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# THE GENESIS OF THE INTERRELATION OF THEORY OF MIND AND SYMBOLIC FUNCTIONS IN PRESCHOOLERS

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## *Abstract*

The present article presents the results of the study of the interrelation of the theory of mind and symbolic functions at a critical stage of their development – at preschool age. The hypothesis of coherence in the development of these abilities is verified. The study of the symbolic functions is carried out by the example of play and drawing. The methodologies comprising the tasks of the different levels of difficulty and allowing to make a comprehensive assessment of this ability at different stages of development are worked and tested for this purpose. The stage of development of the theory of mind has been estimated by means of two sets of tasks: the test "The Theory of Mind for Children" by Sergienko and Lebedeva, the battery of tasks "The Theory of Mind" by Hutchins, et all. We have compared the data about the development of these abilities with the indicators of children intellectual development (WPPSI – Wechsler Preschool and Primary Scale of Intelligence). The study involves 60 children in two age groups, 3-4 years old and 5-6 years old. Intelligence quotient is about the average level of the Wechsler scale in all the children. It is shown that at various stages of ontogenesis the symbolic function changes the nature of the relationship with the theory of mind. At that, heterochrony in the development of the individual components of the symbolic functions (understanding and applying) in play and drawing is found.



**Keywords:** The theory of mind, understanding of mental states, a symbolic function, development of play and drawing, pretend play, preschool age.

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## 1. Introduction

The theory of mind (ToM) – the ability to understand mental states – becomes one of the central constructs of the cognitive development research in the recent decades. This ability is a system of mental representations concerning the mental of one's own as well as other people, which enables us to understand the mental states of others and to predict their behavior (Sergienko et al, 2009). One of the critical issues in this field of research is the ratio of the development of symbolic functions and ToM at a critical stage of people's development – at the age of 3-4 and 5-6 years old. At this particular time the qualitative changes of these abilities take place. The understanding of mental states as well as the ability of symbolization implies the transition from reality to the mental representations that gives a reason for the existence of connections in their development. Symbolic functions provide representation of reality at the internal level, allowing transition to the mental models of reality, which should contribute to the development of the ability to understand mental states. However, the results of modern investigations make it impossible either to confirm or refute this hypothesis (Lillard, 1993, 2013)

## 2. Problem Statement

### 2.1. Contemporary studies of the relation between the theory of mind and symbolic functions

The concepts of the role of symbolic functions both in mental development in general and in the development of the mental model are based on two key theories, that is, the cultural-historical concept by L.S. Vygotsky and theory of cognitive development by Jean Piaget. So, from the point of view of the perspective of the cultural-historical theory, the symbolic function forms an essential basis for the development of higher mental functions. From the point of view of Piaget's theory, the acquisition of sign-symbolic systems by the child is a natural cognitive achievement, that evidence the transition to a qualitatively new level of development, but is not its cause (Vygotsky, 1984; Piaget, 1969).

The data of research in the recent years do not provide any sufficient proof of causation, but rather indicate plurality and coherence of different lines of development in ontogenesis. In most of them, the evaluation of symbolic functions development is given in the framework of pretend play. If a symbolic function is indeed an essential source for further development, positive relationships with other aspects of mental development have to be identified. The influence of pretend play on the development of cognitive processes, creativity and mastering of skills at the use of syllogisms and metaphor is shown in the works of Russian psychologists (Diatchenko, 1996; Veraksa, 2012). The research by Smilansky (1968) reveals the relation of pretend play with creativity. However, the later work of Peelegrini and Gustafson (2005) does not reveal similar correlations. The results of the study of relation between symbolic functions and intelligence, decision making and theory of conservation do not demonstrate stable links either (Cole, Lavoie, 1985; Golomb et al. 1982; Wenner, 2009).

