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**THE ROLE OF MENTAL DEVELOPMENT IN ONTOGENESIS OF
SYMBOLIC FUNCTIONS**

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Abstract

This article presents the results of the study concerned with the relationship between the development of symbolic functions and mental abilities (theory of mind and intelligence) in children of preschool age. The development of symbolic functions was assessed during play and drawing in two main aspects: the use of symbolic means and the understanding of their meaning by another child. During the play activity, a child was presented with an opportunity to play in a similar way, choosing one of the three sets of alternate objects, different in their size and the degree of external similarity to real objects presented in the cartoon. During the drawing activity, a child was asked to choose toy and draw it. For the drawing of the story, a short story was presented describing a joyful or sad event involving two heroes. To evaluate theory of mind, techniques were developed and tested that provide data on both the general level of development of this ability and its individual components. The psychometric intelligence was evaluated using the WPPSI - III. Sixty children at the age of 40-87 months old have participated. Results showed that at different stages of ontogenesis (3-4 years and 5-6 years), the nature of the connection of symbolic functions with theory of mind and individual intellectual abilities changes. As well as that, changes in relationships are observed when comparing the theory of mind and intellectual abilities with symbolic functions in different activities and for different aspects (use of symbolic means and their understanding).

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Keywords: Symbolic functions, theory of mind, psychometric intelligence, preschool children, pretend play, drawing.



1. Introduction

At present, the question of the role of symbolic functions in mental development and in the development of theory of mind (ToM) remains controversial, despite rather intensive research in this field. Two views collide in this area: cultural-historical viewpoint (Vygotsky, 1984), in which the development of symbolic activity is the cause of mental development (higher mental functions) and the viewpoint of Piaget (1969), for whom the development of symbolic functions is a natural cognitive achievement, which is an indicator of the transition to a new structural level of development by the child. Modern researchers provide experimental evidence of these two points of view. However, it should be noted that a significant amount of this research is for the most part contradictory. Even more acute is the question of the relationship between the development of symbolic functions and mental development in relation to the ability to understand the mental worlds of people and their mental states. Since the replacement of reality and the ability to move to mental models occurs in symbolic activity, this ability should contribute to the development of understanding of the hidden mental states of other people and predicting their actions (Flavell, 2004; Leslie, 1987). Modern verification of this point of view does not provide unambiguous solutions (the data are contradictory and suggest other models of relationships).

2. Problem Statement

Interest in the question of the relationship between ToM and symbolic functions is based on the presence of a number of similarities between them. Both ToM and symbolic functions require the representation of reality in the internal plan and go through a critical stage of development at preschool age. Much of the work in this area also focuses on juxtaposition of ToM with pretend play. The results of these studies demonstrate the connection of such aspects of pretend play, such as the number of pretend play episodes in the child's overall activity, the ability to agree with a partner, and substitution with the individual components of ToM (Keskin, 2005; Schwebel, Rosen, & Singer, 1999; Youngblade & Dunn, 1995). At the same time, such correlations are unstable. For example, Astington and Jenkins (1995) on a sample of children aged between 3 and 5 years showed a connection between understanding false beliefs and the ability to agree with a partner. However, a reproduction of this experiment did not find a similar relationship (Lillard et al., 2013).

Works studying the relationship of symbolic functions in drawing with the level of ToM development focus on the aspect of understanding images as a result of symbolic activity. The question of the need to take into account the author's intentions when interpreting the drawings (the intentional strategy) is discussed, which is one of the competencies that is being formed within the ToM framework. The results indicate that this strategy is available to children as young as 2-3 years old (Bloom & Markson, 1998).

These data indicate that ToM is involved in the understanding of symbolic means, but the relationship with their use remains unexplored. In addition, the isolated consideration of symbolic functions in different types of activity while controlling only certain aspects of it does not allow for comparing the available data and considering symbolic functions as a unified ability.

The studying of the contribution of intellectual abilities to the realization of symbolic functions to create a general mental model and its development at a critical age for cognitive development also requires detailed analysis.

3. Research Questions

- How are ToM and symbolic function (use of symbolic means and their understanding) related in preschool age?
- How is the psychometric intelligence related to the development of these abilities?
- Are there common patterns in the genesis of the development of ToM and symbolic functions?
- How do these relationships change in preschool age, which is critical for mental development?

4. Purpose of the Study

The aim of this study is the investigation of the relationship of the development of symbolic functions, theory of mind and intellectual development in the preschool age.

