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Text and metatext event in the gaze behavior of impulsive and reflective readers

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Abstract. Experimental research testing the effects of text complexity onto gaze behavior and comprehension have revealed multiple factors which underlie the distribution of attention in reading. In the study, we explored event construal cues in text and metatext fragments in drama plays as mediating the gaze behavior of both reflective and impulsive readers. To annotate the event construal cues in text and metatext (in characters' speech and in author's remarks), we developed a Text Event Construal Protocol. It specifies three groups of construal cues in Referent group, Event Frame group, and Perspective group. The protocol was tested and implemented in the MultiCORText search engine and database. Cognitive semantic analysis helped identify the differences in event construal in author's and characters' intexts. The highest distinctions were found in perspective construal, where subjectivation cues were significantly less frequent in author's intexts. Additionally, the differences were observed in other event construal groups, for instance in the frequency of abstract referent, activity of visual / audial perception or mental activity (thinking / understanding), and action, state or activity of space location. In the

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cognitive psychological study, we tested the gaze behavior of reflective and impulsive participants reading 5 one-page drama text fragments incorporating the author's and characters' intexts (overall, 126 areas of interest) previously annotated following the Text Event Construal Protocol. The study found evidence for significant distinctions in the gaze behavior (in First Fixation duration, Max Fixation duration) of the readers displaying different cognitive style; importantly, major effects of event construal cues were observed among the reflective readers. The results allowed to scale the effects of event construal cues in text and metatext for different groups of readers. Therefore, the data provide new evidence in the cognitive semantic research of text and metatext via the methods and instruments of cognitive psychology.

Keywords: Text; Metatext; Gaze behavior; Cognitive style; Event construal; Event Construal Protocol

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экономии когнитивных ресурсов человека при интерпретации медиа текстов: Разработка Мультимодального Корпуса Окулографических Реакций MultiCOR» и проведено в Центре СоциоКогнитивных Исследований Дискурса в Московском государственном лингвистическом университете.

Аннотация. Установление факторов, детерминирующих распределение внимания при чтении, является предметом экспериментальных исследований, тестирующих влияние семантических характеристик текста на глазодвигательное поведение читателей и / или их понимание прочитанного. В исследовании анализу подвергаются особенности конструирования события в текстовых и метатекстовых фрагментах пьес как способные оказывать воздействие на изменения глазодвигательного поведения читателей, рефлективных и импульсивных. Для реализации исследования разрабатывается протокол, позволяющий аннотировать особенности конструирования события в текстовых и метатекстовых фрагментах (репликах персонажей и репликах автора в пьесах). Протокол описывает 3 группы характеристик, тип референта, тип действия / состояния, тип перспективы; он верифицирован и применен в поисковом корпусе MultiCORText. В ходе когнитивно-семантического анализа устанавливаются различия в конструировании событий в репликах автора и персонажей. Наиболее значимые различия выявлены в конструировании перспективы; так, роль субъективности в конструировании события снижена в репликах автора. Однако определенные особенности наблюдаются и в других группах, например, в различающейся представленности абстрактного объекта, действия или состояния восприятия или понимания, действия или состояния с указанием локализации в пространстве. В ходе когнитивно-психологического анализа исследуется глазодвигательное поведение импульсивных и рефлективных испытуемых, читающих 5 одностраничных фрагментов пьес, включающих реплики автора и персонажей (126 зон), описываемые протоколом конструирования событий. Были обнаружены значимые различия в глазодвигательном поведении (в продолжительности первой фиксации, максимальной продолжительности фиксации в зоне) у испытуемых с разным когнитивным стилем; при этом наибольшее воздействие особенности конструирования событий оказали на рефлективных читателей. Результаты исследования позволили ранжировать значимость особенностей конструирования события в тексте и метатексте для разных групп читателей. Тем самым полученные результаты развивают положения когнитивной семантики текста и метатекста с помощью инструментария когнитивной психологии.

Ключевые слова: Текст; Метатекст; Глазодвигательное поведение; Когнитивный стиль; Конструирование события; Протокол конструирования события

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1. Introduction

The present study addresses two research problems. The first is exploring the ways people construe events in text and metatext (author's intexts). While philosophy of language presents an influential view on the structure of metatexts and their types (Lotman, 1992; Litvinenko, 2008), cognitive semantics offers a different approach which studies the ways texts and metatexts are construed as cognitive events (Kubryakova, Aleksandrova, 2008; Kubryakova, Petrova, 2010). Texts and metatexts serve to identify the cognitive processes which underly the interplay of author's and characters' remarks. Among these processes the studies name the construal of referents, states and actions (Tomlin, 1987; Talmy, 2007; Verhagen, 2007); still, when it comes to metatexts, perspective construal seems the most important (Iriskhanova, 2013; Rzheshevskaya, 2014). However, to this date there is scarce knowledge about the differences in event construal in texts and metatexts. The obvious reason for that is that to contrast event construal in texts and in metatexts, the common event construal protocol should be developed, which will allow to study the processes in text and in metatext event construal, for instance in author's and characters' intexts within drama texts on the same grounds. Developing this protocol and exploring event construal in text and metatext becomes the first objective of this study, which relates to cognitive semantic aspect of textuality and metatextuality.

The second research problem is exploring the ways texts and metatexts are perceived by the readers or construed by the readers; therefore, it relates to a more general problem of text and discourse complexity (Solovyev et al., 2022). Whereas researchers may develop intricate semantic models of event construal via exploring multiple frameworks of texts and metatexts, the only way to test these models is via the readers' interpretation, for instance in gaze behavior. Extensive experimental research has been carried out in recent years which attests to the significance of single event cues for gaze behavior (Velichkovsky et al., 2005; Fehd & Seiffert, 2008; Papafragou et al., 2008; Rayner et al., 2009; Papenmeier & Huff, 2010; Coventry et al., 2010; Divjak, Milin & Medimorec, 2020). Most commonly, these are dynamics, spatial orientation of objects and participants, the number of objects and participants. Additionally, these are the salience effects or the effects of singular event cues which stand out against other event cues which make some objects or event participants more accessible (Givoni & Giora, 2018; Pokhoday et al., 2019). However few if any existing research identify the cumulative effects of event cues in terms of their visual accessibility, therefore we are still unaware which cues may neutralize or suppress other cues in event perception. In this study, the Text Event Construal Protocol will be applied to explore the event cues which might produce different gaze costs with different readers, depending on their cognitive style (reflective and impulsive), and consequently to range the accessibility potential of these cues in the author's and character's intexts. Therefore, we will also test this protocol as part of the pilot corpus of gaze reactions MultiCORText.

To verify the Event Construal Protocol as potentially efficient in exploring event construal in text and metatext with the aim of incorporating it into MultiCORText, we adopt the method of indirect measurement which is customarily applied to study the cases where direct measurement is not possible for different reasons (Gamer & Pertzov, 2018; Nahari et al., 2019). Since the direct measurement of event semantics cues salience is not possible, we range the cues salience via the changes in their accessibility in the gaze behavior of experiment participants reading texts containing these text cues. Overall, we use the effects of gaze metrics which are instrumentally obtained to identify (and scale) the construal effects which cannot be directly instrumentally measured. Significant changes in gaze behavior help identify the significance of event construal effects. Exploring these

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changes while integrating the Text Event Construal Protocol into the pilot corpus and database of gaze reactions MultiCORText becomes the second objective of this study, which relates to cognitive psychological aspect of textuality and metatextuality.

