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Mapping models in novel metaphors and their effect on gaze behavior and default interpretations in native and target languages

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Abstract

In the study, we address the problem of existing differences in reading and understanding novel metaphors in the text fragments in native and target languages (L1 and L2), with these differences potentially attributed to both the specifics of forming analogies in native and target languages, and the mapping characteristics of metaphors. The study identifies the contingency effects of several primary metaphors onto the gaze behavior and default interpretation of textual novel metaphors in L1 (Russian) and L2 (English). To proceed, we use the text fragments in L1 and L2 containing novel metaphors appearing in more and less focal syntactic positions in a two-stage oculographic experiment. We obtain the participants' gaze metrics values and the participants' responses specifying the target domains of the novel metaphors, which further allows us to disclose the contingencies. Methodologically, the study is grounded in the metaphor processing theories developed in cognitive psychology, which explore the structure of analogical reasoning and associative fluency as manifesting potentially different effects in L1 and L2. To validate it, we also address the cognitive linguistic theories which provide the framework for identifying the primary metaphor models (here the models PATIENT (OBJECT) IS AGENT, PARTS ARE WHOLE, CONCRETE IS ABSTRACT) and for testing their effect onto information construal. We hypothesize that reading and understanding metaphors will proceed differently in L1 and L2, which is attributed to associative fluency in metaphor mapping in native and target languages. The experiment results do not show the differences in understanding the mapping model PATIENT (OBJECT) IS AGENT in L1 and L2, whereas these differences appear in understanding the models PARTS ARE WHOLE and CONCRETE IS ABSTRACT with higher default interpretation index in L1. The model PATIENT (OBJECT) IS AGENT is also found to stimulate higher gaze costs. The results suffice to claim that there are differences in the cognitive costs produced by primary metaphor models, which allows us to range and specify their role in information construal in L1 and L2.

Keywords: *novel metaphor, metaphor mapping model, native language, target language, gaze behavior, default interpretation*

Модели окказиональных метафор и их влияние на глазодвигательное поведение и распознавание в родном и иностранном языках

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Аннотация

В исследовании решается проблема установления различий в восприятии и распознавании окказиональных метафор в тексте на родном и иностранном языках, обусловленных как особенностями ассоциативного мышления читателей, так и характеристиками самих метафор. Целью настоящей работы является определение влияния ряда базовых метафорических моделей на глазодвигательное поведение и распознавание текстовых окказиональных метафор в родном (русском) и иностранном (английском) языках. В качестве материала исследования используются фрагменты художественных текстов, содержащие окказиональные метафоры в разных синтаксических позициях; также материалом выступают характеристики глазодвигательного поведения читателей и ответы читателей, фиксирующие распознавание сфер-целей метафоры. Методологически исследование опирается на постулат о значимости когнитивного процесса установления аналогий (analogical reasoning) и его основной характеристики, скорости ассоциативного мышления, для чтения и распознавания метафор на родном и иностранном языках, а также на постулат о влиянии типов базовых метафорических моделей (СТАТИЧЕСКИЙ ОБЪЕКТ ЕСТЬ ДИНАМИЧЕСКИЙ ОБЪЕКТ, ЧАСТИ ЕСТЬ ЦЕЛОЕ, АБСТРАКТНОЕ ЕСТЬ КОНКРЕТНОЕ) на восприятие и понимание содержания прочитанного. Гипотеза исследования заключается в том, что восприятие и распознавание метафор будет демонстрировать определенные различия применительно к родному и иностранному языку, что обусловлено скоростью установления ассоциаций. Результаты проведенного окулографического эксперимента показали отсутствие различий в успешности распознавания модели СТАТИЧЕСКИЙ ОБЪЕКТ ЕСТЬ ДИНАМИЧЕСКИЙ ОБЪЕКТ, в то время как успешность распознавания моделей ЧАСТИ ЕСТЬ ЦЕЛОЕ, АБСТРАКТНОЕ ЕСТЬ КОНКРЕТНОЕ выше в родном языке. Также установлено, что модель СТАТИЧЕСКИЙ ОБЪЕКТ ЕСТЬ ДИНАМИЧЕСКИЙ ОБЪЕКТ стимулирует увеличение продолжительности глазодвигательных реакций. Полученные результаты свидетельствуют о ранжированной значимости базовых метафорических моделей для восприятия и понимания, что позволяет уточнить их роль в процессах конструирования информации на родном и иностранном языках.

Ключевые слова: *окказиональная метафора, метафорическая модель, родной язык, изучаемый язык, глазодвигательное поведение, распознавание*

1. Introduction

One of the central themes in cognitive linguistics has been the notion of metaphoric construal and metaphor mapping modeling. In this study, we will explore the process of novel metaphor interpretation and reading in L1 and L2 as influenced by the mapping models and the syntactic position of metaphors, more and less focal. There is sufficient experimental evidence on the effects of the readers' language awareness appearing in analogical reasoning and associative fluency which they produce onto metaphor comprehension and gaze behavior in reading. Meanwhile, little is known about how different metaphor models modulate these processes. The studies have revealed significant differences in metaphor processing depending on the metaphor input domains and their elements, such as agentivity or dynamicity, abstractness, and singularity; however, they do not pertain to elicit the systemic effects.

