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DEVELOPMENT OF MIND AND BEHAVIOURAL CONTROL IN
PRESCHOOLERS WITH DIFFERENT MENTAL AGE

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Abstract

The article considers the mutual relations of theory of mind (ToM), behavioural control and verbal mental age. It describes the development of ToM and behavioural control in preschool children. Behavioural control is assessed by the Day-Night task, the Test of Child Anxiety by Tamml, Dorky and Aman and a series of neuropsychological tasks. ToM is assessed by the following tasks: visual perspective understanding tasks, the task for the understanding of desires, the task for the understanding of “seeing leads to knowing”, the first-order false belief task and the understanding of false belief in stories task. Verbal mental age is assessed by the subtest “Vocabulary” of the Wechsler Preschool and Primary Scale of Intelligence-III. One hundred and seventeen children at the age of three, four and five years old (36-72 months old, 48 males) have participated in the study. The results of typically developing children and children with low verbal mental age are compared. The children with low and normal mental age at the age of three differ in behavioural control, and at the age of three and four they differ in ToM. The role of verbal mental age in the development of theory of mind and behavioural control at the age of 3-4 years old is more significant than at the age of 5. At that age, these abilities do not correlate with the verbal mental age.

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Keywords: Behavioural control, theory of mind, verbal mental age, preschoolers.



1. Introduction

Considering the mutual development of self-regulation and theory of mind, we have to take into account a possible influence of the third factors on the development of these abilities.

We consider the cognitive and regulatory function of the subject, namely, the development of social understanding (theory of mind (ToM)) and self-regulation (behavioural control).

Behavioural control is a psychological level of self-regulation and one of the main factors of human adaptation to environment. It organizes human mental resources for goal achievement and provides an opportunity of goal-directed behaviour. ToM is the ability to attribute mental states to other people different from our own ones and the ability to consider these states as the cause of another person's behaviour (Sergienko et al., 2009).

One of the most important factors contributing to the development of behavioural control and ToM is speech. One of the main functions of speech is regulatory one (Luria, 1979).

2. Problem Statement

Wittke with colleagues think that parents and teachers assess executive functions (EF) of children with speech impairment to be significantly worse than those of typically developing ones. And, this estimate correlates with the level of speech abilities of the child (Wittke et al., 2013). Yang and Gray find that 4-5-year-old children with primary speech impairment show deficits in EF (working memory and cognitive flexibility) compared with their peers with typical development, but they have no impulsivity control impairment (Yang & Gray, 2017). On the contrary, Vissers with colleagues regard that preschool children with speech impairment suffer delays in impulsivity control, too. And, therefore, they suggest that both EF and the level of speech development contribute to speech delay (Vissers et al., 2015).

The role of speech in the development of ToM is also great, a certain level of its development is necessary for a successful understanding of the mental world of another person (Sergienko et al., 2009). Thus, the meta-analysis of 17 studies involving a total of 745 children aged 4-12 years old finds that children with speech impairment had a significantly lower level of ToM development than typically developing children at the same age. (Nilsson, de López, 2016).

Comparative studies of the development of theory of mind in typically developing children and children with autism spectrum disorders have shown the relationship between the success of performing tests on ToM and the verbal intelligence of children (Happe, 1995). In recent studies, the importance of the level of verbal development only is considered, but not a general level of intelligence as an indicator of success of the performance of ToM tasks. (Blijd-Hoogewys et al., 2008). At the same time, there is evidence that verbal abilities predict the development of EF but not ToM (Hughes & Ensor, 2007).

Our previous study shows the connection of the level of verbal intelligence and theory of mind in typically developing children and children with autism spectrum disorders (Sergienko et al., 2009).

Sometime earlier we found that the level of development of ToM is associated with the development of verbal intelligence in typically developing children at the age of 4-5 years old (Vilenskaya & Lebedeva, 2014), but nothing in children at the same age with speech impairment in the special kindergarten (Vilenskaya & Lebedeva, 2016). We assumed that such a result could relate to the effect of speech therapy in the special kindergarten.

The role of speech was shown in the development of ToM and EF, but the role of verbal mental age in both behavioural control and ToM has not been considered.

3. Research Questions

1. Are there any differences in the development of ToM and behavioural control in children with low verbal mental age and those, whose verbal mental age is equal to the chronological one or exceeds it?
2. Is there any connection between ToM's and behavioural control's variables and verbal mental age?

4. Purpose of the Study

The aim of this study is the comparison of the development of the behavioural control and ToM of preschoolers with a different level of verbal mental age (low or normal).

5. Research Methods

5.1. Subjects (cases)

The subjects under test were 117 children at the age of 3-5 years old.