The contributions of this study include: (i) developing and testing the Text Event Construal Protocol to explore event construal in text and metatext; ii) revealing the effects of event construal in text and metatext onto the gaze behavior of readers; iii) scaling the effects of different event construal groups, Referent, Event Frame and Perspective construal onto the gaze behavior of reflective and impulsive readers.

The article is structured as follows. In Section 2 the background literature on event construal in cognitive semantics and cognitive psychology is presented. In Section 3 we introduce the Text Event Construal Protocol incorporated into MultiCORText pilot corpus of gaze behavior. In Section 4 we present the design of the semantic and psychological study exploiting the protocol. In Section 5 we present the results of the study which involve 1) text and metatext event construal differences, 2) gaze behavior results mediated by these differences in two readers' groups, reflective and impulsive. Sections 6 and 7 outline the major outcomes of the study within cognitive semantics and cognitive psychology, both relating to text and metatext event construal.

2. Background literature

Since we expected to develop the Text Event Construal Protocol (TECP) which will be used both for identifying event construal specifics in text and metatext (a cognitive semantic aspect) and for identifying the effects produced by event construal onto the readers (a cognitive psychological aspect), we addressed both semantic and experimental studies in this area.

As known, in cognitive semantics the researchers consider event types (Demyankov, 1983, 2019), event construal mechanisms or operations (Tomlin, 1987; Talmy, 2000; Verhagen, 2007; Langacker, 2015; Pascual &

Oakley, 2017; Iriskhanova, 2021), with foregrounding and perspectivization being the most described (Talmy, 2007; Wårwik, 2004; Iriskhanova, 2014, 2019), and event models (Elman, 2009; Richmond & Zacks, 2017). Additionally, experimental gaze studies have already identified the effects of event construal characteristics. For instance, the work (Divjak et al., 2020) explored how the picture was viewed when its demonstration was not accompanied by speech or was accompanied by speech foregrounding agent or patient. The results showed that without speech the participants first viewed the Action and there was an increase in Dwell Time. With speech foregrounding Agent, the participants first viewed the Action and there was a decrease in Dwell Time and then the participants passed on to perceiving Agent. With speech foregrounding Patient the participants first viewed the Patient and there was a decrease in Dwell Time, next they passed on to Action. This means that event construal cues may modulate the gaze metrics. Experimental studies also proved that other construal effects may affect gaze behavior, for instance dynamicity and stativity (Velichkovsky et al., 2005; Papenmeier & Huff, 2010), space construal (Coventry et al., 2010), manner and path of action (Ji & Papafragou, 2018), and salience (Givoni & Giora, 2018). Still, these effects have not been experimentally attested more complex text formats, for instance in text and metatext fragments (Lotman, 1992; Litvinenko, 2008); although metatext event semantics has been much discussed in cognitive semantic studies (Kubryakova, Aleksandrova, 2008; Kubryakova, Petrova, 2010).

Interestingly, event construal specifics have scarcely if ever been explored on a systemic basis in gaze behavior studies. While fundamental characteristics of eye movements in reading and information processing have long been established in eye tracking research (Rayner, 1998), most existing eye tracking research operate on Potsdam Sentence Corpus protocol, proposed by R. Kliegl et al. (Kliegl et al., 2004), with 2 × 3 × 2 design: part of

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speech (noun/verb), word length (short/medium/long), word frequency (high/low) (Laurinavichyute et al., 2019). First fixation duration, gaze duration, and word skipping rate (early-stage measures, reflecting the initial processes of lexical access), as well as regression rate and total reading time in reading are recorded, and along with the reading material are disclosed for research purposes. However, while providing plenty of evidence of formal word characteristics on eye movements in reading, Potsdam Sentence Corpus protocol does not consider event construal effects attested and verified in cognitive semantics. We expect that TECP developed in the current study and incorporated into the pilot corpus and database of gaze reactions MultiCORText may serve as a research instrument for exploring event construal in text and metatext integrating both cognitive semantic and cognitive psychological views on event construal and interpretation.

Additionally, since we intended to reveal event construal effects produced by text and metatext, we also expected that these effects would differ among the readers with different cognitive style. Given that high impulsivity (tendency to resolve speed-accuracy trade-off towards quick responses and more mistakes) is associated with increased vulnerability to extraneous distraction (Forster et al., 2014), we assumed that event construal effects in author's and characters' intexts might promote distribution of attention of more impulsive subjects in favour of more foregrounded characteristics, for instance agentivity and dynamicity. Therefore, we expected that impulsivity / reflectivity cognitive style, sometimes referred to as conceptual tempo (Zhang & Sternberg, 2012), will affect event construal in text and metatext, which will be observed in the gaze behavior of impulsive and reflective participants. The construct "impulsivity-reflectivity" is used in visual perception studies, where it is sometimes linked with holistic / analytic construal (Nitzan-Tamar et al., 2016), where shorter

latency and lower accuracy of the impulsives produce fewer details but generate a more systemic or holistic outlook (Rozencwajg & Corroyer, 2005).

3. Text Event Construal Protocol in MultiCORText

The efficiency of attributing gaze reactions to event construal characteristics in these and other studies gave rise to developing the Event Construal Protocol estimating event construal characteristics. Since construal can be viewed as "a feature of the meaning of all linguistic expressions… <which underlies> …various ways for categorizing situations, their participants and features, and the relations between them" (Verhagen, 2007: 48-49), we specified the components of event construal which include its referents (participants and objects), their relations which frame the communicative event, and the ways of categorizing it in perspective. Therefore, the components most frequently addressed to in the event semantic studies are referents represented by Referent (participants and objects), Event Frame representing actions and states, and Perspective representing the ways of their relations construal.

In our studies, an event is a semantic construct based on cognitive representations of Referents, Event Frame, Perspective within a discursive act. These three groups allow describe any event in any semiotic system, be it either text or image. The developed Event Construal Protocol has already been tested in multiple experimental studies (Kiose, Rzheshevskaya, 2021; Kiose et al., 2022). The complete list of Referent construal cues (or characteristics) involves 5 groups, Agentivity, Number, Reference, Referential integrity, Personalization. The list of Event Frame cues has 12 groups, Truth, Type, Relations, Manageability, Completeness, Instantness, Achievement, Evaluation, Space Location, Time Location, Repeatability, Cause and Effect. The list of Perspective construal cues combines 6 groups, Vantage Point, Viewpoint, Distancing, Observation Path, Key Referent

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Centrality, Event Centrality (for further details see Kiose, 2022).

However, to be incorporated into the pilot corpus MultiCORText, a trial version of protocol was developed applicable to texts and metatexts, in which Referents, Event Frame, Perspective within a discursive act are considered within linguistic representations. The basic requirement for selecting the subgroups to be included into the test version protocol was high agreement between the annotators since it was to become a search instrument in the pilot corpus. As known, in annotating the cognitive construal cues, the agreement coefficient is significantly lower than in annotating formal semantic cues; for this reason, we included into TECP only the subgroups of event cues where agreement Cohen's Kappa between the two annotators exceeded 0.9.