One of the possible solutions to the problem of identifying the differences in novel metaphor processing is to consider how different metaphor mapping models affect comprehension and gaze behavior in reading during the oculographic experiment with incorporated comprehension checks. In this study, we design the experiment with L1 and L2 participants who have to read and comment on the use of novel metaphors manifesting several most potentially determinal primary mapping models. Therefore, we address two frameworks exploring metaphor – cognitive psychology and cognitive linguistics. To reveal the contrastive status of different mapping models, we explore the instrumental data on the gaze costs and multiple test responses provided by the L1 and L2 participants.

The contributions of this study include: (i) developing the procedure of novel metaphor identification within cognitive linguistic framework; (ii) revealing the effects of mapping models and metaphor syntactic position onto comprehension and gaze behavior of novel metaphors in L1 and L2; (iii) identifying the differences in L1 and L2 comprehension of novel metaphors and gaze behavior as modulated by analogical reasoning and associative fluency of the participants.

2. Theoretical prerequisites

2.1. Analogical reasoning and associative fluency in L1 and L2 in novel metaphor processing

Metaphor construal which is thinking or speaking of one domain of knowledge in terms of another domain is pervasive in human cognition and communication. It redistributes the attention of the speaker in a specific way and redirects the attention towards certain aspects of the scene or situation by means of metaphoric mapping. Most commonly, to describe the process of metaphoric mapping, the terms

'metaphoric source domain' and 'target (base) domain' are exploited (Lakoff & Turner 1989, Gentner 2008, Grady 2007). For instance in the model DEATH IS A REAPER, REAPER manifests the source domain projected onto the target domain DEATH. Following Lakoff and Turner (1989), the metaphoric models are further decomposed into elements (the components of the mapping process); in their example the metaphor DEATH IS A REAPER can be decomposed into a lower-level mapping PEOPLE ARE PLANTS TO BE HARVESTED, and the metaphor LIFE IS A JOURNEY can be further decomposed into DIFFICULTIES ARE OBSTACLES and OBJECTIVES ARE DESTINATIONS.

The novel metaphors which become the object of this study can also be explored in terms of lower and higher-level mappings. In *My wife is a real beauty, her waist is a genuine hourglass* (COCA) we observe the contextual adjustment of the metaphoric source domain WHOLE (OBJECT) expressed in *hourglass* projected or mapped onto the target domain (BODY) PART expressed in *waist*. This mapping manifests a higher-level mapping PARTS ARE WHOLE which is one of the primary metaphors or the metaphors which are basic for conceptualizing the world.

Until recently, metaphor processing was mostly explored in terms of individual differences caused by the differences in analogical reasoning in cognitive psychology. According to Holyoak (1984), analogical reasoning contributes to contextual processing and involves the observation of partial similarities between domains so that the characteristics of one of the domains can be used to shed light on the other. This process can be decomposed into the sub-processes of accessing the metaphor source domain, followed by performing the mapping between the source and the target domain, evaluating the match, storing inferences in the target and extracting the commonalities (Gentner 1983: 234). Importantly, this process is activated in case we construe novel metaphors; whereas entrenched metaphors are processed by category selection or category inclusion (Gentner & Bowdler 2008) which is a less demanding (in terms of cognitive effort required) cognitive task. According to Schmid (2016) and Langacker (2016), novel metaphors exploit the models (in their terms, image-schemas) which have not been earlier activated; therefore, higher efforts to process them are caused by the necessity to activate new mapping models.

Meanwhile, later studies have addressed the problem of differences in novel metaphor procession mediated by language proficiency. Experimental studies report that accessing the metaphor source domain with higher default interpretations (better recognition) is contingent on higher language proficiency. For instance, Heredia and Garci (2017) have shown that bilingual speakers activate metaphoric meanings of language which could be interpreted either literally or metaphorically faster than the bilinguals with one dominant language. They account for the differences in encoding and retrieval in bilingual episodic memory which cause it; still between-language conditions and within-language conditions (as they term them) employ comparable mechanisms. Apart from the differences in default

interpretations in bilinguals and monolinguals, the studies also consider the differences in the speed of metaphor processing; they show that there is a delay in metaphor processing in L2. These results are often attributed to associative fluency which is the ability to make a wide range of connections when presented with a given stimulus (Guilford 1967, Carroll 1993). Since metaphor processing is the construal of the 'semic webs' or the networks of associations surrounding the target domain, associative fluency affects the speed to construe the mappings. Holyoak & Stamenković (2020) claim that analogical reasoning in metaphor processing is mediated by the associative fluency of the participants, which means that these two processes are somehow interrelated. To explain it, the studies (Boers & Lindstromberg 2012, Siyanova-Chanturia et al. 2011) suggest that in L1 metaphorical meanings are accessed directly without accessing the literal meanings first, which does not happen in L2. Associative fluency is lower in L2 with L1 being the dominant language; therefore, metaphor procession will take longer (Pollio & Smith 1980, Littlemore 2002, Littlemore et al. 2011). Overall, both the differences in default interpretations and procession time in L1 and L2 are expected, since interpretations will be mediated by analogical reasoning and associative fluency.

