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Interpretation of Metaphors in the Preschool Age: Interrelation with Emotional and Cognitive Processes

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Abstract

The present article analyzes the process of interpreting a metaphor by pre-school children. The study involved 88 participants, attending a kindergarten in Moscow, Russia. The preschoolers were given a basic set of metaphors created by the authors as well as the NEPSY-II tests as a part of diagnostic work.

The results show that metaphorical representation is an important form of the reflection of reality by children of pre-school age. Authors state that a metaphor acts as a tool of cognitive activity in the middle-age and senior-age groups of the pre-school age. The results demonstrate that there are two types of tasks that can be resolved using metaphorical representation: the first one is resolving the cognitive tasks, and the other is emotional regulation of cognitive activity. Also the dynamics of mastering metaphorical representation by pre-school age children has been determined.

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Keywords: pre-school children; cognitive activity; metaphorical representation; metaphor; NEPSY-II

1. Introduction

In previous works, we have attempted to show the value of a symbolic image as a cognitive tool [1]. We have applied a similar study to a metaphor, since within a metaphor the principle of symbol construction is expressed, with the only difference being that the metaphor content, unlike that of a symbol, is related to quite certain reality, which is, to the meaning covered by a metaphor [2].

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Haley in describing the works of Ch. Peirce, stated that the metaphor should not be understood as “*only a literary or a linguistic phenomenon, but also as the fundamental conceptual or cognitive mechanism*” [3, p. 422]. By using the metaphor in such a way it has gained popularity as being one of the basic thinking mechanisms.

If according to Searle’s theory [4] you address a metaphoric understanding as being an act of speech, then the opportunity of a literal interpretation has no meaning because the transfer to a metaphoric meaning has taken place. Indeed, research has proven this statement to be incorrect because the use of brain imaging methods did not reveal any differences in the analysis of metaphoric and literal expressions [5].

Experiments conducted by Reynolds and Schwartz [6] found that text containing metaphors was more difficult to understand. But it did produce a much better delayed recall than the content expressed literally. In this case comprehension requires a higher degree of attention and concentration. That is why it can be assumed that the use of a metaphor is positively related to the attention development level.

As we showed above [1], a symbol is used by a subject for orientation in situations with the following two features: uncertainty and the necessity to act on it (significance). Metaphors tend to be used more frequently when there is an emotional tension and an uncertainty of the subject matter in a conversation.

Therefore, we have all the evidence to view a metaphor as a transitional stage from a symbol to a sign, and it is either interpreted or categorized by a subject depending on the degree of uncertainty of a situation and the emotional tension it causes.

Interpreting a metaphor assumes comparison and holds a certain amount of emotional tension regarding the subject. For those reasons we expect there to be some form of correlation: 1) between the development level of the metaphoric representation of the situation by the subject and the level of his or her attention; and 2) between the development level of the metaphoric representation of the situation by the subject and the level of his or her emotional tension.

Studies into the age peculiarities of a metaphor's use by Gardner et al. [7] showed that children of a pre-school age were sensitive to using a metaphor. Whereas, metaphor usage decreased significantly with school age children but increased again with children within the juvenile age bracket. Several studies have shown that over a period of 5 years children are capable of using metaphors for both descriptive and emotional purposes [8]. According to Sapogova, with the metaphorization process, the frame is not set (or it is not strictly determined), and therefore a similarity with them is not found but created by the child. If preschoolers cannot interpret a situation they will look for a familiar experience of their own by restructuring and regrouping familiar elements and in turn unite them into a new structure in accordance with a new backbone principle. It is an important discovery to realize that a 6/7 year old child can, at such a tender age, already have the ability to replace poorly defined situations with a meaningful alternative [9, p. 36].

