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METAPHOR FEATURES AND THE INFLUENCE OF INDIVIDUAL DIFFERENCES ON THE COMPREHENSION OF NON-LITERARY METAPHORS [a]

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Abstract

Given that the use and comprehension of figurative language is one of the most intriguing abilities of the mind, this study extends the line of research related to the process of understanding figurative language to individual differences. The starting assumption is that individual differences affect our ability to understand figurative language, focusing on fluid and crystallized intelligence. These types of intelligence were measured in relation to the ability t1o understand metaphors, and their influence was investigated indirectly, through tests that reliably examine both types of intelligence. The research investigates non-literary metaphors in the Serbian language, normed according to the following dimensions: metaphoricity, aptness, and familiarity. This study seeks to show whether and to what extent fluid and/or crystallized intelligence influence the process of understanding non-literary metaphors normed according to different features. Through selected verbal and non-verbal tests, Raven's progressive matrices (Raven, 1938), semantic similarities test (Stamenković, Ichien, & Holyoak, 2019a), as well as a non-literary metaphor comprehension test, it is determined in which way fluid and crystallized intelligence play roles in the process of metaphor comprehension, as well as which possible cognitive mechanism allows us to process metaphors. The results show that the comprehension of non-literary metaphors mostly relies on crystallized intelligence, while fluid intelligence seems to be employed in individual cases, only with some groups of metaphors.

Key words: metaphor comprehension process, fluid intelligence, crystallized intelligence, metaphoricity, aptness, familiarity.

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ОСОБИНЕ МЕТАФОРА И УТИЦАЈ ИНДИВИДУАЛНИХ РАЗЛИКА НА РАЗУМЕВАЊЕ НЕКЊИЖЕВНИХ МЕТАФОРА

Апстракт

С обзиром на то да је употреба и разумевање фигуративног језика једна од најзанимљивијих способности ума, ово истраживање наставља наше испитивање односа између процеса разумевања фигуративног језика и интелигенције. Полазна претпоставка је да индивидуалне разлике утичу на нашу способност да разумемо фигуративан језик, а у раду се фокусирамо на флуидну и кристализовану интелигенцију. Ове врсте интелигенције мерене су у односу на способност разумевања метафора, а њихов утицај истраживан је посредно, преко тестова који поуздано испитују једну и другу врсту интелигенције. У истраживању се користе некњижевне метафоре на српском језику, нормиране према следећим димензијама: метафоричност, погодност извора да опише циљ и степен познатости. Ово истраживање настоји да покаже да ли и у којој мери флуидна и/или кристализована интелигенција утичу на процес разумевања метафора нормираних према различитим особинама. Кроз одабране вербалне и невербалне тестове, Рејвенове прогресивне матрице (Raven, 1938), тест семантичких сличности (Stamenković, Ichien, & Holyoak, 2019a), као и тест разумевања некњижевних метафора утврђује се на који начин флуидна и кристализована интелигенција играју улоге у процесу разумевања метафоре, а тиме се одређује и могући когнитивни механизам који нам омогућава да метафору разумемо. Добијени резултати потврђују да се некњижевне метафоре углавном разумеју уз ослањање на кристализовану интелигенцију, док се флуидна интелигенција користи у изолованим случајевима.

Кључне речи: процес разумевања метафоре, флуидна интелигенција, кристализована интелигенција, метафоричност, погодност извора да опише циљ, степен познатости.

INTRODUCTION

Metaphor is a prominent phenomenon that pervades language, science, literature and everyday life, and in the broadest sense, it can be defined as a stylistic figure that equates two unrelated things by highlighting their similarities. However, despite the general agreement that metaphor is a salient phenomenon consisting of common cognitive, linguistic and psycholinguistic processes, and despite a considerable body of research dealing with it, not much is still known about how people understand this linguistic phenomenon from a psychological point of view.

Therefore, this study tries to continue unravelling the relationship between the understanding of figurative language and intelligence. The basic assumption is that individual differences affect our ability to understand figurative language, and intelligence is not viewed as a general ability, but deconstructed into two components in accordance with the theory of fluid and crystallized intelligence (Cattell, 1963, 1967, 1971; Horn & Cattell, 1966, 1967, 1982). The influence of intelligence types was inves-

tigated indirectly, through tests that reliably examine both types of intelligence. The research examines non-literary metaphors, in the Serbian language, normed according to the following dimensions: metaphoricity, aptness, and familiarity. This study aims to show whether and to what extent individual differences in fluid and/or crystallized intelligence influence the understanding of non-literary metaphors normed according to different features.