5. Research Methods

5.1. Subjects (respondents)

The study involved 60 children. 30 of them were 3-4 years old (16 girls, ages from 40 to 59 months, M=46 months), and 30 were 5-6 years old (15 girls, ages from 61 to 87 months, M=71 months), all with typical development (IQ > 85 points according to the WPPSI-III).

5.2. The testing procedure and methodology

A battery of tests was used to assess ToM: "Theory of mind. Children version" (20 test tasks) and "The Theory of Mind" (Hutchins, Bonazinga, Prelock, & Taylor, 2008) (9 test tasks). Each of them covered the major 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 states.

An assessment of the level of intelligence was carried out at the initial stage of research with the use of the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III).

The development of symbolic functions was assessed separately in play and drawing, aspects of "Understanding" and "Use" of symbolic means were taken into account for each type of activity. When drawing, participants were asked to perform 2 drawings (drawing with the presence of a sample item of choice and drawing of a story) and to identify a set of images done by their peers. To assess the use of symbolic means during play, after viewing a short cartoon (play with a doll or a car), a play situation was created in which a child had to perform 3 actions, independently picking up the three substitutes most suitable from her point of view (a set of items-copies of the cartoon, but smaller in size, items that perform similar functions, but have relative similarities, and abstract items-substitutes). After that, the participants were asked to recognize 3 actions in the video, which were performed with items similar in terms of symbolic representation, but within the framework of another plot (for more details, see Koroleva &

Sergienko, 2017).

The data collected were analyzed with the use of the “R 3.2.” statistics package.

6. Findings

6.1. Theory of mind and symbolic functions

The data obtained indicate the different nature of the connection between the theory of mind and symbolic functions in different types of activity. When drawing, there is an increase in the relationship between the use of symbolic means and ToM with age; no similar correlations were found in the play activity. The results of the correlation analysis of performing the tasks for ToM and understanding and use of symbolic means in play and drawing are presented in Tables 01 and 02.

Table 01. Correlations between theory of mind and symbolic functions in children 3-4 years old

| | Emotion Recognition | Situationally conditional emotions | Emotions caused by mental states | Visual perspective | Mental states | False beliefs |
|--|------------------------|------------------------------------|----------------------------------|-------------------------|------------------------|-------------------------|
| Use of symbolic functions in play | 0.40* p=0.02 | -0.15 p=0.428 | 0.24 p=0.19 | 0.27 p=0.14 | 0.231 p=0.22 | 0.192 p=0.31 |
| Understanding of symbolic functions in play | 0.24 p=0.19 | 0.34 p=0.06 | 0.35* p=0.05 | 0.18 p=0.34 | 0.15 p=0.40 | 0.12 p=0.50 |
| Use of symbolic functions in drawing | 0.27 p=0.13 | 0.01 p=0.94 | 0.00 p=0.96 | 0.48** p=0.00 | 0.42* p=0.02 | 0.42** p=0.01 |
| Understanding of symbolic functions in drawing | 0.20 p=0.27 | 0.071 p=0.709 | 0.19 p=0.31 | -0.01 p=0.94 | 0.05 p=0.76 | 0.19 p=0.30 |

Note: ** Significant p-level $\leq 0,01$, * Significant p-level $\leq 0,05$

Table 02. Correlations between theory of mind and symbolic functions in children 5-6 years old

| | Emotion Recognition | Situationally conditional emotions | Emotions caused by mental states | Visual perspective | Mental states | False beliefs |
|--|---------------------|------------------------------------|----------------------------------|--------------------|------------------------|-------------------------|
| Use of symbolic functions in play | -0.24 p=0.21 | 0.14 p=0.43 | 0.12 p=0.50 | 0.10 p=0.57 | 0.20 p=0.27 | 0.28 p=0.12 |
| Understanding of symbolic functions in play | -0.02 p=0.90 | 0.10 p=0.56 | 0.18 p=0.33 | 0.17 p=0.36 | 0.19 p=0.31 | 0.34 p=0.06 |
| Use of symbolic functions in drawing | -0.26 p=0.15 | 0.34 p=0.06 | 0.46** p=0.00 | 0.00 p=0.99 | 0.31 p=0.08 | 0.44** p=0.01 |
| Understanding of symbolic functions in drawing | 0.11 p=0.54 | 0.48** p=0.00 | 0.44** p=0.01 | 0.18 p=0.32 | 0.39* p=0.02 | 0.38* p=0.03 |

Note: ** Significant p-level $\leq 0,01$, * Significant p-level $\leq 0,05$

Tables data showed, that play activity in younger children implies the development of ToM abilities using symbolic means to a lesser extent, and understanding does not rely on these abilities. While in drawing, the aspect of use is based on the ability to understand mental states. In older children, both use

and understanding of symbolic means implies understanding of mental states. If in drawing a graphic symbol is recognized as the total result of an activity, separated from its subject, then in play, the action with the substitute item is recognized at the moment without detachment from the person performing it, which removes the task of attributing a symbol to an absent subject that is inaccessible for children of 3-4 years old, and allows for the analysis of mental states.