Gentner [10] identified three types of metaphor: “attributive”, these are connected with certain signs, for example “*Sun like orange*” because both are round and orange in color; “metaphors of relation”, these are connected with the structure of signs, for example: “*tire like boot*” because both objects can travel long distances and both are in contact with the ground; “double metaphors”, these are similar because they both consist of external features and a structural appearance, for example: “*stem like straw for a plant.*” Both these objects are cylindrical in shape and can pick up liquids.

We based our own research on the principles of categorization by Gentner and we found that the children gave three types of answers: structural (based on structural relations); attributive (based on external features); functional (based on functional features).

2. Method

We suggest that the representation of metaphoric answers in various ages will be unequal (Hypothesis 1). That is, we believe that the different types of answers will characterize the peculiarities in a child’s cognitive (Hypothesis 2) and emotional development (Hypothesis 3).

The research was carried out at a Moscow kindergarten from March till May of 2012. The participants were kindergarten pupils that were divided into two age groups. The first contained 45 children ($M_{age} = 66.20$ months) and was called the ‘Middle-age group’, and the second had 43 children ($M_{age} = 81.13$ months) – the ‘Senior-age group’.

We used the following techniques: **set of 10 metaphors created by the authors**. The following four parameters were used: interpretation on the basis of constructs “*structure*”, “*external feature*”, “*function*”, and the total value of their interpretations.

Diagnostic work: NEPSY-II (A Developmental Neuropsychological Assessment, second edition) [11, 12] tests were used. In our study we worked only with the domain that deals with the attention and executive functions. Therefore, we used the following sub-tests: *The “Inhibition Test” sub-test* assesses the ability to inhibit automatic responses in favor of novel responses. *The “Knock and Tap” sub-test* is designed to assess self-regulation and inhibition. *The “Statue” sub-test* is designed to assess motor persistence and inhibition. *The “Word Generation” sub-test* is designed to assess a child’s verbal productivity through the ability to generate words within specific categories. *The “Auditory Attention and Response Set” sub-test* has two tasks. “*Auditory Attention*” is designed to assess selective auditory attention and the ability to sustain it (vigilance). The second task, “*Response Set*” is used to assess the ability to shift and maintain a new and complex set involving both the inhibition of responses previously learned and correctly responding to matching or contrasting stimuli. *The “Cats form” subtest* was used to assess visual attention.

The Raven’s Colored Progressive Matrices was used to determine the level of intellectual development of the participants (Raven J., Raven J.C., & Court, 2009). *The figurative form of the Torrance Tests of Creative Thinking (TTCT)* adapted by Shcheblanova and Averina [13] was used to assess the creative thinking of the participants. *The Pictogram test*. This test was used for the diagnostics of the preschoolers’ memory [14]. *The Russian version of the “Preschool Anxiety Scale” (PAS)*.

2.1 Procedure

Parents of preschoolers attending this kindergarten received a written description of the study and its procedure, and were asked to give their written parental agreement. Children of parents who gave their written consent were included in the participant list. All preschoolers were tested individually in a quiet room located at kindergarten.

At the first stage of the study all participants completed diagnostic tests. At the next stage of the study all participants got to know the set of metaphors. Prior to the intervention the selected metaphors were given to three expert linguists for validation that they conformed to the declared constructs.

3. Results and discussion

3.1. Hypothesis 1

The preschoolers of the First (Middle-age) group generally interpreted metaphors more successfully than the children of the Second (Senior-age) group (see Table 1). Further usage of the Mann-Whitney test proved the statistical validity of the differences discovered in the interpretation values on the basis of construct “*Structure*” and “*External Feature*”, and also respectively of the total value of the interpretations of the metaphors by the preschoolers of the older and pre-school groups.

Table 1

Average values of the amount of correct interpretations of the metaphors set by preschoolers

Basic Construct of Metaphor Group	Structure	Function	External Feature	Total Value
Senior-age group	3.31	1.81	3.40	8.59
Middle-age group	2.28	1.33	2.80	6.42

To study in more detail how children of various ages understood the peculiarities of metaphors we carried out a comparison of structures of connection between the senior-age and the middle-age group, and our results were determined as a result of correlation analysis.