The unit of analysis in MultiCORText is a text or metatext unit corresponding to a discursive act, which performs "responses and interpretations from an external world" (Perinbanayagam, 2011). Each discursive act represents an act of order, command, instruction, recommendation, request, prayer, plea, narration, description, etc. We identified three basis formal types of discursive acts in our stimuli: 1) a clause (Опять все долго смеются / Бито. / (Зевает.)), 2) two clauses representing one discursive act (Добрый он, хороший. / Что за ребенок, что за ребенок золотой?), 3) a clause with discourse markers (Видно, что они только что напились чаю, / А в четверг – ну, ей-богу, ну, клянусь – сидел в кресле). Importantly, to be included into analysis the Areas of Interest (AOIs) containing the discursive acts had to be one-line texts; two or multiple-line texts could not be selected due to distinctive gaze behavior when making transfer from the previous to the next line (Rayner et al, 1998).

The test version of MultiCORText TECP specifies three groups of event cues:

1. Referent group which involves 1a) agentive participant, 1b) recipient, 1c) object, 1d) instrument, 1e) abstract referent. These cues appear in the referent typologies (Pustejovsky, 1995) as well as in the typologies of referent accessibility (Siewerska, 2004) and referent foregrounding (Iriskhanova, 2014). One annotation unit can manifest several referent types, since it can involve both participants and objects. However, in the cases of elliptical pronouns use (for instance, in *(Смеется, целует ее.)* where the agent is missing) we did not annotate them as present since there was low agreement in identifying elliptical pronouns in the clauses with the verb in the 3rd person due to the fact that the clauses lacked the indicators of reference. This occurred frequently because the author's intexts were mostly elliptical clauses, besides the characters' intexts were all in dialogical format; consequently, we adopted the decision to annotate only the cases with explicit reference in the clauses, even in the cases of 1st person pronoun use.

2. Event Frame group which involves the subgroups Activity type in 2a) dynamic action, 2b) state / non-dynamic action, 2c) activity of visual / audial perception or mental activity (thinking / understanding), and Activity location in 2d) action, state or activity of space location, 2e) action, state or activity of time location. This group specifies the activity type (2a, 2b, and 2c) and its spatial or / and time location (2d and 2e); therefore, in annotating the samples each of them was tagged as action, state or activity, and also as manifesting (if applicable) space and time location. States and actions as well as different action types (events-achievements and accomplishments) were described in both syntactic and referential semantics, however distinguishing between them is not always possible. Therefore, in TECP we adopted the version offered in cognitive semantics which apart from action and states identifies sensory and mental activities within the event construal paradigm (Talmy, 2000; Jackendoff, 2002; Bergen, 2015). Although space and time location will require further specification, at this point we decided to include these generalized characteristics,

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since not all specifications were found in the samples subjected to the analysis.

3. Perspective group which involves 3a) subjectivation (with target words – *about me, to us, for me*), 3b) objectivation (*to him, to them, about you, for her, about it*), 3d) intersubjectivation (*he <...> to them, I <...> for them, they <...> about me*). Since the group specifies three characteristics where one of them (3c) incorporates either (3a) or (3b), in each unit we annotated only either (3a), (3b) or (3c). However, in the cases of two or more predicates present within the unit of analysis or the presence of the indicators of possession (most commonly possessive pronouns like in radost' moya [Trans. – my happiness]), we annotated perspective in both; therefore, both subjectivation and intersubjectivation could be present in one unit. This perspective subgroup was the only one selected from a wider range of subgroups (see above) defined in (Verhagen, 2007; Iriskhanova, 2013; Rzheshevskaya, 2014; Kiose, 2022) due to low Cohen's Kappa received in agreement tests with other subgroups.

The developed protocol was incorporated as part of the pilot corpus and database of gaze reactions MultiCORText. The corpus allows the gaze search and provides further visualizations of gaze paths stored in the gaze behavior database. The search results are retrieved following the cognitive semantic queries specified in TECP. The corpus is available online and hosted at multicortext.linguanet.ru.

4. Study design and procedure

Since the research has two objectives, 1) applying TECP to explore the differences in text and metatext event construal, which relates to cognitive semantics, and 2) identifying the differences in gaze behavior of reflective and impulsive readers of text and metatext, which is cognitive psychological, the study employs a complex procedure.

4.1. Exploring the differences in text and metatext event construal

The text and metatext data further employed as stimuli in the eye tracking experiment, are 5 one-page drama texts, which are "Lessons of Music" by L. Petrushevskaya (636 signs), "Biography" by L. Razumovskaya (1204 signs), "Reminiscence" by A. Arbuzov (730 signs), "Lodger" by A. Vampilov (1373 signs), and "Cherry Orchard" by A. Chekhov (905 signs). The texts were selected following the prior annotation procedure which helped identify the stimuli different in event construal specifics (Kiose & Rzheshevskaya, 2021). There were 126 AOIs in the 5 stimuli selected for the experiment, which means that 126 discursive acts manifesting different event cues were subjected to cognitive semantic analysis. They displayed two types of intexts, 73 AOIs with the author's remarks and 53 AOIs with the characters' remarks. A smaller number of characters' intexts resulted from their line disposition (their length exceeded the limits of one line), which made us discard many of them.

The AOIs were annotated using the TECP. Below, we present several examples of annotation of the author's intexts:

(AOI 9) (Любови Андреевне.)

The intext is the author's remark from the play "Cherry Orchard" by A. Chekhov. The annotations are as follows: Referent group – patient, Event Frame group – state / non-dynamic action, Perspective group – intersubjectivation.

(AOI 26) (удивленно). [Trans. – surprisingly]

The intext is the author's remark from "Cherry Orchard" by A. Chekhov. The annotations are as follows: Event Frame group – state / non-dynamic action, Perspective group – objectivation.

(AOI 45) (Она сидит у пианино, [Trans. – She is sitting at the piano]

The intext is the author's remark from the play "Reminiscence" by A. Arbuzov. It received the following annotations: Referent group – patient, Event Frame group – state / non-dynamic action, space location, Perspective group – objectivation.

(AOI 47) **Шурочка**.

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This intext is the author's remark from the play "Reminiscence" by A. Arbuzov. It received the following annotations: Referent group – patient, Event Frame group – state / non-dynamic action, Perspective group – objectivation.

Overall, the author's intexts most commonly display either patients or agentive participants, state / non-dynamic action or dynamic action with more rare cases of activity of visual / audial perception or mental activity, objectivation.

Below, we present several examples of annotating the characters' intexts.

(AOI 40) Нет, совершенная ерундистика… [Trans. – No, that is total nonsense]

This intext is the character's remark from the play "Reminiscence" by A. Arbuzov. The annotations are as follows: Referent group – abstract object, Event Frame group – state / non-dynamic action, Perspective group – objectivation.

(AOI 38) Заждалась вас, радость моя, светик… [Trans. – (I) have been waiting for so long, my happiness, my light]

This intext is the character's remark from the play "Cherry Orchard" by A. Chekhov. It has the following annotations: Referent group – patient, Event Frame group – state / non-dynamic action, Perspective group – subjectivation (in радость моя), objectivation (in Заждалась вас).