It also tries to answer the question of which cognitive mechanisms underlie metaphor comprehension in relation to the three main theoretical viewpoints of psycholinguistics: the one that claims that metaphor is based on analogical reasoning, the second one that states that the basic mechanism is categorization or conceptual combination, or the third viewpoint that represents conceptual metaphor (Kertész, Rákosi, & Csatár, 2012; Holyoak & Stamenković, 2018). Supporters of analogical reasoning claim that the source and target domains represent complex propositional structures, and that systematically developed connections between those two structures are found through mapping (Gentner & Bowdle, 2008). Gentner et al. (Gentner, Bowdle, Wolff, & Boronat, 2001) question whether metaphors create meaning or merely reflect structural parallels. On the other hand, advocates of the categorization view (Glucksberg & Haught, 2006a, 2006b) believe that metaphor is understood as a category statement based on conceptual combination. In the third approach, close to the first one, and related to the school of cognitive linguists, metaphor is considered a separate conceptual mechanism and an indispensable part of human perception and cognition (Lakoff, 1990; Lakoff & Johnson, 1980; Lakoff & Turner, 1989).

Additionally, we aimed to expand the empirical investigation of metaphor to languages other than English since research on metaphors outside the Anglophone world has been infrequent (e.g., Aisenman, 1999; Bambini, Canal, Resta, & Grimaldi, 2019; Boot & Pecher, 2010; Cacciari & Glucksberg, 1995; Milenković, Stamenković & Figar, 2016; Stamenković, Milenković, Ichien, & Holyoak 2023; Utsumi, 2007). The present study consisted of metaphors in the Serbian language, presented to Serbian speakers.

Metaphor Features

Metaphor features terminology exhibits a certain inconsistency because different authors classify them using different terms. Thibodeau et al. (Thibodeau, Sikos & Durgin, 2017) consider the following important properties of metaphors: (a) surprisingness – whether metaphors occur naturally or suddenly; (b) comprehensibility – the ease of understanding the given statement; (c) familiarity – some expressions differ in how conventionally they express a given idea; (d) metaphoricity – even metaphorical expressions differ in whether they are closer to figurative or literal

meaning; (e) aptness – the extent to which metaphors express important characteristics of the target domain. In addition to these features, authors mention meaningfulness (e.g., Chiappe, Kennedy, & Smykowski, 2003b; Gernsbacher, Keysar, Robertson, & Werner, 2001), truthfulness, or validity (e.g., Camac & Glucksberg, 1984; Wolff & Gentner, 2000), inversion (e.g., Chiappe et al., 2003b; Glucksberg, McGlone, & Manfredi, 1997), mental imagery (e.g., Gibbs & O'Brien 1990; Gibbs, Gould, & Andric, 2006), systematicity, asymmetry and abstraction (Saeed, 2009).

Among all these features, aptness and conventionality are the most prominent ones in research. Aptness can be defined as the extent to which the figurative meaning of the source domain expresses an important characteristic of the target domain (Blasko & Connine, 1993; Chiappe & Kennedy, 1999; Chiappe et al., 2003b; Gerrig & Healy, 1983; Glucksberg & McGlone, 1999). In order for a metaphor to be characterized by high aptness, two conditions must be met: a) the source domain should have a prominent feature that is attributed; and b) the prominent feature of the source domain must be relevant to the target domain. In a series of experiments, Gagné (2002) showed that the comprehension of comparison-based word combinations is influenced by factors like aptness, expectedness, and prominence. Higher aptness and prominence aided the understanding of combined concepts, while high expectedness only facilitated comprehension when complemented by high prominence.

Conventionality refers to the frequency of encounter with a certain metaphor, i.e., when we encounter a metaphor for the first time, it is considered new; however, upon repeated encounters, the metaphor becomes familiar, and in some cases, it takes on a new, literal meaning (Kittay, 1987; Utsumi, 2007). This metaphor feature actually represents the strength of the relationship between the source domain and its figurative meaning (Bowdle & Gentner, 2005; Gentner & Wolff, 1997; Wolff & Gentner, 2000; see also Giora, 1997). In other words, the more the term is used in a metaphorical sense, the more conventional it becomes.

Also, it is important to note that the term 'conventionality' in this usage refers only to the relation between the source domain and its metaphorical distinctiveness. Namely, conventionality describes how often a given source domain expresses a certain figurative meaning, as well as how quickly that source domain can retrieve the given figurative meaning in a metaphor (Bowdle & Gentner, 2005). In addition to this, there is another use of the term conventionality related to the familiarity of the source-domain pair, i.e., a dimension that describes the frequency of a metaphorical expression**.** In other words, conventionality refers to a feature that is manifested at the word level, while familiarity is present at the sentence level (Thibodeau et al., 2017). Given that this research focuses on non-literary metaphorical sentences, familiarity is relevant to the understanding of metaphors at this semantic level.

However, one of the main research concerns is how metaphor features are dealt with methodologically. One of the most widely used methods is to collect subjective ratings of features such as familiarity, aptness or metaphoricity (e.g., Cardillo, Watson, & Chatterjee, 2017; Cardillo, Schmidt, Kranjec & Chatterjee, 2010; Katz, Paivio, Marschark & Clark, 1988; Roncero & de Almeida, 2015; Stamenković, Ichien & Holyoak, 2020). In recent research, it has emerged that manipulating these features in experiments is not as simple as subjectively evaluating statements. Also, given that conventionality and aptness are highly correlated, researchers have looked for other ways to examine the influence of these features on the metaphor comprehension process (Thibodeau & Durgin, 2011).