Our results showed that with the middle-age group the correlation that reflects connection between values of metaphors understanding and values of expression of obsessive compulsory anxiety of children was positive ($r = 0,410, p < .05$). Whereas with the senior-age group it was negative ($r = -0,403$). The correlation signs of the test

parameters stayed unchanged when applied to more adult participants. This result can be interpreted as: the metaphorical representation in the middle-age pre-school age group appears as a consequence of the uncertain situations that arise in the cognitive activity of children. Whereas the results of the senior-age group can be related to a use of the metaphorical representation as a tool for reducing the uncertainty of situation.

Age-specific changes in understanding of metaphors are also reflected in the fact that some interrelations obtained in the middle-age group are not found in the senior-age group and vice versa. For example, unlike with the middle-age group, the data from the senior group did not correlate with the results of the “*Knock and Tap*” sub-tests, with the value that reflects intensity of social anxiety, with the quantity of mistakes made by the participants in passing the “*Auditory Attention*” sub-test, with the results of the pictogram test, and with the thinking fluency index.

At the same time, unlike with the senior-age group, in the middle-age one there is no interrelation with the final value of the “*Cats form*” sub-test, also with the value that represents intensity of generalized and separation anxiety, and with value of elaboration of thinking. The connection between generalized anxiety and metaphorical representation may be explained as during this period adults are excessively motivating their children about going to school, and preschoolers turn to metaphorical representations as tools for overcoming anxiety.

3.2. Hypothesis 2

To check the supposition that some of the preschoolers’ answers characterized peculiarities of their cognitive development (Hypothesis 2), we carried out a correlation analysis of the preschoolers results of the metaphors interpretation and the data obtained from the results of work with the diagnostic complex NEPSY, Raven’s colored progressive matrices, the figural form from brief Torrance tests of creative thinking (TTCT), and a pictogram test.

Interpretations on the basis of the “Structure” construct. It was found that if there was an increase in this type of interpretation then the amount of mistakes made by the participant passing the “*Cats form*” sub-test decreased ($r = -0,312, p < .05$). If there was an increase in value of metaphors interpretations on the basis of “*Structure*” construct, then the total number of mistakes made by a participant in the “*Inhibition Test*” sub-test, with the first series of the “*Figures*” sub-test (series “*Naming*”) ($r = -0,342, p < .05$), decreased.

In the older groups there were positive interrelations of understanding the metaphors based on the “*Structure*” construct combined with the results of performing the pictogram test ($r = 0,503$, at the level of $p < .05$), a general value reflecting the intensity of anxiety ($r = 0,331$), and a value of reflecting flexibility of thinking ($r = 0,309$) were also discovered. In these groups a negative correlation tendency with the value that reflects the number of the mistakes that were not corrected by the participant when they passed the second series of sub-test “*Arrows*” in the “*Inhibition Test*” ($r = -0,405$) was found.

Interpretation on the basis of the “Function” construct. The value that reflects flexibility of thinking ($r = 0,319$) is positively related to the value of children’s understanding of metaphors based on the “*Function*” construct.

In the middle-age group the significant positive interrelations of understanding metaphors based on the “*Function*” construct with them passing the pictogram test ($r = 0,513, p < .05$) and the value of flexibility of thinking ($r = 0,536, p < .05$) were additionally revealed. At the level of tendencies, the negative interrelation with the number of mistakes made by the participant in association with the “*Inhibition*” type, and when passing the first series of the auditory attention sub-test ($r = -0,467, p < .05$) is shown.

Interpretation on the basis of the “External Feature” construct. The results of the correlation analysis show a series of significant positive interrelations for the quantity of interpretation value on the basis of the “*External Feature*” construct. Also shown was the number of mistakes that were independently corrected by the participant whilst passing the first series of part “*Arrows*” of the sub-test “*Inhibition Test*” ($r = 0,358, p < .05$), in addition to the amount of time it took to pass the second part of the “*Inhibition*” series ($r = -0,325, p < .05$).