(AOI 52) Отец семейства сорока пяти лет! [Trans. – The father of a family of forty-five years of age!]

This intext is the character's remark from the play "Reminiscence" by A. Arbuzov. We annotated it as follows: Referent group – patient, Event Frame group – state / non-dynamic action, Perspective group – objectivation.

(AOI 73) Навалились. [Trans. – Coming together]

The character's remark is from the play "Lodger" by A. Vampilov. It received the following annotations: Event frame group – dynamic action, Perspective group – objectivation.

Each unit of analysis in both author's and characters' intexts was annotated by two annotators following the procedure described above. Cohen's Kappa was next calculated to identify the agreement coefficient in both annotation sets (the author's and characters' intexts); next the annotation results were discussed and one common decision was developed in each case of discord. The analysis of frequency was then employed to explore the distribution of event cues in author's and characters' intexts. Since the procedure of coded annotation was applied, we used HETEROSTAT software[1] to process the data. Analysis of variance was further conducted in Jamovi software. Repeated measures ANOVA tests preceded with Shapiro-Wilk normality tests were performed to identify whether there are significant distinctions in event construal cues in text and metatext exemplified in characters' and author's intexts.

4.2. Identifying the differences in gaze behavior of reflective and impulsive readers of text and metatext

The experiment was a two-step procedure. At the first step, the psychological test to identify impulsivity / reflectivity score was conducted. At the second step, the eye tracking experiment was carried out.

Impulsivity / reflectivity score was measured with traditional Familiar Figures Test (MFFT) (Kagan et al., 1966). In the test, the subjects have to find as quickly as possible a match for a target image among eight variants. Based on 1) latency (time taken to respond) and 2) accuracy (number of mistakes) score, the subjects are classified as impulsive (short latency, low accuracy) or reflective (long latency, high accuracy). Given that eye movement patterns of impulsive and reflective subjects have been shown to vary in visual search task (Blinnikova & Izmalkova, 2017), we hypothesized that significant distinctions in eye movement characteristics

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[1] Kiose, M. and Efremov, A. (2020). HETEROSTAT software for complex calculation of discourse parameters. Registered in FIPI 21.09.2020, registration number 2020661240.

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would be observed for the reading task as well. MFFT was carried out before the eye tracking experiment and allowed to identify two subject groups: more reflective and more impulsive participants.

During the eye tracking experiment, the eye tracker SMI Red-x binocular system, frequency = 60 Hz, accuracy = 0.4°, head movement 40x20 cm, operating distance = 60-80 cm, was applied. The stimuli contained 73 AOIs of author's intexts and 53 AOIs of characters' intexts which were further analyzed in BeGaze 3.0 software. 16 (15) subjects (students, age range 20-26, mean age 22) participated in the study. We received 1890 probes which were later subjected to analysis. Since there were two subject groups: more reflective and more impulsive, and there were two types of stimuli data considered, author's and characters' intexts, the probes were analyzed in 4 data sets: 1) reflective readers, author's intexts, 2) reflective readers, characters' intexts, 3) impulsive readers, author's intexts, 4) impulsive readers, characters' intexts.

3 gaze metrics were considered: First Fixation duration, Max Fixation duration, and Average Fixation duration in AOIs. These metrics were selected following the gaze behavior studies employing text stimuli with AOIs (Rayner, 1998; Kliegl et al., 2004).

Jamovi software was applied to explore gaze behavior variance. Kruskal-Wallis One-way ANOVA (non-parametric) preceded by Shapiro-Wilk normality tests were performed to identify whether there are significant distinctions in gaze behavior of reflective and impulsive readers. The tests were used to estimate how the means of quantitative dependent variable (First Fixation duration, Max Fixation duration, Average Fixation duration) change according to the 2-level independent variable, the presence or absence of each of the five Referent, Event Frame and Perspective construal cues in two participant groups. We then scaled the H-coefficients of event cues (considering only the cases with significant p-values) as mediated by 1) text and metatext AOIs (characters' and author's intexts), 2) impulsive and reflective participants, 3) event construal groups, Referent group, Event Frame group, Perspective group. The described procedure allowed to obtain the scaled data and contract the accessibility of event cues.

5. Results
5.1. The differences in text and metatext event construal

In this subsection, we present the results of cognitive semantic analysis aimed at revealing the event construal differences in text and metatext in the stimuli. Since the coded annotation procedure was adopted, we first advocate the agreement results (between two annotators) followed by frequency and variance test results.

In the author's intexts, the agreement coefficient Cohen's Kappa exceeded 0.96, whereas in the characters' intexts it was lower (0.9); still the results proved that TECP allowed to receive consistent results. The cases of discord were higher in characters' intext, which was expected since AOIs in characters' intexts were longer and in most cases included more than one event cue (this circumstance led to incidental omissions in code annotation by any of the annotators) in each of the event construal groups. With AOIs of author's intexts equal to 73 and AOIs of characters' intexts equal to 53, the event construal cue frequency (activity) was equal to 426. In the author's intexts, the event construal cue frequency was 232; in character's intexts, it equaled 194. Contrasting the cue frequency in the intexts, we received the following frequency distribution (Figure 1).

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Figure 1. Frequency of event construal cues in author's and characters' intexts
Рисунок 1. Активность параметров конструирования в интекстах автора и персонажей
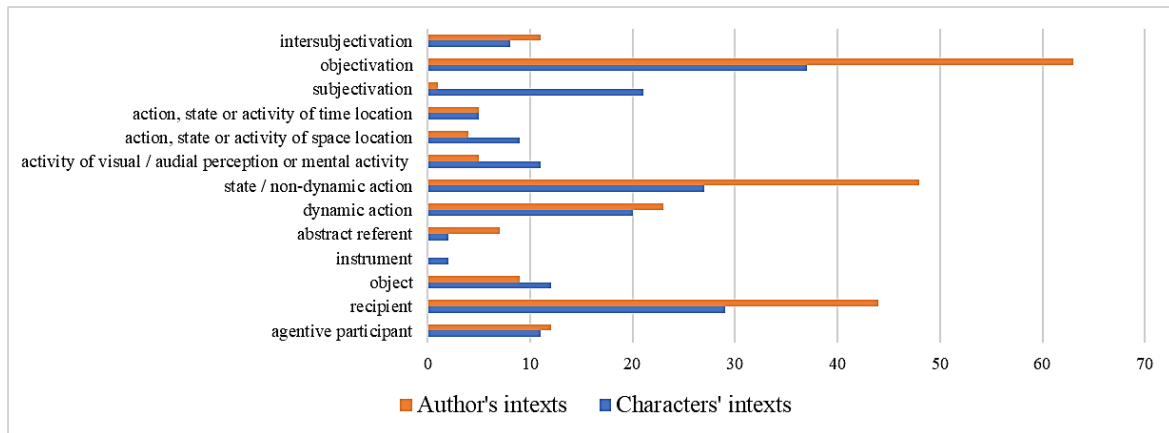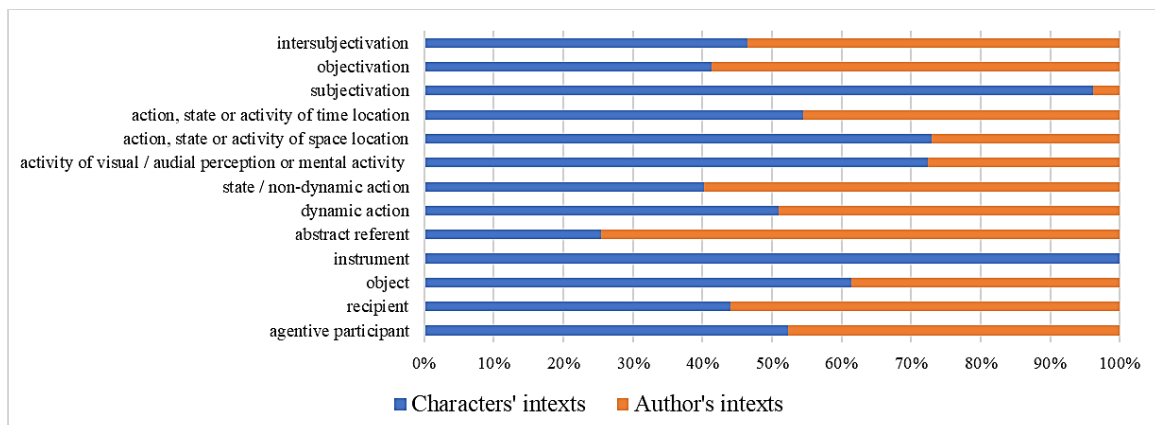