2.2. Language construal and linguistic foregrounding as affecting metaphor processing in L1 and L2

While the psychology studies confirm that analogical reasoning and associative fluency both contribute to novel metaphor processing in L1 and L2, cognitive linguistics studies also claim that different metaphors types like other construal phenomena reflect the speaker's or the reader's conceptualization of the scene, which may demand higher or lower cognitive effort. For instance, Kaushanskaya & Rechtzigel (2012) report that the words manifesting lower degree of abstractness and higher degree of concreteness are better recalled (and consequently processed). In Ashby et al. (2018) it is shown that there are differences in metaphor processing which are attributed to the syntactic position of a metaphor, either syntactically foregrounded or not. Therefore, there may be specific features of both language construal (here – the referent type) and linguistic foregrounding (here – syntactic foregrounding of the referent) which will contribute to novel metaphor processing irrespective of the language proficiency of the speaker (reader). This also means that irrespective of L1 or L2, several types of metaphors might be processed with higher or lower cognitive effort.

Linguistic foregrounding has been mostly explored in terms of the salience (or corpus frequency) effects onto on metaphor processing and comprehension. According to the Graded Salience and the Defaultness Hypotheses developed in Giora (2003) and Giora, Givoni & Fein (2015), higher corpus frequency of a metaphoric lexeme stimulates its better recognition in a new context. Importantly, it accounts for both entrenched metaphor recognition and for the recognition of novel metaphors exploiting the lexemes with higher corpus frequency. In Giora's view (Giora 2003), metaphoric meanings are more accessible if they are influenced

by word frequency, familiarity, conventionality, and prototypicality or stereotypicality. Apart from the corpus frequency which contributes to linguistic foregrounding of a metaphor in context (as well as linguistic foregrounding of other lexical units (Laposhina et al. 2022)), the studies also address syntactic foregrounding as potentially significant for metaphoric mapping processing and metaphoric meaning elicitation. In Ashby et al. (2018), metaphor processing is shown as highly dependent on the syntactic position of a metaphor, both novel and entrenched. However, in our prior study (Kiose 2020) we did not reveal the straightforward effect of syntactic foregrounding on both novel and entrenched metaphor processing, which means that both metaphor frequency and syntactic foregrounding account for it.

Language construal as opposed to linguistic foregrounding is a more challenging area since it invokes the changes in how a scene or a situation is construed (perceived and conceived) across a cline of language constructions. We have already reported the results of an experimental study (Kaushanskaya & Rechtzigel 2012) validating the prominent role of concreteness and abstractness of a referent in construal. Additionally, there are studies which specify the effects of language construal on language processing; most commonly they explore the effects of agentivity (Altmann et al. 1992, Papafragou et al. 2008, Flecken et al. 2015), degree of detail in referent construal (Noë & O'Regan 2001), dynamicity in construal shifts (Chen 2014, Chen & Epps 2019, Divjak et al. 2020); however, they do not pertain to elicit the systemic effects. Still, these construal features manifested in metaphor mapping domains are seldom experimentally tested in metaphor processing; the obvious reason for it being that in natural language the mapping domains of metaphors may foreground several of these features.

However, presumably, if we address the language construal as the promoter of various cues representing the scene or the situation, we still may investigate the effect that different cues or language construal elements have on metaphor default interpretation and processing. The aim of this study is to explore this effect across several types of alternations: 1) referent agentivity, 2) referent number, 3) referent abstractness. These three alternations were chosen because they represent a cline with respect to the extent to which referent accessibility may be scaled and consequently its prominence may be explored in the source and target domains in metaphor mapping models. Moreover, each alternation can be used either in the source or target domain or in both domains of the primary metaphors. These alternations (although not applicable to metaphor source and target domains) were scaled with regard to prominence effects in text comprehension in Siewerska (2004). She scales the referent prominence effects in terms of its agentivity in speaker > addressee > non-participant, its referent type in high physical salience > low physical salience, human > animate > non-animate. This accessibility scale was further modulated in Iriskhanova (2014), where (among other multiple prominence or focusing cues) the author enlists the referent number and scales singular referents as more prominent

than two or multiple ones. The accessibility of abstract and concrete referents is also corpus-verified in Solovyev (2022a).

For instance, in *Когда-то годы и города подполья, ссылки войны бросали ему навстречу сотни редкостно прекрасных людей, и это море окружало его и давало силы жить* (A long time ago the years and the towns of hiding from the war people and the sings of war threw onto him hundreds of wonderfully good people, and this sea surrounded him and supported his stamina) (RNC) we observe the metaphor mapping of a lower level MANY PEOPLE ARE MOVING WATERS. Its source domain present in *the sea* denotes the referent of an abstract non-animated type (sea); whereas its target domain present in *people* denotes the multiple referents of an animated type. Importantly, mapping is further elaborated in *окружало его и давало силы жить* (surrounded him and supported his stamina), where the referent animateness is mapped onto the non-animate sea and stimulates its agentivity; therefore, the sea now represents the target domain, and the people represent the source domain. This mapping model relates to a higher-level primary model PARTS ARE WHOLE. The example allows to claim that identifying the direction of mapping in a context with metaphor in non-finite sentence position is a challenging task; for this reason, only the metaphor mapping model will be considered. In the example above, we will identify it as 1) agentivity – non-agentivity, 2) multiple referents (parts) – single (whole) referent, 3) concreteness – abstractness. Therefore, three primary mapping models will be tested as potentially affecting the comprehension and the gaze behavior, PATIENT (OBJECT) IS AGENT, PARTS ARE WHOLE, CONCRETE IS ABSTRACT.