In the middle-age group the interpretation of the metaphors based on the “*External Feature*” construct is significantly connected with various values of the “*Inhibition Test*” sub-test. Also noted was the amount of mistakes independently corrected by the participant whilst passing the first series of part “*Arrows*” (series

“Naming”) ($r = 0,566, p < .05$). In addition to the connection at the level of tendency with the amount of time that was spent in passing the second series of part “Arrows” of sub-test “Inhibition Test” (series “Inhibition”) ($r = -0,355$).

In the senior-age group there were a significant amount of metaphor interpretations based on the “External Feature” construct. The amount of mistakes made by participants when passing the first and second series of part “Figures” (series “Inhibition”) and sub-test “Inhibition Test” ($r = -0,545, p < .01$ and $r = -0,447, p < .05$, respectively) was highlighted. The amount included the number of mistakes of the “Omission” type made by the participant when passing the second series of the “Auditory Attention” sub-test (“Response Set”) ($r = -,525, p < .01$) as well as the level of tendency connection with the value of flexibility of thinking ($r = 0,411$).

All the data obtained clearly shows that the metaphors based on the “External Feature” construct act for the senior-age children as tools of their cognitive activity and help to voluntarily organize it.

Total value of interpretations. This value is positively related to the fluency of thinking index ($r = 0,350, p < .05$). There is also a positive connection at the tendency level with the flexibility of thinking index ($r = 0,312$) associated with this value.

It is noticeable that the middle-age group of children is represented at the tendencies level with the flexibility of thinking index ($r = 0,398$) and the fluency of thinking index ($r = 0,399$). The middle-age group also has a significant connection with the results of the pictogram test ($r = 0,570, p < .05$).

As well as the above mentioned interrelations, the senior-age group also has a significant correlation with the amount of mistakes made by the participants when passing both series of part “Figures” of sub-test “Inhibition Test”: “Naming” ($r = -0,439, p < .05$). Also, an association at the tendency level is shown for the total amount of mistakes made by the participant ($r = -0,363$) and the time it took them to pass the second series of part “Figures” of sub-test “Inhibition Test” ($r = 0,400$).

3.3. Hypothesis 3

Finally, we decided to test the hypothesis that some of the answers the preschoolers gave characterized features of their emotional development. It was found that the value of *interpretations on the basis of the “Structure” construct* is in positive correlation with the value reflecting the intensity of the children’s (irrespective of their age) obsessive compulsory anxiety ($r = 0,318, p < .05$). The middle-age groups showed a positive interrelation (at the tendency level) of understanding metaphors based on the “Structure” construct, with the general value reflecting an intensity of anxiety ($r = 0,331$).

Also, the results of correlation analysis show a significant positive interrelation with the general value of anxiety for the value of *interpretations on the basis of the “External Feature” construct* ($r = 0,317, p < .05$).

Our interpretation of the data is that it provides evidence of a connection between a metaphorical representation and an uncertain situation, which creates an anxious state of mind. Therefore, metaphors built on the basis of the “Function” construct have a tendency to participate in the regulation of a preschooler’s cognitive activity than in looking for decisive action.

Whereas, the value of *interpretations on the basis of the “Function” construct* in addition with the values that reflect the intensity of obsessive compulsory anxiety ($r = -0,403$) and the general value of anxiety intensity ($r = -0,407$), is also related to the value that reflects an intensity of general anxiety ($r = -0,301$).

3.4. Discussion

We emphasize that the different ages of the preschoolers were a key factor in how they understood the principles of metaphors. Unlike the middle-age group, the children of the kindergarten senior-age group (probably due to their age) have a better understanding of metaphors based on the “Structure” and “External Feature” constructs.