Since subjective ratings of metaphorical sentences can be reliable in the sense that respondents agree that some metaphors are more familiar than others, or that they are characterized by a greater aptness, this type of research carries great theoretical potential if the measurement of features is performed in the correct way. The problem with subjective ratings is what these ratings actually reflect because respondents may mistakenly identify processing fluency with the dimension they are supposed to rate (Alter & Oppenheimer, 2009; Kahneman, 2011; Jacoby & Whitehouse, 1989; Jacoby, Allan, Collins, & Larwill, 1988). Thus, respondents tend to replace a more difficult question (e.g., to what extent the source domain expresses important features of the target domain in the sentence) with an easier question (e.g., how easy it was to understand this metaphor). In other words, there is a possibility that subjective ratings of metaphor dimensions actually represent an indirect and unintentional measure of processing fluency, and not the dimensions themselves (Thibodeau & Durgin, 2011), which could also explain why there is a high degree of correlation between aptness and familiarity in research (Jones & Estes, 2006; Thibodeau & Durgin, 2011), even though these two features are considered quite different.

Regarding the influence of aptness and conventionality on metaphor comprehension, some studies have shown that conventional metaphors are understood faster on average than novel metaphors (Blank, 1988; Bowdle & Gentner, 2005; Gentner & Wolff, 1997), and that more apt metaphors are also processed faster (Chiappe et al., 2003a; Gagné, 2002) and more easily (Chiappe et al., 2003a; Gagné, 2002; Kusumi, 1987; Sternberg & Nigro, 1983; Tourangeau & Rips, 1991; Tourangeau & Sternberg, 1981) than those characterized by lower aptness. However, the problem with these studies is that they do not delineate conventionality and aptness, but confuse them (see Bowdle & Gentner, 2005, pp. 204–205; Jones & Estes, 2005, p. 118), and neither of these clarifies whether the metaphor comprehension process is determined by aptness or conventionality.

Although in theory conventionality and aptness are two independent features (Chiappe et al., 2003a), Jones and Estes (2006, p. 19) note that in different studies these two features have been found to have a very similar influence on metaphor comprehension because in previous research these characteristics were seen as almost equal. The authors (Jones & Estes, 2006) consider that the demarcation of these two features is crucial for determining the mechanism underlying metaphor comprehension, i.e., the career of metaphor (according to which new metaphorical mappings can produce new word meanings that function as general categories) (Bowdle & Gentner, 1999, 2005; Gentner & Bowdle, 2001; Gentner & Wolff, 1997; Wolff & Gentner, 2000) or categorization that they identified as dominant in their experiments.

Individual Differences in Metaphor Comprehension

Individual differences are very important in explaining differences in people's behaviour and personality, and some aspects of these differences concern memory, intelligence, abilities, interests, feelings, or various physical factors. Also, the importance of individual differences seems even greater if we bear in mind that people differ in the frequency with which they use metaphors, and, therefore, also in the frequency of the experience of metaphorical thinking.

The initial theory of general intelligence was extended by Raymond Cattell (Cattell, 1963, 1967, 1971), and later by John Horn (Horn & Cattell, 1966, 1967, 1982), who pointed out that there are two components of general intelligence: crystallized intelligence, which depends on previously acquired information and skills, and fluid intelligence, which includes new information. Fluid intelligence is a product of the influence of biological factors on intellectual development, while crystallized intelligence reflects the influence of experience, education, and culture on an individual; therefore, the first is biologically determined, and the second culturally. Fluid intelligence is measured through tasks such as inductive reasoning, semantic relations, and associative memory. On the other hand, crystallized intelligence is determined by tasks such as verbal comprehension, formal reasoning, and conceptual fluidity.

Interestingly, a relatively small number of studies dealt with individual differences in cognitive factors (Stamenković et al., 2019a, 2020, 2023), which were found to influence metaphor comprehension both in the analogical reasoning view (Trick & Katz, 1986; Nippold & Sullivan, 1987) and in the categorization view (Kazmerski, Blasko, & Dessalegn, 2003; Chiappe & Chiappe, 2007). Metaphor comprehension is thought to be related to both types of intelligence – fluid intelligence is closely related to analogical reasoning (Holyoak, 2012), while verbal crystallized intelligence affects conceptual combination that depends on lexical semantics. In Stamenković et al. (2019a), the pattern of individual differences

showed that crystallized intelligence has an impact on understanding a wide range of different metaphors, while individual differences in fluid intelligence mainly affect cognitively more complex metaphors, such as literary metaphors. Namely, both fluid and crystallized intelligence were in a reliable and independent correlation with the understanding of literary metaphors (though not in all cases), while in the case of non-literary metaphors such a correlation existed for crystallized intelligence, but not for fluid intelligence (at least it was not significant) (Stamenković et al., 2019a).