In Referent group this was the recipient which was most frequent in both author's and characters' intexts; besides, its coefficients are more than two times higher than any other referent type. In Event Frame group the prevailing type is state / non-dynamic action, second frequent is dynamic action. In Perspective group objectivation was the most frequent; however, we observed major differences in subjectivation which prevailed in characters' intexts, which was much expected. We hypothesized that there might be significant differences between the distribution of these characteristics in author's and characters' intexts. Shapiro-Wilk normality test found that while the event construal cue data in characters' intexts had normal distribution (with $p = 0.255$), the data in author's intext did not ($p = 0.005$); therefore, non-parametric Repeated measures ANOVA test was used to identify the variance differences in the use of event construal cues. Repeated measures ANOVA did not prove the hypothesis; with $F (1, 25) = 0.33$ at $p = 0.564$, we cannot reject the null hypothesis that there are no significant differences in the cues distribution.

To assess the relative frequency of event construal cues in author's and characters' intexts, we present the coefficients after second approximation in Figure 2.

Figure 2. Relative frequency of event construal cues in author's and characters' intexts (after second approximation)
Рисунок 2. Относительная активность параметров конструирования в интекстах автора и персонажей (после второй аппроксимации)

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As seen from Figure 2, the differences are observed in all event construal groups. In Referent group the differences are found in recipient, object and abstract referent (we will not consider instrument due to low absolute values). In Event Frame group the distribution varies in state / non-dynamic action, but more significantly in activity of visual / audial perception or mental activity. Interestingly, whereas no difference was found in time location, in space location it was displayed. Still, major differences were observed in Perspective group with subjectivation prevailing significantly in characters' intexts.

These stimuli event construal cues suffice to outline the specifics of text and metatext within MultiCORText, which will be presented in Section 6.

5.2. The differences in gaze behavior of reflective and impulsive readers of text and metatext

Familiar Figures Test (MFFT) (Kagan et al., 1966) conducted at the first step of the experiment allowed to assess the time taken to respond (T) and the number of mistakes made by 16 participants (MN). Two subject clusters were further identified, 9 impulsive subjects (T = 370.3 s, MN =10.7) and 7 reflective subjects (T = 756.7 s, MN = 4.9). However, the gaze results of one participant were further discarded due to calibration problems. The gaze results of 15 participants were subjected to analysis.

Below, we present the results of gaze behavior of impulsive and reflective participants in 53 characters' intexts and 73 author's intexts separately. First, we present the gaze data of reflective and impulsive participants reading AOIs with characters' intexts (Table 1).

Table 1. Gaze metrics of reflective / impulsive participants reading AOIs with characters' intexts
Таблица 1. Глазодвигательное поведение рефлективных / импульсивных читателей в зонах интереса – интекстах персонажей

	First Fixation duration, ms	Max Fixation duration, ms	Average Fixation duration, ms
N	318 / 334	318 / 334	318 / 334
Missing	0 / 0	0 / 0	0 / 0
Mean	162 / 169	206 / 222	159 / 164
Median	140 / 159	188 / 199	149 / 159
Minimum	83 / 85	89 / 95	89 / 90
Maximum	438 / 461	737 / 685	328 / 348

With 318 trials (AOIs readings) of reflective participants and 334 trials of impulsive participants, we can observe the differences in almost all the gaze metrics which show an increase in gaze duration among the impulsive participants. The mean values were compared in three gaze metrics depending on the cognitive style. Shapiro-Wilk test was used before the variance test. The results did not conform to normal distribution with Shapiro-Wilk p = 0.05. Next,

Repeated measures ANOVA non-parametric test was conducted to determine whether there is an effect of the cognitive style (impulsive and reflective) as a grouping variable onto the mean values as dependent variables. No significant distinctions were found, with F (1, 5) = 1.19, p = 0.275. However, we expected that there might be individual differences in gaze. In Figure 3 and Figure 4 we present the diagrams displaying the gaze data of individual experiment participants.