Meanwhile, we also observe that the syntactic position of the metaphor *sea* in the example given above is not a foregrounded one – it is a subject position which is followed by a syntactically foregrounded predicate *surrounded him and supported his stamina*. It is probable that this allows to redirect the attention intendedly to the animated "actions" of the sea which are *surrounding and supporting*. Considering this observation, we will explore referent agentivity, referent number, referent type in three types of language construal in metaphor mapping domains as mediated by syntactic foregrounding with the metaphor in non-focal subject or object position or focal predicate position. To test the effects of these alternations on default interpretations and gaze behavior in L1 and L2, we design an oculographic experiment followed by the participants' reports in identifying the target domain of metaphors.

3. This study: Methods and Procedure

In the eye tracking experiment, fourteen participants (age range = 19–28) who had C1 level of English language proficiency, all native speakers of Russian, had to read a series of text fragments containing metaphors. The metaphors manifested the mapping models with the alternations in 1) referent agentivity, 2) referent number, 3) referent type appearing in non-focal subject or object position or focal predicate position.

Each of the fourteen participants was subjected to the sentences in two stimuli, one with 8 sentences in Russian (L1), the other containing 8 sentences in English (L2). All the sentences were manually selected from modern fiction (from the National Corpus of the Russian Language and the Corpus of Contemporary American English). To identify the novelty of metaphoric model, we applied the following procedure which modifies MIP VU procedure of metaphor identification (Steen et al. 2010), since the latter did not aim at specifying novel metaphors:

Step 1. If the noun was used figuratively, we addressed the dictionary to determine its definitions.

Step 2. If the meaning of the target domain of the lower-level mapping model was found out within the semantics of noun definitions, even if it was marked as figurative, we did not consider this word as a novel metaphor and further addressed only the examples with the metaphors whose target domain meanings were not registered in the dictionary.

Step 3. If the metaphor did not display the target meaning registered in the dictionary, we initiated a new corpus search with this noun as a target word and identified the meanings (here – of its first 100 uses, considering the first use of the target word on the search page and the first author's use).

Step 4. If we found out the corpus uses of the noun exploiting the same meaning in the target domain as in the sentence under consideration, we regarded the metaphor as entrenched.

Step 5. If the metaphor was entrenched in terms of its dictionary or corpus use, still there was a clear disanalogy in the mapping model in the text fragment, we finally considered the metaphor as novel.

As an example, we will consider the fragment *Зимняя дорога. Ровная, твердая, гладкая: белый фарфор* (Winter road. Even, hard, smooth: white china) (RNC). In the fragment, the noun *фарфор* is used figuratively, meaning 'the smooth white road'. In RLD we find two meanings of the word *фарфор*: 1) the clay mass used to make dishes, 2) the dishes made of this mass; therefore, neither of these two meanings bears reference to the target domain of the lower-level metaphor model ROAD IS CHINA. RNC search revealed 1 190 documents and 2 167 samples of its use (on 119 search pages); applying the procedure described above we identified the reference of *фарфор* in the first sample of each page. We did not reveal any more meanings except the ones given in the dictionary; still, the first meaning was in several cases extended to identify not dishes but other objects made of china, for instance a 'frame' in *Карточка матери на фарфоре сильно поблёкла, но черты лица хорошо различались*, or 'teeth' in *Ну оставайтесь! – подмигнул хозяин, сверкнув фарфором* (RNC). The lexeme was several times used metonymically meaning 'the place where china is produced' like in *Чехонин – один из первых создателей «агитационного фарфора», художественный руководитель Государственного фарфорового завода в Ленинграде* (RNC). This allows to conclude that the lexeme *фарфор* is not used to refer to the domains ROAD or WAY; therefore, the metaphor mapping of the source domain CHINA

onto the target domain ROAD is not an entrenched one and the metaphor is novel. It manifests a higher-level metaphor mapping model CONCRETE IS ABSTRACT.

One more example may serve to demonstrate an entrenched metaphor: *Он умел улыбаться, и, когда улыбался, то это был ангел, втирался в доверие к людям и потом их обманывал* (He could smile well and when he did it, he was an angel, he made people trust him and then deceived them). In the fragment, the noun *ангел* is also used metaphorically, meaning 'having mild and meek looks'. This meaning is the second one in RLD ('referring to a person as an embodiment of innocence and mildness') where it is ascribed as metaphorical. Supposedly, while being a metaphor (Steen et al. 2010), this metaphor does not seem to be novel. However, following Step 5, in the fragment we observe the disanalogy between the source and target domains of the metaphor (Gentner 1983, Fauconnier 2001), since the man under consideration displays the behavior not appropriate to a person who is an embodiment of innocence and mildness. Consequently, this metaphor is novel, it manifests a higher-level metaphor model PATIENT (OBJECT) IS AGENT.

In the experiment, the participants read the text fragments in L1 stimulus and did the recognition task (a multiple choice consisting of three options), next, they proceeded with L2 stimulus. The recognition task was to identify the correct referent in each fragment and to give a default answer aloud. The eye movements were recorded with SMI Red-x eye tracker working at the sampling rate of 60 Hz. The data were then analyzed with SMI BeGaze software (version 3.0). Before recording, a 4-point calibration was performed for each participant, followed by verification of calibration accuracy – subjects were asked to look at the same points again. Every participant sat at a distance of 60–80 cm from the camera and was instructed not to move their head within 10 cm from the initial position.