Differences in the relationship between ToM and certain aspects of symbolic functions are also confirmed by studies of communication of preschoolers.

The manifestation of symbolic functions in communication was investigated in the process of real interaction between two children, where one of the participants spoke as a narrator of stories about mental and physical causality of events, and the other was a listener. During the interaction, both the retelling success (the use of symbolic means, that is, the detail and complexity of the description) and the level of understanding of the listener (understanding of symbolic means, that is, the basic meaning of the events described) were evaluated (Ulanova & Sergienko, 2015). The results of this work showed there is a mismatch between use and understanding and in verbal activity as a symbolic function.

6.2. The psychometric intelligence and symbolic function

The results of the previous phase of the study found differences in the relationship between the development of symbolic abilities and indicators of verbal, non-verbal and general intelligence, depending on the age of children (Koroleva & Sergienko, 2017). In children of 3–4 years of age, the use of symbolic means in drawing is associated with the general ($r=0.366$, $p < 0.05$) and non-verbal intelligences ($r=0.575$, $p < 0.01$), while in children 5-6 years of age there was a connection of understanding of symbolic means in drawing only with the index of verbal intelligence ($r=0.420$, $p < 0.05$). The similar nature of the correlations of psychometric intelligence with the use and understanding of symbolic means is also found with their indicators in play.

Analyzing the relationship between the development of symbolic functions in play and drawing and individual intellectual development, it was found that not only intellectual abilities that can play a role in the development of symbolic functions change with age, but the relationships themselves become qualitatively different (Figures 01, 02).

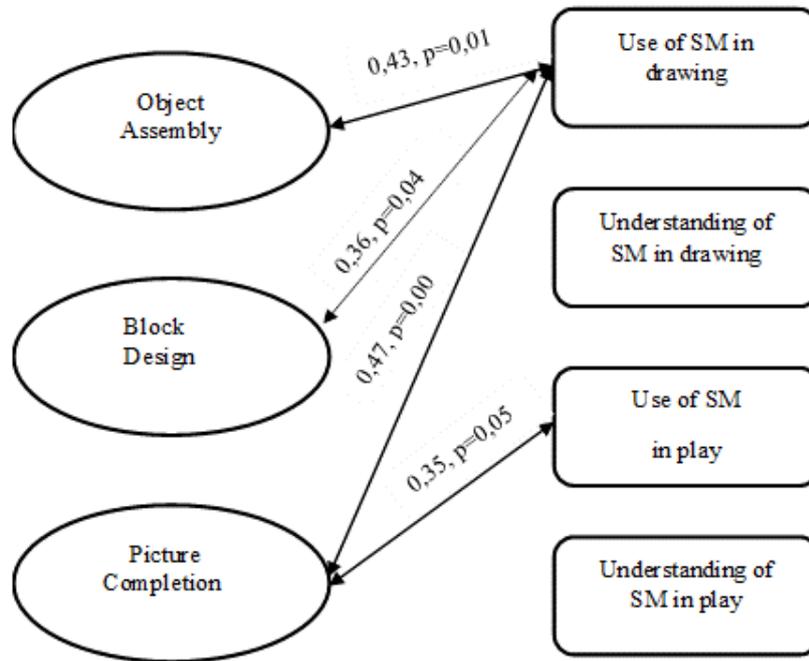


Figure 01. Correlations between symbolic functions in play and drawing and indicators for individual subtests of WPPSI in children aged between 3-4 years (SM –symbolic means)

In early preschool age, only the use of symbolic means in play and in drawing is associated with intellectual abilities. The results of the study of the relationship between the development of symbolic functions and intellectual development in a group of children between 5-6 years old, unlike children of 3-4 years old, showed the role of verbal intelligence in understanding and using symbolic means in drawing and playing.

It can be assumed that the ability to symbolize in drawing in children of 3-4 years old and children of 5-6 years old has differing reasons. If for younger children the ability to visualize the image of an object is significant, then for older children it is the knowledge about people's behavior, about the reasons for their actions.