Metaphor Features AND Norming Studies

Since metaphor research methodology exhibits a certain degree of inconsistency, involving various techniques, instruments, and stimuli, this requires compiling norming studies that would motivate more reliable and controlled research. The pioneering norming study by Katz et al. (1988) included 464 metaphors and 10 scales divided into comprehensibility, metaphoricity, imagery, and other factors such as familiarity, semantic relatedness, and alternative interpretations. The study found that individuals reacted differently to the same metaphors, indicating clear individual differences among participants. However, there was a significant correlation among the ten dimensions, and both literary and non-literary metaphors showed similar patterns in descriptive and relational statistics.

Another large-scale norming study was conducted by Cardillo et al. (2010, 2017) who aimed to provide sufficient material for studying metaphors in neuroscience. They normed pairs of metaphorical and literal sentences in both nominal and predicate forms, focusing on various aspects such as familiarity, naturalness, imageability, figurativeness, and comprehensibility. Through the participation of 160 individuals, the study aimed to minimize inhibiting factors and facilitate the exploration of the relationship between specific metaphor features and their comprehension in the human brain.

In a more recent metaphor norming study, Roncero and de Almeida (2015) examined participants' generation of associated properties for 84 pairs of source and target domains, including both metaphors and similes. The researchers analysed the frequency, saliency, and connotativeness scores of these properties and investigated whether the type of expression influenced interpretations. The study found that metaphors elicited more salient properties compared to similes, but the connotativeness levels for metaphors were similar to the salient properties of similes. Based on these results, the authors concluded that there were no significant differences between metaphors and similes in terms of measures such as aptness, conventionality, familiarity, and interpretive diversity.

Finally, Stamenković, Milenković & Dinčić (2019b) conducted a study to create pre-tested materials for psycholinguistic research. They developed a normed metaphor corpus in Serbian, including 55 non-literary and 55 literary metaphors. The study assessed the metaphors along dimensions such as metaphoricity, quality, aptness, familiarity, comprehensibility, source-target similarity, and number of interpretations. The literary metaphors were sourced from renowned Serbian poets, while the non-literary metaphors were selected from a list of highly apt metaphors (Katz et al., 1988). The analysis compared literary and non-literary metaphors, examined dimension correlations, and rated the metaphors. The study resulted in a normed corpus, reliable scales for each dimension, and significant correlations among the dimensions. Non-literary metaphors had lower metaphoricity but were rated as more apt, familiar, comprehensible, and with clearer source-target similarity. Literary metaphors were influenced by their poetic origins, while some participants rated non-literary metaphors as having higher quality due to their perceived aptness. Surprisingly, there were no significant differences in the average number of interpretations between non-literary and literary metaphors. Similar to Katz et al. (1988), this study found consistent ratings for each dimension and significant correlations among many dimensions. This norming study has been extended towards testing the differences in features in original and translated metaphors (Milenković, Tasić & Stamenković, working paper). The materials from this norming study have been utilized in various empirical procedures (e.g., Milenković 2021; Stamenković et al. 2023; Ichien, Stamenković & Holyoak, working paper).

METHOD

Participants

A total of 94 participants took part in this study, which included 76 females and 18 males. The mean age of the participants was 23.2. The participants were students at the Faculty of Philosophy and Faculty of Mechanical Engineering, University of Niš, represented various levels of study and participated for course credit. The study was approved by the Research Ethics Committee of the Faculty of Philosophy, University of Niš.

Instrument, Materials, and Procedure

The questionnaire used in the study consisted of three tests – Raven's progressive matrices (RPM), semantic similarities test (SST), and non-literary metaphor comprehension test, which had three variations depending on which of the three metaphor features it examined. All tasks were administered to participants individually using Google Forms. None

of the tasks involved any time pressure. The entire questionnaire session lasted approximately 50 minutes. The questionnaire was composed of the following three tests:

1. A short version of Raven's progressive matrices (Arthur, Tubre, Paul, & Sanchez-Ku, 1999) was used to assess fluid intelligence.

2. The Serbian version of the SST was used to assess crystallized verbal intelligence, as well as to predict non-literary metaphor comprehension. The SST, developed by Stamenković et al. (2019a), is designed to measure the ability to recognize similarities between concepts presented as word pairs, with varying degrees of abstraction. In the SST, participants are presented with word pairs and asked to identify similarities between the two concepts.