Table 01. Characteristics of the subjects

Age	Children N	Sex (m/f)	Chronological Age Median	Chronological Age Range
3 years old	42	16/26	42	36-46
4 years old	44	20/24	54	48-59
5 years old	31	12/20	65	60-71

5.2. Methods

The tasks to understand the visual perspective of first and second levels, to understand the desires, the principle of the "seeing leads to knowing", the false beliefs (similar to "the Sally-Anne test") and the false beliefs in stories (Baron-Cohen, 2000; Vilenskaya & Lebedeva, 2014) were used to assess theory of mind. All the variables of ToM were measured on the basis of dichotomous scale: 0 = the task was not performed correctly; 1 = the task was performed correctly.

Behavioural control was assessed by the following methods:

- cognitive control by means of the Day-Night task (Gerstadt et al., 1994). The number of errors was recorded (the range of 0-18).
- control of the actions by means of some tasks from the Bailey Scales of Infant Development (BSID-2) and the Ozeretsky scale (Golovei, Rybalko (ed.) Practicum ..., 2001); for children of 5 years of age as well as the tasks from the Luria's neuropsychological battery (Akhutina, 2016) (the range of 0-7).

- emotional control with the help of the Children Anxiety test of Temml-Dorki-Amen (Practicum ..., 2001) (the range of 0-100%).

The assessment of verbal mental age of children was carried out using the Wechsler Preschool and Primary Scale of Intelligence Test- III (Ilyina, 2006), the subtest "Vocabulary" as the most revealing in its series.

For statistical analysis we used Statistica 6.0. and SPSS 19, with nonparametric Spearman rank order correlation. We used Fisher's angular transformation criterion to determine the differences in the success of performing certain tasks on theory of mind (ϕ).

6. Findings

6.1. The difference in a verbal mental age

According to the assessment of verbal mental age, we divided the children into 2 groups (Table 02): the children with low verbal mental age (the difference between the verbal mental age and chronological age more than 6 months in favour of chronological age – $CA > VMA$) and the children with normal mental age (verbal mental age is equal to chronological one or exceeds it – $CA \leq VMA$)

Table 02. Characteristics of the children with low and normal mental age

Age	Children N	Sex (m/f)	Chronological Age Median	Chronological Age Range	Verbal mental Age Median	Verbal mental Age Range
3 years old $CA \leq VMA$	36	15/21	42	36-46	48	36-54
3 years old $CA > VMA$	6	3/3	44.5	42-46	36	33-39
4 years old $CA \leq VMA$	35	15/20	53	48-59	54	48-56
4 years old $CA > VMA$	9	5/4	56	48-58	45	36-51
5 years old $CA \leq VMA$	10	5/5	62.5	60-69	63	60-72
5 years old $CA > VMA$	21	8/13	66	61-71	51	45-57

6.2. Overall group comparisons of the 3-5-year-old children with low and normal verbal mental age

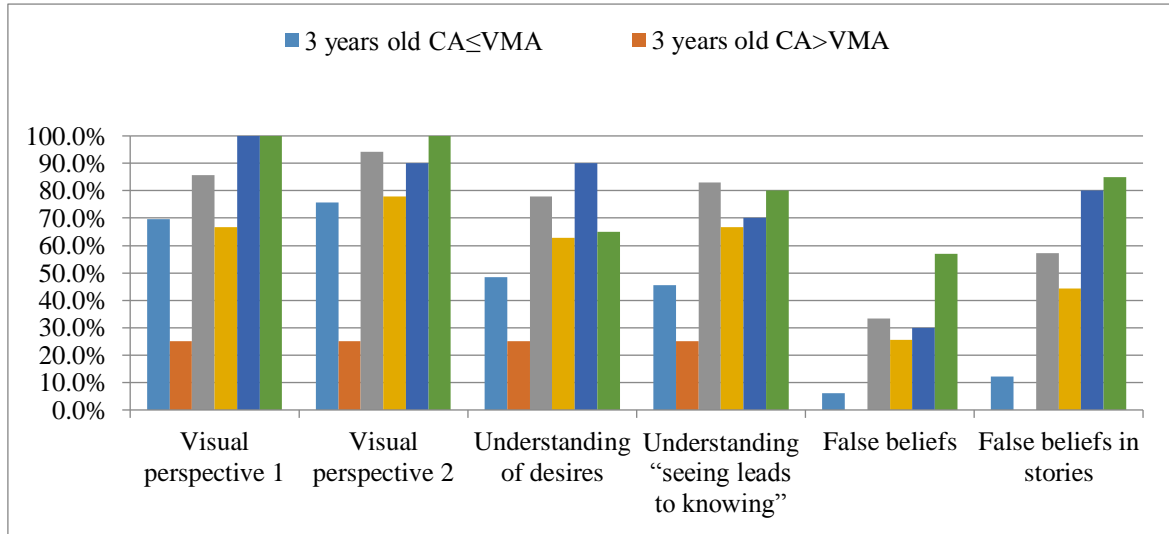


Figure 01. Results of ToM tasks performance (%) by the 3- 5-year-old children with low and normal verbal mental age

According to the our findings presented in Figure 01 and in Table 03, the children aged 3-4 years old with low verbal mental age performed the ToM tasks significantly worse than those whose verbal mental age was equal to chronological one or exceeded it. Significant differences for the children aged 5 years old were not found. Probably, the role of verbal mental age for the development of theory of mind decreased along with chorological age.