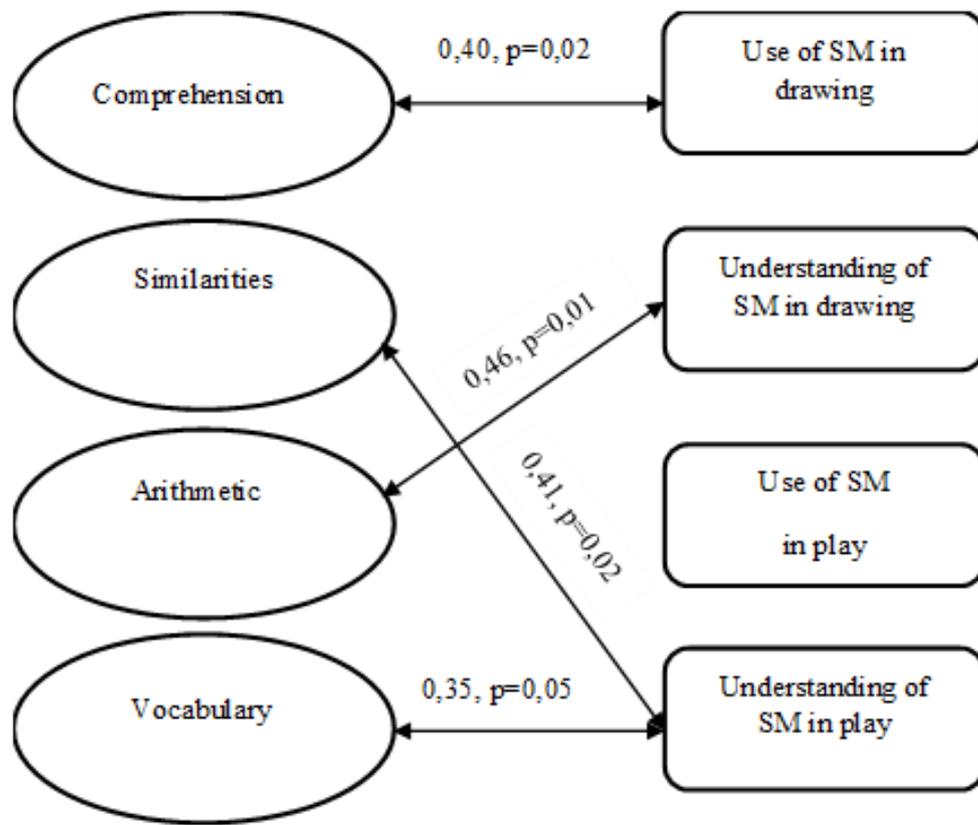


Figure 02. Correlations between symbolic functions in play and drawing and indicators for individual subtests of WPPSI in children aged between 5-6 years (SM –symbolic means)

Thus, ToM and psychometric intelligence form differing psychological systems that are interconnected with different types of symbolic activities (playing, drawing), and with various aspects of symbolization: using symbolic means and their understanding.

According to the theory of Vygotsky (1984), the development of symbolic functions is the cause of further mental development. If this were so, then regardless of the type of activity, we would have observed similar dynamics of the relationship of this ability with the development of theory of mind and indicators of psychometric intelligence. However, the results of our study contradict this statement. The data obtained show fundamental differences in the nature of the relationships of the studied abilities in play and drawing.

The lack of a unified dynamic of the development of symbolic functions in play and drawing, the heterochronic development of its individual components (understanding and use) is also not consistent with the point of view of Piaget (1969) on the development of this ability. Within his concept, the process of symbolization is subject to the general logic of cognitive development, reflecting its main stages, which also presupposes the consistency of its development indicators at different stages of ontogenesis with other mental processes and functions.

Both of these theories and subsequent research based on them are founded on the statement about a single line of development of symbolic functions. Our data indicate that this is not the case, which may explain the inconsistency of the results presented in the literature as part of the study of this problem.

7. Conclusion

1. The heterochronic and heterogeneous development of certain aspects of symbolic functions (use of symbolic means and their understanding) in various activities is shown.
2. Understanding and use of symbolic means have different support from the theory of mind at different stages of ontogenesis in different types of activity: in drawing, an increase in the number of connections of the theory of mind is observed both with understanding and using symbolic means. In play, most of the connections are found in 3-4 year-olds, and they weaken in 5-6 year-olds.
3. The role of psychometric intelligence in the development of symbolic functions changes with age. In children of 3-4 years old, intellect is associated with the use of symbolic means, in 5-6 year-olds with their understanding.

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