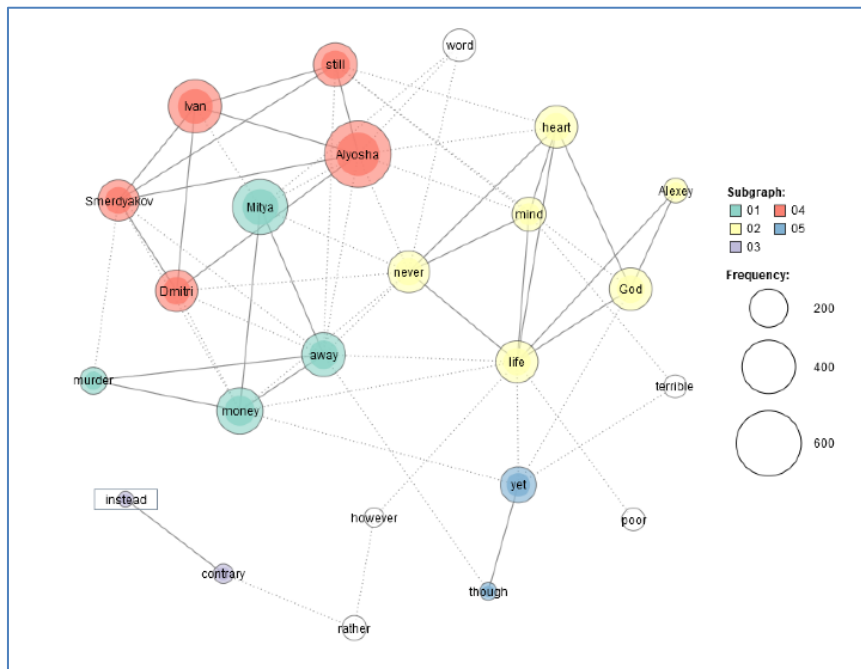


Figure 6. A conceptual map built from co-occurrences of words in Book XI

For making a comparison, we asked ChatGPT about a polyphonic fragment in the discussion between Ivan and Smerdyakov in Chapter VIII (“The Third And Last Interview With Smerdyakov”) of the Book XI and we got the answer from Figure 7.



Figure 7. The ChatGPT answer about the discussion between Ivan and Smerdyakov in Chapter VIII (OpenAI, 2023)

The answer provided by ChatGPT is brief and general. After reading the novel, one can remark that the discussion on “morality, free will, and the existence of God” is a major topic in the novel, but it is less present in Chapter VIII of Book XI. Moreover, it cannot provide details about which fragment is the most polyphonic. For having a correct image on the discussions between Ivan and Smerdyakov in this chapter, the polyphonic interanimation analysis could be helpful.

For the third and fourth steps, the detection of interanimations in Chapter VIII, we used a Python program to emphasize the co-occurrences of voices and cue phrases. After a visual examination of the result, we remarked a short fragment where the voices ‘money’ and ‘murder’ appeared almost rhythmically, accompanied by other voices (Dmitri, God, ‘life’, ‘mind’) and cue phrases indicating divergences (see Figure 8). These are strong indicators of a polyphonic interanimation, and we consequently read the corresponding text (Figure 9), where we also identified the repetition of the ‘kill’ verb, which is very strongly semantically related to the voice ‘murder’, allowing us to consider it as belonging to the same voice. The voices Ivan and Smerdyakov are explicitly and implicitly present, they are being physically participating to the conversation. In fact, this fragment is one climax of the novel because

it reveals the truth about who killed the father of the Karamazov brothers, one of main topics of the novel.

```

====> Smerdyakov
but ====> Ivan
though ====> Ivan
====> Ivan
away - ----> money
never - ----> money
away - ----> murder - ====> Dmitri
away - ----> money - ====> Dmitri
----> money
no - but - ----> money - ====> Dmitri
still - away - ----> murder
instead ====> Dmitri
----> life - ====> Ivan
though - ----> money - murder
====> Smerdyakov - Ivan
====> Dmitri
but - ----> word
bad - but - ----> money - ====> Dmitri
but ====> Smerdyakov
angry - though ====> Ivan
====> Dmitri
----> murder
====> Dmitri
but - contrary - though - though
====> God - Ivan
though ====> Smerdyakov
no - never|
====> Smerdyakov
away - ----> money - ====> Smerdyakov
----> murder
still - ----> life - money
no - no - no ====> God
----> money - ====> God
====> Smerdyakov
----> money
====> Ivan
====> Ivan
----> money
====> Smerdyakov - Ivan
====> Ivan
but ====> Ivan
still - although - ----> mind

```

Figure 8. A fragment of interanimations with a strong polyphonic weaving

Chapter VIII.
The Third And Last Interview With Smerdyakov

.....
 "... Go home, you did not murder him."
 ...
 "Well, it was you who murdered him, if that's it," ...
 "... You murdered him; you are the real murderer, I was only your instrument, your faithful servant, and it was following your words I did it."
 "Did it? Why, did you murder him?" Ivan turned cold.

 "Stay," Ivan interrupted; "if he had killed him, he would have taken the money and carried it away; you must have considered that. What would you have got by it afterwards? I don't see."
 "But he would never have found the money. That was only what I told him, that the money was under the mattress. ... A stupid thing to believe.
 So if Dmitri Fyodorovitch had committed the murder, finding nothing, he would either have run away in a hurry, afraid of every sound, as always happens with murderers, or he would have been arrested. So I could always have clambered up to the ikons and have taken away the money next morning or even that night, and it would have all been put down to Dmitri Fyodorovitch. I could reckon upon that."
 "But what if he did not kill him, but only knocked him down?"
 "If he did not kill him, of course, I would not have ventured to take the money, and nothing would have happened. But I calculated that he would beat him senseless, and I should have time to take it then, and then I'd make out to Fyodor Pavlovitch that it was no one but Dmitri Fyodorovitch who had taken the money after beating him."
 "Stop ... I am getting mixed. Then it was Dmitri after all who killed him; you only took the money?"
 "No, he didn't kill him. Well, I might as well have told you now that he was the murderer... But I don't want to lie to you now, because ... because if you really haven't understood till now, as I see for myself, and are not pretending, so as to throw your guilt on me to my very face, you are still responsible for it all, since you knew of the murder and charged me to do it, and went away knowing all about it. And so I want to prove to your face this evening that you are the only real murderer in the whole affair, and I am not the real murderer, though I did kill him. You are the rightful murderer."

Figure 9. The text fragment that includes the interanimations from the previous figure

4. Conclusions

A reasonable question is whether GAI (e.g. ChatGPT) can substitute the experience of reading, re-reading, and analysing complex discourse structures in novels. We hope that the paper argues that the answer is no. However, using NLP, different types of visualisations, and manual examinations, a reader or researcher can identify important fragments in a novel, where occur many interanimation among characters and ideas.

Moreover, from these data, polyphonic discourse weaving can be revealed, which can provide deep insights about the novels.

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