The data on default interpretation and on gaze behavior (average dwell time, first fixation duration, and revisits) which are considered as the most reliable metrics of gaze costs (Rayner 1998, Holmqvist et al. 2011) were then subjected to contingency tests to identify the correlations between the mapping models AGENT IS PATIENT (OBJECT), PARTS ARE WHOLE, CONCRETE IS ABSTRACT and gaze behavior, additionally modulated by the non-focal subject or object position or focal predicate position of the novel metaphor.

4. Results and Discussion

4.1. Metaphor mapping models

In each stimulus, the first fragment (L1.1 and L2.1) was a filler. In L1 stimulus L1.1. was *И оказывалось, что каждое дерево, каждый куст и даже самый маленький цветок имеют свое имя и историю* (And it happened so that every tree, every bush and even the smallest flower had their name and their history) where no metaphor is included. In L2 stimulus L2.1 did not contain a metaphor either, in *Her face was like a little screwed-up ball of brown paper which became smaller and smaller*. We used the bold type to identify the nominal groups, *самый*

маленький цветок in L1 and *little screwed-up ball of brown paper* in L2. In both cases after reading the sentence, the experiment participants had to choose between the three options (a multiple-choice task) – for L1.1 they were a) цветок (flower), b) человек (man), c) нет ответа (don't know); for L2.1 they were a) face, b) paper, c) don't know. While making their option, the participants were to provide (aloud) an answer on which option suits better to refer to the nominal group in the bold type. This first fragment served to tune in the participants to the experiment procedure.

Each fragment was annotated as 1) manifesting non-focal subject or object position or focal predicate position, 2) manifesting one or more novel metaphor mapping models, AGENT IS PATIENT (OBJECT), PARTS ARE WHOLE, CONCRETE IS ABSTRACT in either of their directions.

In both stimuli the fragments 2, 5, and 6 manifested the use of the nominal groups appearing in non-focal subject or object position. In L1 these were L1.2 *На другой стороне площади появилось много новых развязок и эстакад, и это бетонное кольцо грозило охватить весь город* (On the other side of the square there appeared a lot of new motorways and overpasses, and this concrete ring threatened to conquer the whole city), where the nominal group *это бетонное кольцо* (this concrete ring) is a novel metaphor used for the roads or motorways. This fragment manifests the mappings PATIENT (OBJECT) (in the motorways) IS AGENT (the ring going to conquer) and PARTS ARE WHOLE. L1.5 *Новиков пошел по железнодорожным путям, боясь, что эшелон уже ушел. Как оказалось, эта игла мешала ему сосредоточиться на мыслях о предстоящем бое* (Novikov was following the railway track frightened that the train had left. As it was, this needle did not allow him to think of the forthcoming battle), where the nominal group *эта игла* (this needle) is a novel metaphor used for the frightening idea. This fragment manifests the mapping ABSTRACT (in the idea) IS CONCRETE (the needle). L1.6 *Когда-то годы и города подполья, ссылки войны бросали ему навстречу сотни редкостно прекрасных людей, и это море окружало его и давало силы жить* (the translation was provided earlier), where the nominal group *это море* (this sea) is a metaphor used for the people. This fragment manifests the three mappings PATIENT (OBJECT) IS AGENT (the sea giving life), PARTS ARE WHOLE, CONCRETE IS ABSTRACT.

In L2 in L2.2 *This was a new emotion, and this intense wave swept over her and her eyes filled with tears*, the nominal group *this intense wave* refers to a new emotion. Although the noun *wave* manifests the corpus uses where it bears reference to emotions, in all cases it is used as part of nominal phrase like *a wave of happiness* or *waves of joy* or within the elliptical nominal groups like [happiness] *coming in waves*; therefore, in these cases it is used metonymically. In L2.2 *this intense wave* is not used metonymically, here emotion is shown as resembling a wave, projecting a mapping model FEELING IS POWER. In this fragment we observe the mapping PATIENT (OBJECT) IS AGENT (the wave sweeping). In L2.5 *She came from a well-to-do family but never married. And naturally, the*

hunters started gathering at once, the nominal group *the hunters* is used for a men eager to marry a girl. In this fragment, there is the mapping PATIENT (OBJECT) IS AGENT (the men hunting for wives). In L2.6 *The water was clear and faintly blue; and this transparency touched the lip and the throat and the heart, if drunk*, the nominal group *this transparency* is used metaphorically meaning 'water'. This fragment manifests the mappings PATIENT (OBJECT) IS AGENT (the water touching), and CONCRETE IS ABSTRACT, where concreteness of a referent (not of a noun) water is mapped onto its feature (transparency).

In both L1 and L2, the nominal group appeared in focal predicate position in the fragments 4, 7, and 8. In L1.4 *Вот это застывшее лицо он сильно старался забыть, потому что память – это настоящая сеть, которую не следует чересчур напрягать, чтобы удерживать тяжелые грузы* (This was the face with a frozen look that he tried to forget, since the memory is a real net that should not be pulled too strong to keep a heavy load), the metaphor *настоящая сеть* (a real net) relates to memory. This fragment manifests the mapping ABSTRACT (memory) IS CONCRETE (a net). In L1.7 *Зимняя дорога. Ровная, твердая, гладкая: белый фарфор* (the translation was provided earlier), where *белый фарфор* (white china) refers to the winter road. In this fragment we identify the same mapping ABSTRACT IS CONCRETE. In L1.8 *Он умел улыбаться, и, когда улыбался, то это был ангел, втирался в доверие к людям и потом их обманывал* (the translation was provided earlier), the metaphor based on the disanalogy *ангел* (angel) refers to a deceptive man. Here, the mapping is PATIENT (OBJECT) IS AGENT.