A number of the studies reveal correlations between the indices of the pretend play development and certain aspects of ToM. The results show the connection of the pretend play level of development (the number of play episodes, the ability to reach an agreement with a play partner, assuming the role) with ability to recognize false beliefs, ability to distinguish between the visible and real and ability to accept a viewpoint of another person (Astington & Jenkins 1995; Keskin 2005; Youngblade & Dunn 1995). The results of similar works indicate that children with a higher level of ToM development turn out to be more

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successful in pretend play in comparison with their peers. However, these data only confirm the existence of relation in the development of ToM and pretend play, but do not answer the question about trends and cause-and-effect relations of these abilities.

In preschool period the symbolic functions are intensively developing in drawing. The child's drawing has been rather extensively studied in psychology. The dynamics of its development clearly defined, (Luquet, 1927), and its relation with the emotional and personal development is shown (Machover, 1996). F. Goodenough proves a high correlation of drawing with intellectual giftedness. On the basis of this, the scale of the assessment of drawing a person to evaluate intelligence is worked out, known as the "Goodenough – Harris Drawing Test" (Harris & Goodenough, 1963). The presented data reveal that the development of drawing as a symbolic activity is closely connected with mental development of the child. However, we have failed to discover any researches that have compared the expressive aspect with the development of ToM.

The communicative aspects, which includes understanding the products of painting activity by preschool children, is extremely under-explored. In the recent researches of this problem a special attention is paid to a perceiver, as an active interpreter of the image. Two strategies of drawing interpretation are considered: realistic nature and intentionality. The strategy of realistic nature implies identification of the drawing, comparing the image with the referent according to the similarity in appearance; in this case the author's intentions are ignored. On the contrary, the intentional strategy focuses on the recognition of the drawing from the prospective of the author's intentions (Freeman, & Sanger, 1995). However, no unambiguous opinion is available concerning the existence of these strategies at the moment. There have been changes in the choice of employing a particular strategy depending on the degree of similarity of the image with its referent and consistence with the author' intent, if it is known to the person involved in recognition (Armitage & Allen, 2015). Nevertheless, the need to take into account the intentions of the author when identifying the figure indicates the existence of a link between the understanding of patterns and ToM.

Thus, the analysis of the present-day investigations on the problem of the relation of ToM and symbolic functions reveals a number of gaps that can be associated with methodological deficiencies. The majority of the researches deal only with some aspects of each of the abilities. So, alongside several components of ToM (understanding of false beliefs, intentions and visual perspective), only certain aspects of symbolic function (applying or understanding symbolic means) and including only one form of activity (in certain forms of pretend play or drawing) have been under study (Armitage &Allen, 2015; Lillard et al., 2013).

## 3. Research Questions

- How ToM and symbolic function in preschool age are related?
- Are there common patterns in the genesis of the development of ToM and symbolic functions?
- How the psychometric intelligence is related to the development of these abilities?

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## 4. Purpose of the Study

The goal of our research is the comparison and analysis of the relations of ToM with symbolic functions at a critical stage of their development – at preschool age.

## 5. Research methods

### 5.1. Sample

The study involved 60 children. 30 of them were 3-4-year-old children (14 boys and 16 girls, from 40 to 59 months, Me=46 months), and 30 were 5-6 year-old children (15 boys and 15 girls, from 61 to 87 months, Me=71 months) featuring a typical development (IQ < 85 points according to the Wechsler Intelligence Scale)

### 5.2. The testing procedure and methodology.

The study involved a complex of methods and means enabling the researchers to work out a multidimensional evaluation of symbolic functions in pretend play and drawing. To assess the level of development of ToM, the tests, enabling one to carry out an overall assessment of its level of development, were used for the first time in the domestic psychology.

An assessment of the level of intelligence was carried out at the initial stage of the research with the help of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI). At a later stage, each of the respondents underwent the process of evaluation, which involved the following methodologies.

A battery of tests was used to assess ToM: "Theory of mind. Children version" (Sergienko E. A., Lebedeva E. I.; 20 test tasks) and "The Theory of Mind" (Hutchins at al., 2008; 9 test tasks). Each of them covered the major groups of the components of ToM: understanding of emotions and their causes, understanding of false beliefs and deception, understanding of visual perspective, understanding of desires and prediction of actions according to the mental conditions.