The ability of children close to school age to operate the different types of metaphors does not depend on their fluency of thinking, their level of memory development, their sensomotor and auditory attention, or their level of social anxiety. At the same time, the number of metaphors the children correctly interpret is connected to

their visual attention, their ability to think elaborately, along with their intensity of generalized and separation anxiety [15].

Although it is interesting to note the effects the understanding of metaphors has on a child's anxiety levels it was more interesting to note that children in the middle-age group, who understood the principles of metaphors the best, demonstrated more anxiety. Whereas the children of the senior-age group showed the opposite (less anxiety). According to the findings of our research as a child gets older the metaphor becomes a familiar tool of orientation in an uncertain situation and also a method of anxiety reduction.

The preschoolers who demonstrated a better understanding of the metaphors also made significantly less mistakes when passing the sub-test for visual attention, as well as the sub-test designed to diagnose a child's ability to switch their attention and volitional inhibition of their own automatic reactions (*"Inhibition Test"*).

With regard to the children of the middle-age group a significant connection was found between their ability to understand metaphors better based on the *"Structure"* construct and their results of the pictogram test designed for diagnostics of their memory. Apparently, this type of metaphor enables children to establish effective connections between the studied object and the structural features of a metaphor itself.

Therefore, we can suppose that if a child is trying to use a metaphor orientated to its structural plan then a high degree of visual attention is needed, a well-developed memory, the ability to switch their attention and volitional inhibition of their own automatic reactions, and also possess the ability of flexible thinking, otherwise it will be difficult to achieve their goal.

The results of the understanding of metaphors based on the *"Function"* construct by the children of the middle-age kindergarten group have significant positive correlation with the level of their memory development (*"Pictograms"*) test, and also with the value of their flexibility of thinking. Also, the preschoolers of the middle-age group with similar results made fewer mistakes when passing the *"Auditory Attention"* sub-test.

The children of the senior-age group who demonstrated a high level of understanding of a metaphor with the basic construct *"Function"* also showed a tendency to display less fluid thinking. That is probably because the nature of metaphors with the basic construct *"Function"* requires a different kind of orientation within its content and is more related to controlling the cognitive activity itself rather than solving cognitive tasks (i.e. it is more related to metacognitive structures).

Therefore, as with the structural plan of a metaphor, it is the preschoolers with their well-developed memory, and more flexibility of thinking and auditory attention that come out on top. But, at the same time, this group of children also showed a tendency to be less fluid thinkers and also possess a lower visual attention span.

In considering the issue of how children understand the use of metaphors with the basic construct *"External Feature"* we have discovered that preschoolers that had better results in interpretation of such metaphors also take less time and make fewer mistakes when passing the sub-test designed for diagnosing the children's ability to switch their attention and volitional inhibition of their own automatic reactions (*"Inhibition Test"*). At the same time this group of children display higher levels of anxiety.

The preschoolers of the senior-age group who understood the content of metaphors with the basic construct *"External Feature"* better, also showed more flexibility of thinking and made fewer mistakes in passing both the *"Inhibition Test"* and the *"Auditory Attention"* sub-tests.

In summarizing the *"External Feature"* results we can expect that these type of interpretations supposes a connection with more flexibility of thinking, better auditory attention, and also a more developed ability for switching attention and volitional inhibition of their own automatic reactions.

Finally, being able to understand and learn metaphors has a positive connection to memory, the fluency and flexibility of thinking, and the ability for switching of attention and volitional inhibition of automatic reactions.

The results of the supplementary correlation analysis only partially confirm the supposition expressed in Hypothesis 3. Therefore, the interrelations between the emotional aspects of preschoolers and their handling of metaphors based on the *"Structure"* and *"External Feature"* constructs were discovered, but there was no significant connections found regarding a functional plan for a metaphor.

Apparently, the high values of anxiety of the preschoolers with the highest ability to understand the metaphors (based on “*Structure*” and “*External Feature*”) may be considered from the point of view of the child’s need for a spontaneous appeal towards a symbolic image for mediation of their emotions. In other words, we suppose that the child experiencing increased anxiety levels allows them to exceed the boundaries of the current situation.