3. The non-literary metaphor comprehension test had three variations depending on whether it examined metaphoricity, aptness or familiarity. This test differed from questionnaire to questionnaire in terms of the metaphors to be interpreted in that part, i.e., in the third part, each questionnaire contained metaphors that, according to the norming study (Stamenković et al., 2019b), were rated as the best and the worst and on one of the three dimensions, thus amounting to three variations. Participants were asked to write open interpretations of 30 non-literary nominal metaphors (15 best-rated and 15 worst-rated) in the Serbian language, of the form A is B, where nouns mostly had premodification. All the non-literary metaphors used in the present study are provided in Appendix A, and next to each one it is indicated in which questionnaires it was used, since certain metaphors were repeated throughout the three questionnaires due to similar norm values in relation to different features. Questionnaire A1 contained nonliterary metaphors normed according to metaphoricity (15 best-rated and 15 worst-rated), Questionnaire A2 according to aptness (15 best-rated and 15 worst-rated), and Questionnaire A3 according to familiarity (also 15 best-rated and 15 worst-rated). Participants were presented with metaphors in a random order, one at a time. To assess comprehension, an open-ended question was used, prompting participants to type their interpretation of each metaphorical statement.

RESULTS

Metaphor Task Rating and Coding

Two independent raters, both linguists and native speakers of Serbian, scored the responses to the non-literary metaphor comprehension task. A 4-point scale was used, with scores of 0, 1, 2, or 3. A score of 3 (completely plausible) was given if the paraphrase described the metaphorical meaning at a level of abstraction beyond the source domain (i.e., a paraphrase that did not simply repeat the metaphorical formulation and

showed full understanding of the metaphor). A score of 2 (mostly plausible) was given if the paraphrase described the metaphorical meaning, but held explicit links to the source domain, focusing mostly on one domain. A score of 1 (partly plausible) was given if the paraphrase was strongly linked to the source domain and remained relatively simple, or if it ascribed physical features to the target. A score of 0 (implausible) was given if the paraphrase restated the metaphor using simpler terms with no further insights (i.e., was literal in nature), if it was a complete misinterpretation or nonsensical, or if no response was entered. Examples of item scoring are provided in Appendix B. Cohen's κ was calculated to determine the agreement between the two raters' judgments of the quality of the metaphor interpretations. The agreement between the raters' judgments was deemed satisfactory, with a κ value of .84, $p < .001$. In cases of disagreement, a discussion was held, and in most instances, the higher of the two scores was assigned.

Individual Differences in Metaphor Comprehension

Table 1 summarizes the descriptive statistics and intercorrelations among the three measures we obtained (RPM, SST, and non-literary metaphor comprehension) for all three item sets.

Table 1. Descriptive statistics for each measure for each group

	RPM	SST	High Metaphoricity	Low Metaphoricity
Mean	6.80	29.10	27.97	26.30
N	30	30	30	30
SD	2.52	3.32	6.90	8.37
	RPM	SST	High Aptness	Low Aptness
Mean	8.07	31.00	31.57	27.27
N	30	30	30	30
SD	2.66	2.99	6.25	5.52
	RPM	SST	High Familiarity	Low Familiarity
Mean	7.18	28.29	25.68	26.91
N	34	34	34	34
SD	3.21	4.20	5.10	6.95

We investigated how individual variations in fluid and crystallized verbal intelligence affected metaphor comprehension scores. This analysis was conducted separately for low and high subsets within the metaphoricity, aptness, and familiarity sets. Figure 1 displays the relationship between our measures of individual differences and the metaphor comprehension scores for each subset. We performed correlation and regression analyses to examine the interconnections among the RPM, SST, and the average score on the metaphor comprehension tests. Table 2 presents both the raw correlations between each predictor variable and the meta-

phor comprehension scores, as well as the partial correlations obtained from the regression analysis. The regression analyses revealed that SST scores predicted a certain degree of variance in comprehension accuracy of metaphors normed according to all the three features, most significantly in metaphors characterized by metaphoricity, with partial correlations ranging from .56 (SST for metaphors low in metaphoricity, $p < .01$) to .69 (SST for metaphors high in metaphoricity, $p < .001$). A weaker raw correlation was evident between SST scores and comprehension of metaphors low in aptness (.41, $p < .05$) and familiarity (.35, $p < .05$). In contrast, RPM scores correlated only with the comprehension of metaphors of any degree of metaphoricity (with a weak raw correlation ranging from .36 to .38, $p < .05$, and partial .42, $p < .05$), metaphors low in aptness, with a raw correlation of .37 ($p < .05$), and no correlation between RPM scores and familiarity of any degree. This pattern suggests that while both measures have an impact on metaphor comprehension to a certain extent (with the exception of fluid intelligence on processing familiar metaphors), for non-literary metaphors SST (crystallized intelligence) is more important than RPM (fluid intelligence). However, it should be emphasized that several correlations were not significant, primarily due to the limited number of participants, as well as the simplicity, and in some instances, the triviality of the selected metaphors, which seems to be an issue we can relate to non-literary metaphors. A greater sample size, the analysis of cognitively more complex metaphors, or their observation within a contextual framework would likely result in more notable correlations.