Special methodologies for evaluation of symbolic functions were developed separately for games and drawing, including the assessment of both understanding and use of symbolic means.

- The application of symbolic means in drawing. Each participant was offered with two tasks: to draw one of the 5 simple objects for choice (a ball, a house, a car, a doll and a dog) and to depict the most important thing, according to the child' opinion, from the presented story (using maximum four sentences), based on a simple plot, comprising the object and two interacting characters. The level of structure, drawing stage and selection of the drawing theme were evaluated. The score was the indicator of the "Application of symbolic means in drawing" (the consistency of indices according to Cronbach's alpha coefficient ($\alpha$=0,77).

- To determine the indicator "Understanding symbolic means in drawing", six drawings of the preschool children were selected, drawn on the basis of the same subjects. They were presented to the children for recognition, whose performance was assessed by using from 0 to 2 points for each drawing, depending on the degree of closeness of the names, given to the drawing by the "author" and the child. The obtained scores were also summed up into the total ($\alpha$=0,72).

- The application of symbolic means in play. To create a play situation, the children were presented with a short cartoon, in which 3 plain activities were shown, involving simple objects (e.g. a bear is feeding

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a doll, washing it and putting to sleep). Then the child was given with the key object (the action with which was performed) and asked to select independently one of the 3 assistive sets of items required for the game. The sets differed in the degree of resemblance of the real object and the possibility of functional applying (small copies of the objects: a bed, bath and dishes; or, their similar substitutes or more abstract objects). Each assistive object had to play the role of a substituting object, with which one is to carry out object actions according to the plot. The following parameters were evaluated: the substituting object quality, level of actions symbolization, the accuracy of the meaning of objects and actions, imitation and development of plot and verbal and vocal accompaniment. A rating system was developed for each parameter based on the availability/unavailability of its key features. The scores, obtained for each indicator, were summed up in the total index (consistency $\alpha$=0,72).

- Understanding of symbolic means in play. The development of this test required creation of a situation which, firstly, would be as close as possible to the actual conditions when the child watches his peers' game. Secondly, it should be compatible with the assessment of applying symbolic means. According to the basic characteristics, the stimulus material matched that, which the children had already played with, but the plot was an unfamiliar story-line. With the help of these materials, two videos were recorded in which three actions were performed with the toy. Each of the actions was carried out using the substituting objects, featuring a different degree of similarity with the referent. The child was required to name each of the actions. Initially, the first video was presented in which the action with the object was specified briefly. If the child named, at least, one action wrong, he was presented with the second video where the action was performed in an unfolded form. But, if the respondent succeeded this time, he received a lower score. The obtained points were summed up in the total ($\alpha$=0,75)

### 5.3. Methods of data analysis

The research results processing was carried out by means of statistics package "R 3.2.". The criterion of angular Fisher transformation was applied to assess the significance of differences (differences were considered to be significant when $p \leq 0.05$ and $p \leq 0.01$). Spearman correlation coefficient was applied to analyze the relationships between the methodologies indices for the theory of mind and symbolic functions (the relationship was considered to be significant at $p \leq 0.05$ and $p \leq 0.01$).

## 6. Findings

The obtained results show that the groups of the 3-4 and 5-6 year-old children do not differ in the level of intelligence (U=169, p= 0,195). The average IQ in the younger group is 106 points, and the in older group – 103 points. The both indices are within the boundaries of the average.

On the contrary, the analysis of the testing results assessing the level of development of ToM and symbolic functions reveals differences between the experimental groups. Figure 1 shows the significance of differences between the groups of the children of 3-4 and 5-6 years in median values of the tests general indices for the assessment of the level of development of ToM and symbolic functions, after applying angular Fisher's transformation, ($\varphi$-criterion) (Fig.1).