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Figure 3. Gaze data of reflective participants reading AOIs with characters' intexts
Рисунок 3. Глазодвигательное поведение рефлективных читателей в зонах интереса – интекстах персонажей
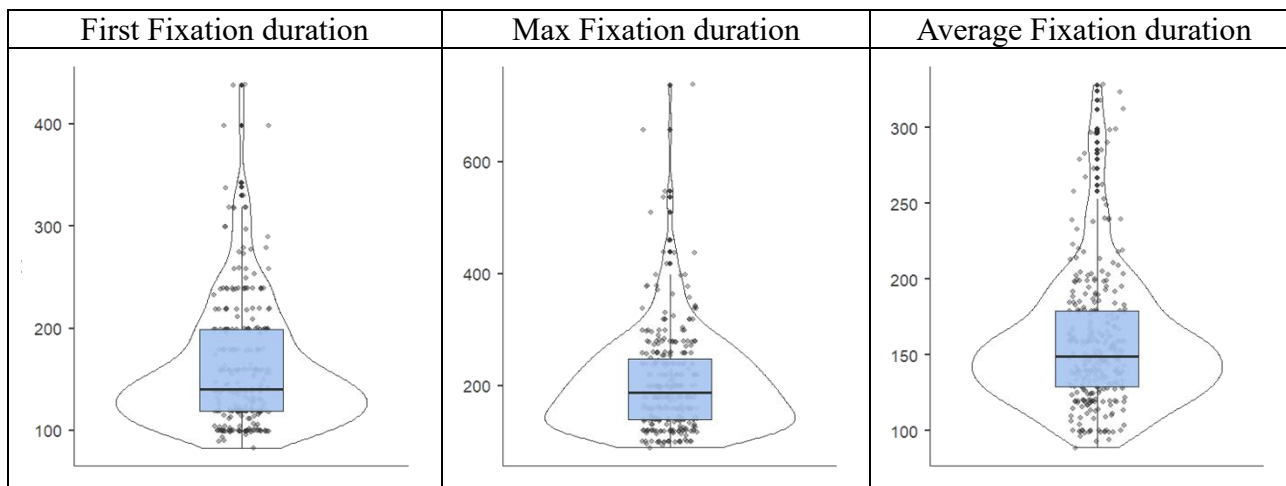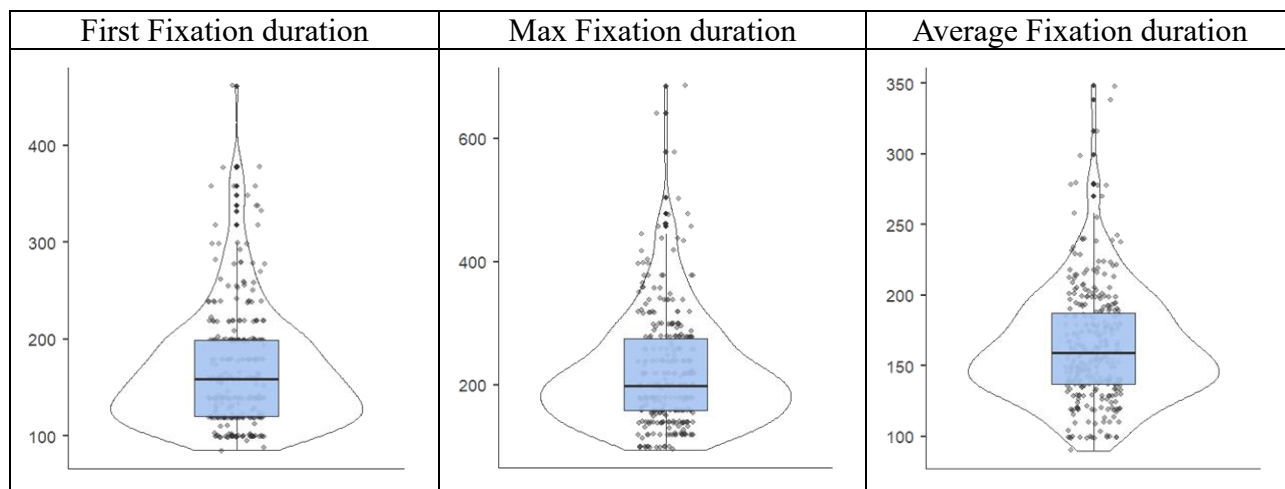

Figure 4. Gaze data of impulsive participants reading AOIs with characters' intexts
Рисунок 4. Глазодвигательное поведение импульсивных читателей в зонах интереса – интекстах персонажей

These diagrams manifest the differences in the variance and medians of reflective and impulsive participants. Though the median in First Fixation duration is lower with the reflectives, a significantly larger group of participants fell into the group with the values exceeding it. With the impulsives the median is closer to the mean value of First Fixation duration, which means that the reflectives displayed higher variance in their gaze reactions.

Shapiro-Wilk normality tests revealed that the mean values data did not have normal distribution, with $p < 0.01$ in all 3 trials. Next, Kruskal-Wallis One-way ANOVA non-parametric test was conducted to determine whether there was an effect of the cognitive style (impulsive and reflective) as a grouping variable onto the mean values of individual participants as dependent variables. No significant distinctions were found in First Fixation duration, with $H (1, 1303) = 3.31$, $p = 0.069$; however, significant differences were observed in Max Fixation duration, with $H = 6.61$, $p = 0.01$, and Average Fixation duration, with $H = 6.43$, $p = 0.011$.

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To study the event construal effects onto the gaze behavior of reflective and impulsive participants reading the character's intexts, we performed multiple Kruskal-Wallis One-way ANOVA non-parametric tests with Referent group, Event Frame group and Perspective group characteristics.

10 Kruskal-Wallis tests were carried out with Referent group cues, 1a) agentive participant, 1b) recipient, 1c) object, 1d) instrument, 1e) abstract referent. No significant differences were found in referent cues mediating the gaze behavior of either reflective or impulsive participants.

10 Kruskal-Wallis tests were carried out with Event Frame group cues, 2a) dynamic action, 2b) state / non-dynamic action, 2c) activity of visual / audial perception or mental activity (thinking / understanding), and Activity location in 2d) action, state or activity of space location, 2e) action, state or activity of time location. The tests revealed that in the group of reflective participants Max Fixation duration depended on action, state or activity of space location with H (1, 635) = 5.5, p = 0.019, and action, state or activity of time location with H (1, 635) = 3.81, p = 0.05. In the group of impulsive participants, we did not observe any significant differences.

6 Kruskal-Wallis tests were carried out with Perspective group cues, 3a) subjectivation, 3b) objectivation, 3d) intersubjectivation. Importantly, both groups were sensitive to perspective construal. Significant differences were observed in Max Fixation duration affected by subjectivation in the group reflective participants, with H (1, 635) = 5.02, p = 0.025. However, in the group of impulsive participants all three perspective construal cues appeared significant, with subjectivation affecting First Fixation duration, H (1, 667) = 3.77, p = 0.05, objectivation affecting First Fixation duration, H (1, 667) = 4.1, p = 0.043, and intersubjectivation affecting Max Fixation duration, H (1, 667) = 3.65, p = 0.05.

Next, we present the gaze data of reflective and impulsive participants reading AOIs with author' intexts (Table 2).

Table 2. Gaze metrics of reflective / impulsive participants reading AOIs with author's intexts
Таблица 2. Глазодвигательное поведение рефлективных / импульсивных читателей в зонах интереса – интекстах автора

	First Fixation duration, ms	Max Fixation duration, ms	Average Fixation duration, ms
N	319 / 366	319 / 366	319 / 366
Missing	0 / 0	0 / 0	0 / 0
Mean	167 / 169	194 / 199	163 / 166
Median	158 / 154	179 / 179	153 / 156
Minimum	80 / 84	80 / 85	80 / 85
Maximum	596 / 508	618 / 513	438 / 508

With 319 trials (AOIs readings) of reflective participants and 366 trials of impulsive participants, in contrast to the readings of character's intexts, we cannot observe the gaze behavior differences. However, the mean values were also compared in three gaze metrics depending on the cognitive style. Shapiro-Wilk test revealed that the data did not conform to normal distribution with p = 0.036. Repeated measures ANOVA non-parametric test did not allow to find significant distinctions, with F (1, 5) = 0.429, p = 0.513. Next, we performed the tests for individual gaze characteristics. In Figure 5 and Figure 6 we present the diagrams displaying the gaze data of individual experiment participants.