Table 2 Correlations and partial correlations of individual-difference measures with metaphor comprehension scores for each item subset

		RPM		SST	
Group		Raw	Partial	Raw	Partial
Metaphoricity	High Metaphoricity	.38 *	.42 *	.67 ***	.69 ***
	Low Metaphoricity	.36 *	.37	.56 **	.56 **
Aptness	High Aptness	.35	.28	.34	.27
	Low Aptness	.37 *	.28	.41 *	.33
Familiarity	High Familiarity	.17	.11	.21	.16
	Low Familiarity	.24	.14	.35 *	.30

Note: * $p < .05$, ** $p < .01$, *** $p < .001$

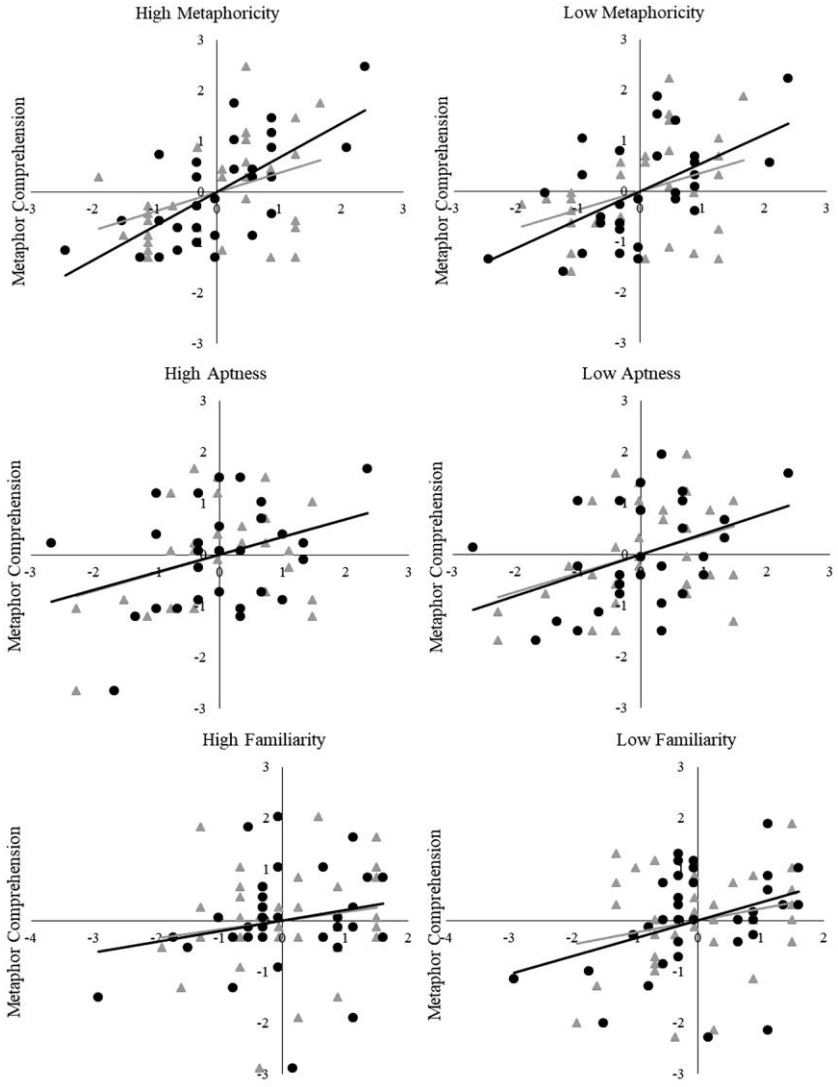

Figure 1. Individual differences in fluid intelligence (standardized RPM scores) and crystallized verbal intelligence (standardized SST scores) plotted against standardized metaphor comprehension scores (▲ RPM ● SST)

DISCUSSION AND CONCLUSIONS

This study examined the relationship between fluid and crystallized intelligence and the comprehension of figurative language. The findings gave significant insights into how individual differences between

the two types of intelligence and the features of non-literary metaphors impact their comprehension. The results confirm the initial hypothesis that individual differences in both fluid and crystallized intelligence influence the understanding of non-literary metaphors normed on various features/dimensions.

Firstly, we observed statistically significant raw correlations between the understanding of metaphors and RPM and/or SST scores in relation to the dimension of metaphoricity, but both high and low metaphorical statements provided similar results. There were slight deviations in the partial correlation measurements, but they still confirmed that both types of intelligence can influence the understanding of these metaphors, with crystallized intelligence showing a stronger statistically significant correlation. In the case of less apt metaphors, there was an influence from both fluid intelligence and crystallized intelligence. When it comes to the understanding of metaphors based on familiarity, the only correlation observed between the variables was an isolated case of crystallized intelligence influencing less familiar metaphors.