In L2 in L2.4 *My wife is a real beauty, her waist is a genuine hourglass, so charming and fascinating*, the nominal group *a genuine hourglass* refers to the woman's waist. Here, we observe the mapping PARTS ARE WHOLE, since the source domain projects the whole referent, the whole body of the woman, not only her waist. In L2.7 *Montag heard the voices talking, talking, talking, giving, talking, weaving, reweaving: the hypnotic web*, the group *the hypnotic web* is used meaning 'the voices'. In this fragment the mappings AGENT IS PATIENT (OBJECT) and PARTS (the single voices) ARE WHOLE are activated. In L2.8 *The time left was running out, for him it was life floating before the eyes*, the metaphor life means 'the time left'. Here, we identify the mapping WHOLE ARE PARTS, since time is shown as manifesting distinct borders (can run out), and life which is floating can only be the sequence of events or objects.

In each case, three options (as a multiple task) were offered to the participants, with 'don't know' always being the third option, and one of the two first options correctly identifying the referent representing the target domain.

Fragment 3 was a filler where the metaphor given in bold type had two counterparts in the pre-position, with the first one (a direct name) being the antecedent of the metaphor, and the second one being the same nominal group used as a simile in the predicate position. In L1.3 *Все эти клиенты были для нее словно папки, такие же безликие. Сегодня он вновь расспрашивал ее по поводу той*

папки, которая приходила на прошлой неделе (All these clients were like files for her, having no identity. Today he was again inquiring after the file which had appeared the week before), the name *папки* (files) is used as a simile in *клиенты были для нее словно папки*, and as a metaphor in *расспрашивал ее по поводу той папки* (in this case it was given in bold); however, its second use cannot be considered as the use of a novel metaphor, since this is a repeated use of the mapping model (see Step 3 of the procedure of novel metaphor identification). Despite the fact that the metaphor was not a novel one and its default interpretation was not assessed (similarly to L1.1 and L2.1), the three options a) документ (document), b) клиент (client), c) нет ответа (don't know) were offered after the fragment where the second option was the only suitable one. In L2.3 we introduced a similar (regarding the metaphor use) fragment *He wore his happiness like a mask and the girl had run off across the lawn with the mask and there was no way of going to knock on her door and ask for it back*. In this fragment, the name mask in *the girl had run off across the lawn with the mask* given in bold type is an entrenched metaphor, as this is its second use activating the domain FEELING after the simile in *He wore his happiness like a mask*. Three options were also offered in this case, with a) mask, b) happiness, c) don't know; and the second option was again the suitable one.

In Table 1 we show the distribution of mapping models present in both stimuli, with S/O and P we additionally indicate the non-focal subject or object position or focal predicate position.

Table 1. **Metaphor mapping models in the stimuli**

L1 Stimulus				L2 Stimulus			
Fragments	**AGENT IS PATIENT**	**PARTS ARE WHOLE**	**CONCRETE IS ABSTRACT**	**Fragments**	**AGENT IS PATIENT**	**PARTS ARE WHOLE**	**CONCRETE IS ABSTRACT**
L1.1	not attested	not attested	not attested	L2.1	not attested	not attested	not attested
L1.2 – S/O	1	1	0	L2.2 – S/O	1	0	0
L1.3	not attested	not attested	not attested	L2.3	not attested	not attested	not attested
L1.4 – P	0	0	1	L2.4 – P	0	1	0
L1.5 – S/O	0	0	1	L2.5 – S/O	1	0	0
L1.6 – S/O	1	1	1	L2.6 – S/O	1	0	1
L1.7 – P	0	0	1	L2.7 – P	1	1	0
L1.8 – P	1	0	0	L2.8 – P	0	1	0

The fragments L1.1, L2.1, L1.3, and L2.3 were fillers (see above), for this reason we did not consider either their mapping models or gaze behavior and default interpretations. In the next sections, we will present the contingency results of the tests with three mapping models and two syntactic positions of novel metaphors as potentially affecting the average dwell time, first fixation duration, and default interpretations in L1 and L2.