4. Conclusion

The results derived from our research showed that metaphorical representation is an important form of the reflection of reality by children of pre-school age. Also the interpretation of the three types of metaphors used differed from one another in the way their content was represented: interpretation on the basis of external feature, structural and functional similarity. The results obtained enable us to state that a metaphor acts as a tool of cognitive activity in the middle-age and senior-age groups of the pre-school age.

The results show that there are two types of tasks that can be resolved using metaphorical representation: the first one is resolving the cognitive tasks, and the other is emotional regulation of cognitive activity. It is proved by the difference in the signs of correlation between the constructs of a metaphor's interpretation and the values of anxiety.

The dynamics of mastering metaphorical representation by pre-school age children has been determined. It can be seen in the differences in correlation connections of the middle and the senior-age groups based on the results of understanding metaphors and passing the NEPSY sub-tests.

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References

- [1] Veraksa, A.N. (2011). Symbolic mediation in cognitive activity. *International Journal of Early Years Education*, 19 (1), 2011, 89-102.
- [2] Losev, A. *Problema simvola i realisticheskoe iskusstvo* [Problem of symbol and realistic art]. Moscow: Iskusstvo, 1995.
- [3] Haley, M.C. Metaphor, Mind and Space: What Pierce Can Offer Lakoff. *Peirce Seminar Papers: Proceedings of the International Colloquium on Language and Peircean Sign Theory*. New York, Duke University Press, 1999.
- [4] Searle, J. *Expression and meaning: Studies in the theory of speech acts*. Cambridge, Engl. Cambridge University, 1979.
- [5] Rapp, A.M., Leube, D.T., Erb, M., Grodd, W., & Kircher, T.T.J. Laterality in metaphor processing: Lack of evidence from functional magnetic resonance imaging for the right hemisphere theory. *Brain and Language*, 100, 2007, 142-149.
- [6] Reynolds, R.E., & Schwartz, R.M. Relation of Metaphoric Processing to Comprehension and Memory. *Journal of Educational Psychology*, 75, 1983, 450-459.
- [7] Gardner, H., Winner, E., Bechhofer, R., & Wolf, D. The development of figurative language. In K. Nelson (Ed.), *Children's language*. New York: Gardner Press, 1978.
- [8] Wagonner, J.E., & Palermo, D.S. Betty is a bouncing bubble: Children’s comprehension of emotion-descriptive metaphors. *Developmental Psychology*, 25, 1989, 152-163.
- [9] Sapogova, E.E. Vniz po krolichiey nore: metafora i nonsens v detskom voobrazenii [Down rabbit-burrow: metaphor and nonsense in child’s imagination]. *Voprosy Psichologii* [Issues of Psychology], 2, 1996, 36-44.
- [10] Gentner, D. Metaphor as structure mapping: the relation shift. *Child development*, 59, 1988.

- [11] Korkman, M., Kirk, U., & Kemp, S.L. *NEPSY II. Administrative manual*. San Antonio, TX: Psychological Corporation, 2007a
- [12] Korkman, M., Kirk, U., & Kemp, S.L. *NEPSY II. Clinical and interpretative manual*. San Antonio, TX: Psychological Corporation, 2007b.
- [13] Shcheblanova, E., & Averina, I. *Kratkij test tvorcheskogo mishlenia [Express-test of creative thinking]*. Moscow: Intor, 1995.
- [14] Loginova, S. V. & Rubinstein, S. Ya. *O primenenii metoda "pictogram" dlya experimental'nogo issledovaniya mishlenia psihicheskikh bol'nih* [Pictogram test's implementation within experimental study of mental patients' brainwork]. Moscow, 1972.
- [15] Janna M. Glozman, Pavel Krukow The social brain. *Psychology in Russia: State of the Art*, 6(3), 2013, 68-77.