Secondly, high metaphoricity influences reliance on both types of intelligence in understanding non-literary metaphors, with crystallized intelligence showing a statistically significant correlation. However, since metaphors both high and low in metaphoricity correlate with both types of intelligence, this raises the question of whether this factor is crucial in terms of differentiation, i.e., separation. As for other features, it is evident that low aptness and low familiarity influence the use of crystallized intelligence in understanding metaphors, and that low aptness, as well as both degrees of metaphoricity, are the only ones that influence the activation of fluid intelligence when understanding non-literary metaphors. What is interesting is that low aptness affects the use of fluid intelligence, which confirms that in these cases we also resort to analogical reasoning in addition to categorization. However, it is important to note that the partial correlation analyses did not show statistically significant results in comprehending metaphors of any degree of aptness or familiarity. Given the strong correlation between RPM scores and measures of analogical reasoning (Snow, Kyllonen, & Marshalek, 1984), and the relatively weak relationship between RPM scores and simple metaphor comprehension, it can be concluded that this study does not support the hypothesis that complex analogical reasoning is necessary for the comprehension of such metaphors (Holyoak & Stamenković, 2018). The fact that RPM scores did not predict comprehension success, even for unfamiliar metaphors that were more difficult, indicates that difficulty alone is not sufficient to activate fluid intelligence to understand metaphors, which refutes the hypothesis that analogical reasoning is necessary to understand novel metaphors (Bowdle & Gentner, 2005). In other words, a stronger connection with analogical reasoning depended on the source-target distance rather

than the familiarity feature, as it did not correlate with RPM scores in any case. However, it is possible that metaphors are still understood through some analogical mechanism that is not as demanding as assumed in current models of analogical reasoning. Overall, measures of fluid and crystallized intelligence both made separable contributions to predicting non-literary metaphor comprehension, with considerably higher contribution of crystallized verbal intelligence.

The findings in the present study partially align with previous research on metaphor comprehension in Serbian involving literary metaphors that varied in rated aptness and familiarity, specifically highlighting the role of crystallized intelligence in understanding metaphors (Stamenković et al., 2023). Whereas in both studies comprehension scores were higher for metaphors that were high rather than low in aptness, in the present study, comprehension scores were higher for metaphors low in familiarity, unlike in the previous study. In both studies, a measure of crystallized intelligence was a significant predictor of comprehension, especially for those metaphors that were either relatively unfamiliar or more apt. In addition, both studies identified the connection between individual differences and fluid intelligence only for metaphors that were low in aptness. However, it should be highlighted that the raw correlations observed in Stamenković et al. (2023) were substantially more significant than in the present study, which did not reveal any partial correlations between the variables, which points at differences between literary and non-literary metaphors.

Finally, although the correlations observed were statistically significant in several instances, it is important to interpret these findings cautiously, as further research is needed to establish more reliable conclusions. Additionally, it should be acknowledged that a larger sample size could potentially yield different results, particularly in terms of the number of participants who completed the questionnaires. Furthermore, it would be highly advantageous to explore other types of metaphor, particularly those that are more cognitively complex, or to observe them within a contextual framework larger than a sentence, especially given the importance of metaphorical framing (e.g., Figar, 2023), or in different languages and cultures. This broader scope would enhance our understanding of metaphor. Considering the limited number of studies on metaphor comprehension in children (e.g., Nippold & Sullivan, 1987) and other age groups (e.g., Newsome & Glucksberg, 2002), future research could include different age groups or individuals with varying cognitive development to gain a more comprehensive understanding of metaphor comprehension. Additionally, when it comes to utilizing tests of individual differences, incorporating other tests measuring factors such as personality, maturity, decision-making, working memory, or emotional reactions would make a significant contribution to the field.

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ОСОБИНЕ МЕТАФОРА И УТИЦАЈ ИНДИВИДУАЛНИХ РАЗЛИКА НА РАЗУМЕВАЊЕ НЕКЊИЖЕВНИХ МЕТАФОРА

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Резиме

Полазећи од једног од најдоминантнијих појмова у когнитивним наукама, метафоре, ово истраживање испитује како индивидуалне разлике у флуидној и кристализованој интелигенцији утичу на разумевање метафора на српском језику нормираних према особинама метафоричности, погодности извора да опише циљ и степена познатости. Тачније, у њему се испитује веза између флуидне и кристализоване интелигенције с једне стране и разумевања некњижевних метафора с друге. У складу са тим, истраживање упоређује резултате успешности на тестовима интелигенције са резултатима успешности на тестовима разумевања некњижевних метафора према три димензије. Три упитника састојала су се из три различита теста – Рејвенових прогресивних матрица, теста семантичких сличности и теста отворених интерпретација метафора. Прва два теста мерила су флуидну и кристализовану интелигенцију, а последњи способност да се разуме и интерпретира некњижевна метафора. Испитаници су били студенти свих година и нивоа студија чији је матерњи језик српски или који га говоре на нивоу матерњег. Главни фокус током анализе биле су корелације и парцијалне корелације између одабраних варијабли. Након анализе корелација између тестова интелигенције и тестова разумевања метафора дат је детаљан опис резултата како би се показао њихов значај, извели закључци и довели у везу са циљевима истраживања, теоријским оквиром и претходним истраживањима. Квантитативна анализа резултата показује да су вредности корелација између тестова индивидуалних разлика и тестова разумевања метафора у неколико случаја значајне. Наиме, добијени резултати потврђују да се некњижевне метафоре углавном разумеју уз ослањање на кристализовану интелигенцију, док се флуидна интелигенција користи у изолованим случајевима, као и да утицај индивидуалних разлика зависи од особина метафора према којима су нормиране.