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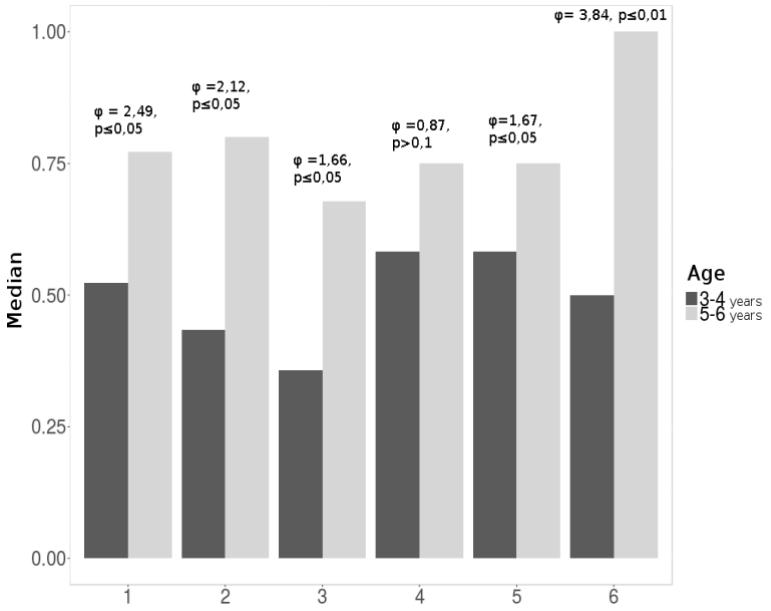


**Figure 1.** The ratio of the median values (in relative points) of variables between sub-samples. Variables and their values: 1 – The test "The Theory of Mind. Children Version" by Sergienko and Lebedeva; 2 – A battery of tasks " The Theory of Mind" by Hutchins et al.; 3 – Application of symbolic means in drawing; 4 – Understanding of symbolic means in drawing; 5 – Application of symbolic means in play; 6 – Understanding of symbolic means in play.

### 6.1. The relationship of the development of the theory of mind and symbolic functions in play and drawing with level of intelligence.

General cognitive abilities (psychometric intelligence) may be one the factors mediating the relationship of ToM and symbolic functions. The revealed correlations of the level of intellectual development and symbolic functions with ToM differ depending on the evaluation method. It might be explained by the specifics of the individual tasks and sensitivity of the batteries as a whole. Differences in relations of these abilities are present in the groups of the 3-4 and 5-6 year-old children. Thus, in the group of the 3-4 year-old children the following relations reveal themselves: general index of the Wechsler test with the both batteries, used to assess the development of ToM (r= 0,44 (p=0.015) the test by Sergienko and Lebedeva; r =0,486 (p=0,007), the Hutchins et al. test); the nonverbal index with the Hutchins et al. test (R=0,477(p=0.008), the verbal index with the Sergienko-Lebedeva test (R=0,425(p=0.019) and, at the trend level, with the Hutchins et al. test (R=0,350(p=0,058). In the 5-6–year-old children, the relations of the both batteries are found at the trend level only for the verbal index (R=0,314 (p=0,091) the Sergienko-Lebedeva test; R=0,339 (p=0,067) the Hutchins et al. test). These data are consistent with those obtained previously (Lebedeva et al., 2012).

Differences are observed in the character of the correlations of intelligence with symbolic function. At that, the intelligence quotient is associated differently with understanding and applying symbolic media in play and drawing.

At younger preschool age the applying of symbolic means in drawing is correlated with general (R= 0,366, p<0.05) and non-verbal indices of the Wechsler test (R=0,575, p<0.01). At senior preschool age the relationship with understanding symbolic means is found, for verbal index only (R=0,420, p<0.05). These

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results are consistent with the data of Harris and Goodenough (1963), who identify a close association between the psychometric intelligence index and level of the scheme of a human's image drawing. The absence of such correlation in the group of the 5-6-year-old children (R=0,04, p=0,83) indicates differences in the relationship between these abilities at various stages of development. A similar character of correlations of psychometric intelligence, involving the usage and understanding of symbolic means, with their results in play reveals itself. At the trend level the connections of non-verbal intelligence with the applying of symbolic means are identified in the children aged 3-4 years old (R=0,359, p=0,052), and those of general index with understanding at the age of 5-6 (R= 0,340, p=0,06).