4.2. Default interpretations

First, we contrast the overall number of correctly identified referents representing the target domain of the lower-level mapping model in the stimuli in L1 and L2. These amounted to 82 in L1 and 81 in L2, which means that the results are similar and do not give evidence of better performance in metaphor interpretation in L1. However, this may refer to interpretation in general and not to single metaphorical models. Therefore, next we address the mapping models default interpretations which we assess applying the Index of Default Interpretation (IDI) which is the ratio of correct answers (correct identification of the target domain or the referent representing the target domain of the lower-level model) to the number of participants of the experiment. In L1 the higher-level mapping model AGENT IS PATIENT appeared in L1.2, L1.6, L.1.8, the reference was correctly identified in 30 cases out of 42 total number of responses, which means that IDI is equal to 0.714. The mapping model PARTS ARE WHOLE appeared in L1.2 and L1.6, here the reference was identified in 22 out of 28 cases. The mapping model CONCRETE IS ABSTRACT appeared in L1.4, L1.5, L1.6, and L1.7; the reference was correctly identified in 40 cases out of 56. In L2 the mapping model AGENT IS PATIENT appeared in L2.2, L2.5, L2.6, and L2.7; the reference was correctly identified in 40 cases out of 56. The mapping model PARTS ARE WHOLE appeared in L2.4, L2.7, L.2.8; the reference was correctly identified in 25 cases out of 42. The mapping model CONCRETE IS ABSTRACT appeared in L2.6; the reference was correctly identified in 8 cases out of 14. In Figure 1 we present the contrastive values of IDIs in L1 and L2.
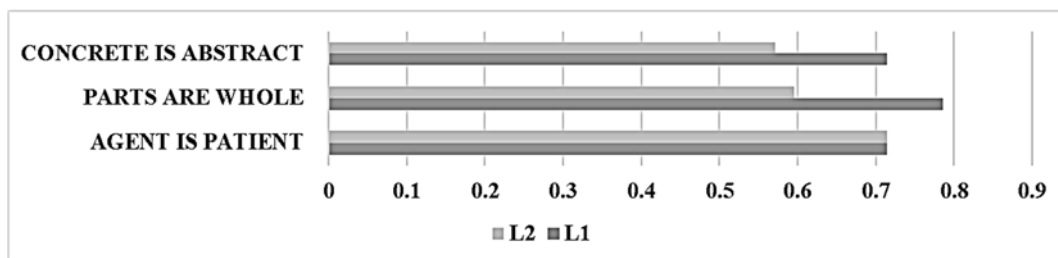

Fig. 1. Mapping models and their Indexes of Default Interpretation in L1 and L2

Although these differences are not statistically significant (the Chi-square tests do not reveal significant differences due to the small number of samples), we can still observe that metaphor models are processed with higher IDI in L1, it mostly relates to the mapping models PARTS ARE WHOLE and CONCRETE IS ABSTRACT. Presumably, these types of mappings manifesting specific ways of analogical reasoning (Gentner 1983, Holyoak 1984) require more cognitive effort. Therefore, the obtained differences extend the prior results shown in corpus and experimental studies (Siewerska 2004, Iriskhanova 2014, Solovyev 2022a, 2022b) in the way that they allow to scale the mapping models as more and less accessible in L1 and L2 in terms of their recognition.

The third question is whether these differences may be attributed to the syntactic position of metaphors. In L1 IDI of the metaphors in non-focal subject or object position is 0.786, whereas in focal predicate position it is lower and is equal to 0.643. This result is highly expected since when novel metaphors appeared in the subject position, the type of domain they represented was already identified due to the context in the pre-position. Meanwhile, in L2 the situation was different, that is we did not reveal any difference in default interpretations in non-focal and focal positions of metaphors (0.732 and 0.762). This may mean that even in the cases of their subject use, the novel metaphors in L2 required the domain identification; presumably this occurred as a result of a typologically different syntactic structure of the sentences, however this hypothesis must be tested on larger data.

4.3. Gaze behavior

Next, we proceed to the analysis of gaze behavior with L1 and L2 participants. Since we expected to find that associative fluency might affect the reading speed of the fragments with novel metaphors in L1 and L2, we considered the gaze metrics of average dwell time, also of first fixation duration and the number of revisits. In the oculographic studies where the experiment participants' gaze behavior was attested, these metrics are assessed in the areas of interest (also named interest areas, zones of interest) (Rayner et al. 1983, Holmqvist et al. 2011); importantly, they allow us to observe both individual differences and also the differences attributed to construal and linguistic, for instance, syntactic focusing effects (Staub 2015). Gaze behavior is also applied to validate the cognitive costs in reading (Toldova et al. 2022). The increase in gaze metrics values suffices to claim that higher attention is being paid to read and consequently to construe the information that is located with this area of interest (AOI), which means that gaze behavior may serve to identify the gaze costs and the cognitive costs spent on metaphor models construal in each particular case.

Since there were several cases when participants did not directly fixate on this or that AOI, we did not contrast the total dwell time in AOI in L1 and L2; the duration of the first fixation seemed more relevant. In L1 it amounted to 156.15 ms, while in L2 it was higher and amounted to 170.15, which means that when presented with a novel metaphor L2 readers faced higher gaze costs to process a metaphor switch. Meanwhile, the number of revisits was the same in L1 and L2, and was in both cases equal to 189 for all the participants.

Since major differences were observed in the first fixation duration in L1 and L2, in Figure 2 we present the diagrams which show this variance.

As we indicated earlier, the mean value of first fixation duration is higher in L2, however the median is higher in L1 and the variance is smaller in L1 as well. This means that gaze behavior in L1 manifests higher uniformity than in L2, which may also be a specific feature of novel metaphors reading in L1 and L2.
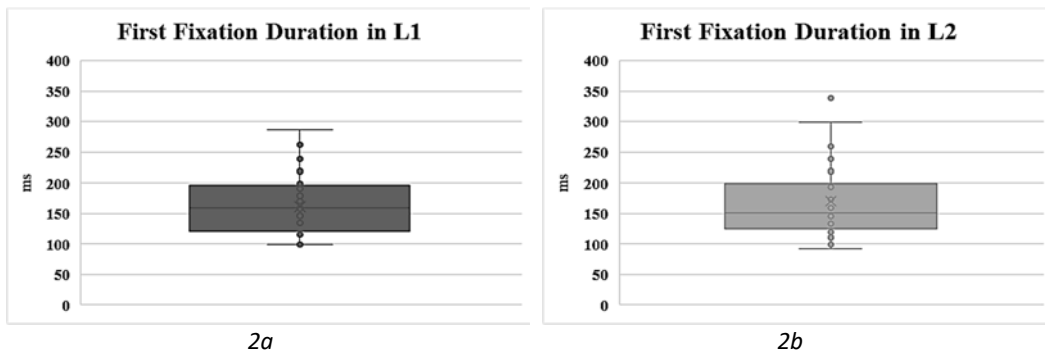
Fig. 2. First fixation duration in L1 (*a*) and L2 (*b*)