Appendix A. Non-literary Metaphor List

1.	Алкохолизам је паразит.	(A3)
2.	Амнезија је гумица за брисање памћења.	(A1)
3.	Брак је легура.	(A1, A2, A3)
4.	Време је талас.	(A1)
5.	Гени су план изградње.	(A1)
6.	Гума је ципела аутомобила.	(A1, A2, A3)
7.	Дете је сунђер.	(A1, A2, A3)
8.	Детињство је јутро живота.	(A1, A2, A3)
9.	Диктатори су давитељи слободе.	(A1, A2)
10.	Дим је визиткарта ватре.	(A2, A3)
11.	Звезде су путокази.	(A1, A3)
12.	Идеја је искра открића.	(A2)
13.	Идеја је храна ума.	(A2, A3)
14.	Изум је дете изумитеља.	(A1, A2)
15.	Инфлација је болест привреде.	(A1)
16.	Истина је лавиринт.	(A1)
17.	Историја је огледало.	(A1, A3)
18.	Кишобран је покретни кров.	(A1, A3)
19.	Корупција је коров привреде.	(A1)
20.	Лептир је крилата дуга.	(A2, A3)
21.	Љубав је гориво брака.	(A1)
22.	Месец је Земљина сијалица.	(A2)
23.	Мисао је мајка науке.	(A3)
24.	Млади људи су небрушени дијаманти.	(A1, A2, A3)
25.	Мозак је кухиња мисли.	(A2, A3)
26.	Музеј је књига из историје.	(A2)
27.	Нова идеја је сунце.	(A1)
28.	Научно истраживање је планинарење.	(A1, A2, A3)
29.	Обмана је заседа.	(A1, A2)
30.	Образовање је фењер.	(A1, A2)
31.	Одрастање је сахрана младости.	(A2)
32.	Осмех је амбасадор.	(A2, A3)
33.	Породица је стена сигурности.	(A3)
34.	Поштовање је драги камен.	(A2)
35.	Привреда је корен државе.	(A1, A2)
36.	Пријатељи су зраци сунца.	(A1)
37.	Прича је ниска перли.	(A2, A3)
38.	Просјаци су пантљичаре друштва.	(A2, A3)
39.	Прошлост је рупа без дна.	(A1, A2, A3)
40.	Развод је земљотрес у породици.	(A3)
41.	Самоћа је пустиња.	(A1, A2, A3)
42.	Саветник је водич кроз живот.	(A1, A2, A3)
43.	Савест је трн у оку ума.	(A1)
44.	Сенка је парче ноћи.	(A3)
45.	Сиромаштво је мајка криминала.	(A2, A3)
46.	Слобода је истина.	(A2, A3)
47.	Снови су филмови ума.	(A1, A2, A3)
48.	Стари наставници су енциклопедије.	(A3)
49.	Трач је куга.	(A1)
50.	Угаљ је храна пећи.	(A1, A3)
51.	Хумор је мелем.	(A2, A3)

Appendix B. Metaphor Task: Examples of Scoring

	Item: Дете је сунђер./A child is a sponge.
0 points	*Дете је као сунђер./A child is like a sponge.*
1 point	*Дете упија./A child absorbs.*
2 points	*Дете прикупља разне информације, па подсећа на сунђер./ A child collects various information, so it resembles a sponge.*
3 points	*Дете упија знање и информације као сунђер воду./ A child absorbs knowledge and information the way sponge absorbs water..*
	Item: Гума је ципела аутомобила./A tire is a car's shoe.
0 points	*Гуме су за кола као ноге за човека./ Tires are to a car as legs are to a man.*
1 point	*Гума се креће по земљи./ A tire moves on the ground.*
2 points	*Гума пружа спољашњу заштиту за несметано кретање и спречава клизање./ A tire provides external protection for smooth movement and prevents slipping.*
3 points	*Гуме су неопходне за кретање аутомобила, као ципеле људима за ход./ Tires are necessary for cars to move, as shoes are for people to walk.*
	Item: Истина је лавиринт./The truth is a labyrinth.
0 points	*Лавиринт је стаза за оне који лутају./ A labyrinth is a path for those who wander.*
1 point	*До истине се може доћи на различите начине./ The truth can be reached in different ways.*
2 points	*Треба пронаћи пут до истине./ You have to find the way to the truth.*
3 points	*Тешко је доћи до истине, као што је тешко наћи излаз из лавиринта./ It is difficult to reach the truth, just as it is difficult to find a way out of a labyrinth.*