### 6.2. The relationship of theory of mind and symbolic functions

Correlation analysis of our research data shows that the relationships of ToM with symbolic function is closer in drawing than in play. That is observed when comparing the symbolic functions with intellectual development. However, their distribution in the age groups varies considerably. The strongest correlations of the indices of ToM with symbolic functions are detected in the drawings in the group of the older preschoolers. Significant relationships are determined by means of both applying (R=0,436 ($p<0.01$), the Hutchins et al. test) and understanding the symbolic means (R=0,539 ($p<0.01$) the Sergienko, Lebedeva test; R= 0,314 ($p<0.10$), Hutchins test et al.). In the group of the 3-4 year-old children only the relation between understanding the symbolic tools and the results of the Hutchins et al. test (R=0,439, ($p<0.01$) is observed. No relations with the level of the symbolic function development in play of the 5-6-year-old children are found. In the group of the 3-4-year-old children, the applying of symbolic means in drawing is connected with ToM according to the general index of the Hutchins et al. Test (2008). And, the understanding of symbolic means in play is with the general index of the Sergienko and Lebedeva test (R=0,398, p=0,0295).

These results indicate that a certain level of development of ToM is necessary for applying symbolic means in drawing at early stages of development already. The development of ToM gains a higher importance at senior preschool age to understand the symbolic means in painting activity. Not only the revealed correlation, but differences in the nature of the responses given by the children of various age groups point out that. When interpreting a drawing, in the absence of a clear understanding of the image, the 5-6-year-old children speculate about what can be depicted, whereas the 3-4-year-old children do not do that. The older children, observing the image, take into account its belonging to another (author). This enables them to consider the latter's points of view, interpreting the drawing as realization of the author' intentions to draw something definite, regardless of the outcome. At junior preschool age, "addressing" to the author may be hampered by a low degree of ability to understand mental states, in particular, taking into account other's point of view.

It is interesting that ToM's level of development turns out to be interrelated with the understanding of symbolic means play in the 3-4 years-old children, while no such relationship is identified in case of the 5-6-year-old children. The task developed by us for understanding symbolic means in play as well as real-life play situation does not separate the subject of activity from its product. On the contrary, while interpreting drawings of others, the child faces an alienated result, whereas in play a symbolic action takes place here and now, taking into account the subject-subject interactions and situational support. Everything

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facilitates the possibility for considering mental states of the partner in play. This is consistent with the layered approach to the formation of ToM proposed by Sergienko E.A. (Sergienko, et. al., 2009).

The results of the research make it possible to state that the relationship in the development of ToM and symbolic functions at preschool age do exist. They, however, do not provide a clear-cut answer to the question concerning the peculiarity of this relationship. It is shown that at different stages of ontogenesis (3-4-year-old and 5-6-year-old children) symbolic function changes the nature of the relationship with ToM. Changes of relationships are also observed, when comparing the capability to understand mental states with symbolic functions in different types of activities (pretend play and drawing).

## 7. Conclusion

1. There are age differences in the relations between ToM and symbolic functions. At the age of 5-6 years old, ToM development becomes an important factor in ensuring the understanding and applying of symbolic means in drawing, whereas at the age of 3-4, the development of this ability is connected with the understanding of play and level of drawing development.

2. There are common patterns in the genesis of the development of ToM and symbolic functions. In the preschool period there is an intensive growth of these closely interrelated abilities, related closely with each other and the level of intellectual development.

3. Heterochronism in the development of various components of symbolic functions (understanding and applying) in play and drawing at preschool age is shown.

4. The contribution of psychometric intelligence to the development of ToM and symbolic functions decreases along with one's growth. In 3-4-year-old children the level of the development of ability to understand mental states and symbolic functions is associated with indices of psychometric intelligence. At the age of 5-6 years old, success in understanding mental states and in the usage of symbolic functions in a situation does not relate to the level of intellectual development.

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