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Figure 5. Gaze data of reflective participants reading AOIs with author's intexts
Рисунок 5. Глазодвигательное поведение рефлективных читателей в зонах интереса – интекстах автора
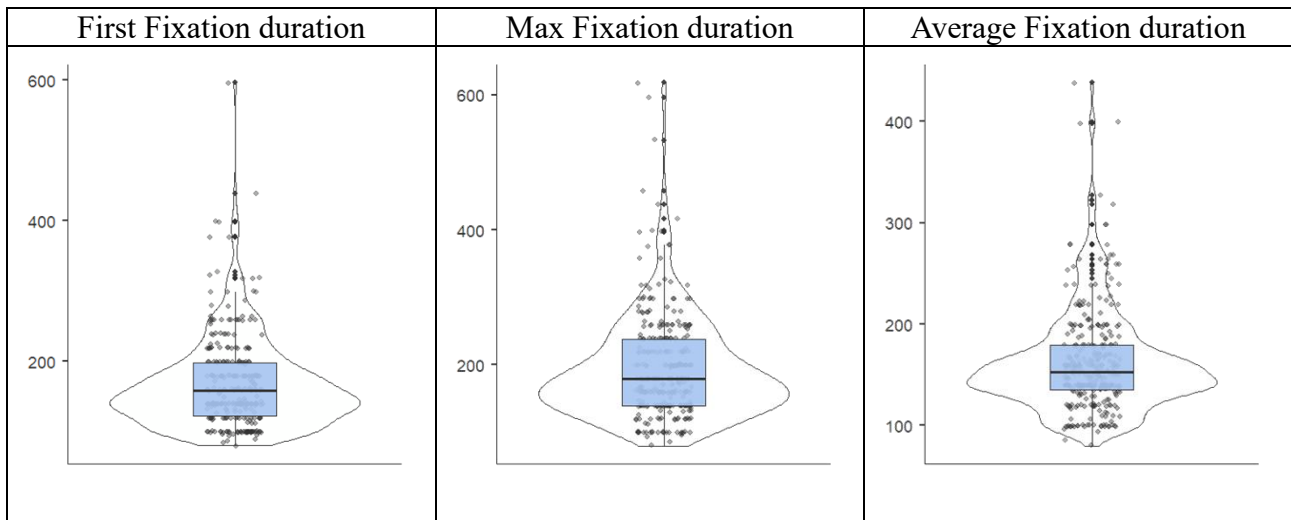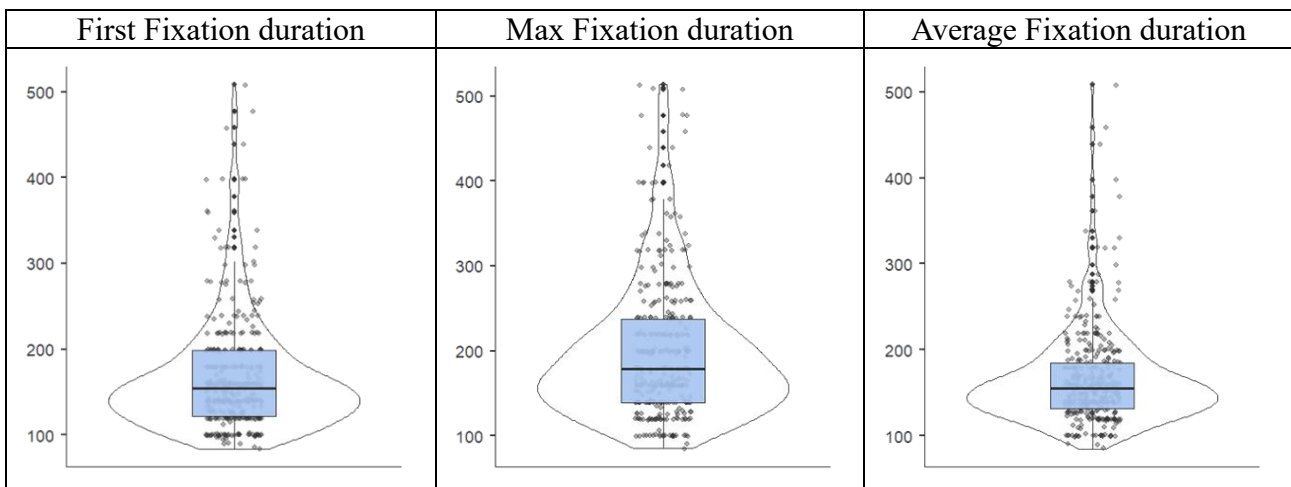

Figure 6. Gaze data of impulsive participants reading AOIs with author's intexts
Рисунок 6. Глазодвигательное поведение импульсивных читателей в зонах интереса – интекстах автора

The largest differences between mean and medians are observed in the gaze data of impulsive participants, in Max Fixation duration; however, they are lower than in AOIs with characters' intexts readings by reflective participants.

Shapiro-Wilk normality tests revealed that the mean values data did not have normal distribution, with $p < 0.01$ in all 3 trials. Next, Kruskal-Wallis One-way ANOVA non-parametric test was conducted to determine whether there is an effect of the cognitive style (impulsive and reflective) as a grouping variable onto the mean values of individual participants as dependent variables. No significant distinctions were found in either First Fixation duration, with $H (1, 1369) = 0.204$, $p = 0.652$, Max Fixation duration, with $H (1, 1369) = 0.563$, $p = 0.453$, or Average Fixation duration, with $H (1, 1369) = 1.107$, $p = 0.293$.

To study the event construal effects onto the gaze behavior of reflective and impulsive participants reading the author's intexts, we

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performed multiple Kruskal-Wallis One-way ANOVA non-parametric tests with Referent group, Event Frame group and Perspective group cues.

10 Kruskal-Wallis tests were carried out with Referent group cues. Significant differences were found in the group of reflective participants with Max Fixation duration depending on the presence or absence of abstract referent, with $H (1, 637) = 7.507$, $p = 0.006$. Interestingly, the same distinction was obtained with impulsive participants, with $(1, 731) = 4.735$, $p = 0.03$.

10 Kruskal-Wallis tests were carried out with Event Frame group cues. The tests revealed several significant distinctions in the group of reflective participants. Max Fixation duration is affected by dynamic action, with $H (1, 637) = 8.476$, $p = 0.004$, state / non-dynamic action, with $H (1, 637) = 5.123$, $p = 0.024$, action, state or activity of time location, with $H (1, 637) = 4.062$, $p = 0.044$. In the group of impulsive participants, we did not observe any significant differences.

6 Kruskal-Wallis tests were carried out with Perspective group cues. Only reflective participants were sensitive to perspective construal. Significant differences were observed in First Fixation duration affected by subjectivation, with $H (1, 637) = 4.47$, $p = 0.035$.

6. Discussion

In this Section, we will first address the results obtained in event construal analysis of text and metatext in the stimuli samples. Next, we will discuss the results of the eye tracking experiment.