The question also was whether any of the three mapping models, AGENT IS PATIENT, PARTS ARE WHOLE, CONCRETE IS ABSTRACT, may produce steady effects onto the gaze behavior increasing the gaze costs in terms of average dwell time, first fixations duration, and revisits, and whether these effects display difference in L1 and L2. To find it out, we conducted a series of regression tests. The results show that in L1 average fixation duration increases when the participants encounter the model AGENT IS PATIENT (E = 68.7 at p = 0.054) and decreases when they encounter the model PARTS ARE WHOLE (E = –57.57 at p=0.054), while the model CONCRETE IS ABSTRACT does not produce the steady gaze costs. In terms of average fixation duration, we did not reveal any constant dependencies. With revisits, however, we observed their steady decrease with the model CONCRETE IS ABSTRACT (E = –1.96 at p = 0.053). The results prove that there is an overall increase of gaze costs contingent on AGENT IS PATIENT model. This does not mean that this model is more difficult to be interpreted, otherwise we would have revealed it during the IDI analysis. Presumably, agentivity is the construal characteristics which is more costly in terms of gaze behavior. These results attest to the results received in (Altman et al. 1992, Papafragou et al. 2008, Flecken et al. 2015), where it was found that agentivity and also dynamicity (Chen 2014, Chen & Epps 2019, Divjak et al. 2020) in construal were more demanding. The regression analysis did not reveal the steady effect of syntactic position onto the gaze behavior, which considered together with the results obtained in IDI mean that syntactic position does not influence directly either novel metaphor interpretation or reading behavior in L1. Therefore, in L1 we did not observe the effects reported in Ashby et al. (2018), who showed that metaphor processing was highly dependent on the syntactic position of a metaphor.

Still, the question is whether the same situation is true of L2. The only statistically significant dependency was observed in the effect of the mapping model AGENT IS PATIENT onto the first fixation duration (E = 51.35 at p = 0.038). Other mapping models as well as the syntactic position of the metaphor did not produce the steady effects onto the gaze behavior. This means that higher gaze costs were in both cases, in L1 and in L2, produced by the mapping model of the same type. The results not only prove that agentivity and dynamicity construal is crucial

in affecting the reading time (Flecken et al. 2015), but also in affecting the reading time of both L1 and L2.

Importantly, other mapping models which were found as affecting the gaze costs in prior research, with CONCRETE IS ABSTRACT (Kaushanskaya & Rechtzigel 2012) or the models demonstrating different degree of detail in referent construal (Noë & O'Regan 2001), here present in PARTS ARE WHOLE, did not produce any significant difference in L2. Meanwhile, we observed statistical evidence of their effect in L1. These results show that gaze behavior in L1 is better predictable than in L2; higher variance in gaze behavior in L2 may be the result of individual differences in associative fluency in L2, still we cannot claim that it is significantly lower than in L1. Probably, good L2 awareness (these were C1 students) contributed to their good fluency performance in the experiment. Therefore, with adult learners, almost proficient in L2, we do not observe the effects described in Littlemore (2002), Littlemore et al. (2011) who claim that associative fluency is lower in L2 and metaphor procession takes longer. What we did observe is higher irregularity in gaze behavior in L2.

5. Final remarks

The study has shown that mapping models can be a reliable instrument of exploring the way novel metaphors are interpreted and read in L1 and L2. We addressed the most common mapping models which are AGENT IS PATIENT (OBJECT), PARTS ARE WHOLE, CONCRETE IS ABSTRACT and which have already been experimentally attested as producing either higher gaze costs or lower default interpretation index. We found that these models are interpreted differently in L1 and L2, for instance metaphor models are processed with higher IDI in L1 and it mostly relates to the mapping models PARTS ARE WHOLE and CONCRETE IS ABSTRACT. Syntactic position, whether more or less focal also plays a different role in default interpretation. In L1 IDI of the metaphors in non-focal subject or object position is higher than in focal predicate position; whereas no similar differences occur in L2. We hypothesized that the reason for it may be the necessity to adapt to the typologically different structure of L2, and instead of lowering their gaze costs in non-focal subject position the participants were still on the alert. What concerns the gaze data, we observed higher uniformity and consequently higher predictability in fixation duration in L1. We also found that all metaphoric models modulate the gaze behavior in L1, whereas in L2 this was only the model AGENT IS PATIENT (OBJECT) which stimulated the increase in the gaze costs. This brings forward the idea of ranging the metaphor models as potentially more and less costly both in terms of default interpretation and gaze behavior. With the metaphor models serving an instrument to assess individual variation as well as learner skills, we may receive a reliable metrics applicable in prognostic modelling and creativity studies.

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