Whereas event construal studies more often explore the effects of single event construal cues (Talmy, 2007; Verhagen, 2007; Iriskhanova, 2013; Langacker, 2015; Pascual, Oakley, 2017), we have shown that integrated protocol is far more potent in explaining the differences in text and metatext semantics. As shown in Figure 2, there is an obvious imbalance in the frequency of event cues in Referent, Event Frame and Perspective groups in author's and characters' intexts. In Referent group, we observed the differences

in recipient, object and abstract referent, which means that what counts is not only agentivity / non-agentivity which is most commonly explored in semantic studies (Talmy, 2007), but other referent types outlined in (Pustejovsky, 1995; Siewerska, 2004; Wårwik, 2004). However, this study extended the results obtained in referent construal semantics, since it specified the semantic effects in text and metatext. In Event Frame group we somewhat unexpectedly found that activity of visual / audial perception or mental activity and the action, state or activity of space location displayed distinction in text and metatext. The results show that these event cues may significantly modulate event construal in addition to other event cues typically explored in semantic studies, for instance, dynamic action in event construal (Divjak et al., 2020). Still, the most important results were obtained in perspective construal. Text and metatext have displayed significant difference in subjectivity, which proves the observations made in (Kubryakova, Petrova, 2010; Iriskhanova, 2013; Rzheshevskaya, 2014; Kiose, 2022), but also attests to the importance of this relatively less studied aspect of event construal (in contrast with referent and event frame construal) in cognitive semantics. Overall, the semantic analysis proved the specificity of metatext construal (Kubryakova, Aleksandrova, 2008); additionally, it manifested the efficiency of contrastive study of text vs metatext, which might pave the way for further semantic and experimental research.

While exploring the gaze behavior in four data sets, 1) reflective readers, author's intexts, 2) reflective readers, characters' intexts, 3) impulsive readers, author's intexts, 4) impulsive readers, characters' intexts, we observed multiple distinctions in the gaze metrics. Contrasting the gaze metrics affected by event construal in two types of intexts, we found 2 cases of First Fixation duration, 7 cases of Max Fixation duration modulated in the group of reflective participants. In the group of impulsive participants, there were 2

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cases of First Fixation duration, 2 cases of Max Fixation duration which produced significant distinctions in the tests. Therefore, reflectives appear to be more sensitive to event construal cues, which more commonly produce changes in Max and First Fixation duration. These results prove that the distinctions between impulsive and reflective readers appear not only in visual search tasks (Blinnikova & Izmalkova, 2017), but also in reading tasks. In terms of the gaze metrics which were modulated, the tests confirmed the effects described in (Rayner, 1998; Kliegl et al., 2004; Laurinavichyute et al., 2019), which reported First Fixation duration as affected; additionally, we showed that Max Fixation duration is also modulated by the reading patterns affected by metatext complexity. Still, no cases of Average Fixation duration as modulated by event cues were found.

Importantly, as opposed to prior results (Forster et al., 2014), impulsive readers had higher gaze costs. Presumably, this may be explained by the presence of metatext AOIs which produce specific reading patterns. The results also show that major distinctions were not observed in the gaze behavior of impulsive readers, but of the reflective ones. However, we expect that these distinctions are not attributed to the reading patterns on the whole, but to the patterns produced by specific event construal cues which we will contrast below. In Table 3 we present the event construal cues which produced significant distinctions in gaze behavior in two readers' groups. Guided by Kruskal-Wallis H-coefficients, we ranged the distinction values in each readers' group and in each of the intext type. In case two gaze metrics were affected by event construal cues, we listed only the metrics with the highest distinction coefficient.

Table 3. Event construal cues affecting gaze behavior of reflective and impulsive readers in two intext types (H-coefficients)
Таблица 3. Влияние параметров конструирования события на глазодвигательное поведение рефлективных и импульсивных читателей в двух типах интекста (Н-показатели)

	Reflective participants			Impulsive participants		
	Referent	Event type	Perspective	Referent	Event type	Perspective
Author's intexts	abstract referent (7.51)	dynamic action (8.48) state / non-dynamic action (5.12) action, state or activity of time location (4.06)	subjectivation (4.47)	abstract referent (4.74)	no	no
Characters' intexts	no	action, state or activity of space location (5.5) action, state or activity of time location (3.81)	subjectivation (5.02)	no	no	objectivation (4.1) subjectivation (3.77) intersubjectivation (3.65)

The results show that major distinctions both in the number of event construal cues and in their H-coefficients are observed in the gaze behavior of reflective readers.

Presumably, in reading tasks conditioned by metatextual complexity, the gaze behavior of reflective participants is better predicted by distinct event cues. As seen, highest H-

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coefficients are obtained in the gaze metrics mediated by dynamicity, which conforms to the prior experiment results received in (Velichkovsky et al., 2005; Papenmeier & Huff, 2010; Divjak et al., 2020). However, we found that dynamicity does not produce the same effects in author's and characters' intexts. On the contrary, this was the presence of abstract referent that produced higher gaze costs in author's intexts. If we address Figure 1, we may find that the presence of abstract referent in author's intexts is a significantly more frequent case in contrast with characters' intexts. However, if we consider the low salience of abstract referent (Siewerska, 2004; Wårwik, 2004; Iriskhanova, 2014), we may conclude that this is the case when low salience manifests low accessibility since it requires higher gaze costs. Importantly, this effect is observed with both the impulsive and the reflective readers.

Overall, these results confirm the observations made in (Rozencwajg & Corroyer, 2005; Nitzan-Tamar et al., 2016) which claim that although impulsive readers identify fewer details, they form holistic outlook on events, which is reflected in their eye movement patterns (Nitzan-Tamar et al., 2022). This implies that reflective readers construe events in detail, which was found in the current experiment. Additionally, the study allowed to identify single event construal cues which help impulsive readers to form a holistic view. These are Perspective cues, objectivation, subjectivation, and intersubjectivation in characters' intexts. Importantly, event frame construal did not produce significant distinctions. This observation alongside with the absence of event construal cues as producing stable gaze reactions in author's intexts (apart from abstract referent, most probably due to its lower salience) implies that impulsive readers are directed by occasional event construal cues in referent and event frame type; however, in more complex characters' intexts they are guided by perspective construal. It is noticeable that for reflective readers only subjectivation produced steady gaze effects,

which means that reflective readers are highly attracted by personalization.

Final remarks

In the study, we addressed text and metatext events as cognitive constructs which can be explored via event construal cues producing different gaze behavior effects. To identify these effects, we developed and tested the Text Event Construal protocol which integrates three types of semantic cues, Referent, Event Frame and Perspective. Featuring two types of intexts, author's intexts (manifesting metatext) and characters' intexts (manifesting text), we applied the method of indirect measurement to range the effects of event construal cues onto the gaze behavior. Additionally, we expected that the psychological factor of cognitive style might produce differences in gaze behavior, which was proved. Importantly, the results allowed to scale the effects of event construal cues in text and metatext for different groups of readers. Therefore, the study develops two distinct foci, cognitive semantic and cognitive psychological.

The results attest to the importance of event construal paradigm in experimental studies which explore text and discourse complexity. Most noticeably, perspective construal which in contrast to referent and event types construal is less explored, may bring forward new insights into how text information is construed as dependent on different psychological characteristics of readers. The present study specifies the differences produced by perspective cues as affected by cognitive style.

Overall, the Text Event Construal Protocol developed for MultiCORText and tested in the study proved its efficiency in exploring gaze behavior as mediated by text and metatext complexity and by the cognitive style of readers. We expect that it may be used alongside with other protocols developed for eye tracking studies. Therefore, the data provide new evidence in the cognitive semantic research of text and metatext via the methods and instruments of cognitive psychology.

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