Table 03. Differences in the success of performing ToM tasks (Fisher's angular transformation criterion ϕ)

Comparison of the groups	Visual perspective 1	Visual perspective 2	Understanding of desires	Understanding "seeing leads to knowing"	False beliefs	False beliefs in a stories
3 years old CA ≤ VMA/ CA > VMA	1,755*	2,013*	2,79**	2,469**	1,795 *	2,013*
4 years old CA ≤ VMA/ CA > VMA	2,31**	1,64*	2,261*	2,214*	1,851*	1,66*
5 years old CA ≤ VMA/ CA > VMA	-	0.498	1.609	0.599	1.459	0.341

** Significant p-level ≤0,01, * Significant p-level ≤0,05

There were no significant differences in behaviour control between the children of low verbal mental age and those whose verbal mental age was equal to chronological one or exceeded it (Figure 02). The difference in performing the Day-Night task by the 4-year-old children showed slightly lower level of significance ($p < 0.057$).

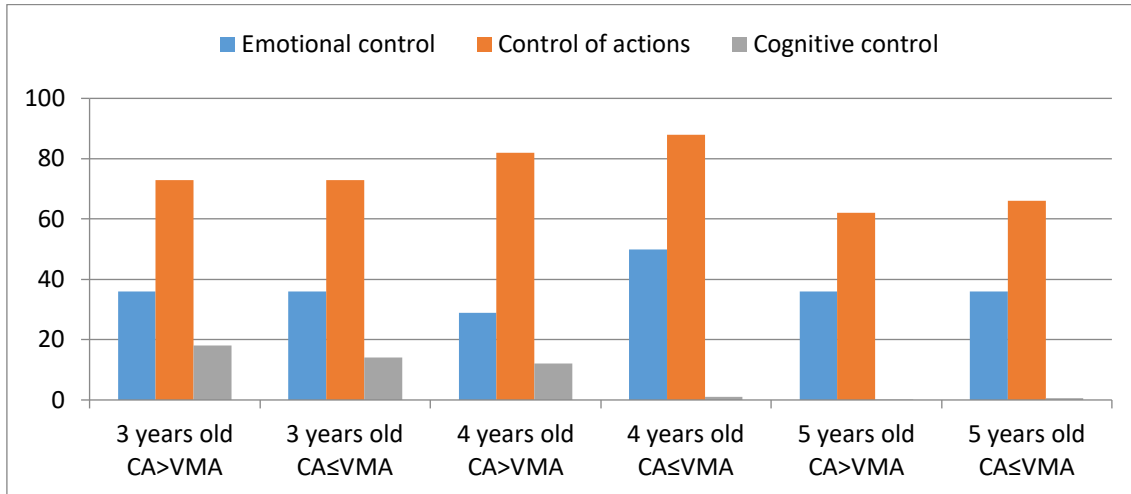


Figure 02. Results of the behavioural control tasks performance by the 3-5-year-old children with low and normal verbal mental age

6.3. The relation between verbal mental age and the performance of the ToM and behaviour control tasks

Correlation analysis of verbal mental age and generalized variable of theory of mind showed connection only in the group of the children at the age of 3-4 years old ($r = 0.453$, $p = 0.000$ and $r = 0.383$, $p = 0.000$), but not in the group of children aged 5 years old. These results are consistent with the other results of some studies (Sergienko et al., 2009; Lebedeva et al., 2012; BlijdHoogewys et al. al., 2008). For younger preschool children with the beginning of theory of mind development, the understanding of the mental world was really connected with verbal mental age.

Table 04. Correlations between behavioural control measures and verbal mental age

	3 years old			4 years old			5 years old		
	Children N	RSpearman	p-level	Children N	RSpearman	p-level	Children N	RSpearman	p-level
VerbMA & Emotional control	42	0,08	0,62	44	0,08	0,61	31	0,03	0,89
VerbMA & Control of actions	42	0,47**	0,001	44	0,2	0,2	31	0,23	0,2
VerbMA & Cognitive control	40	-0,32*	0,05	44	-0,16	0,31	31	-0,06	0,74

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

The results of correlation analysis of performing the tasks for behaviour control and verbal mental age were presented in Table 04. The correlations between verbal mental age and behavioural control indicators were observed only at the age of 3 years old as well as indicators of control of actions and cognitive control (in the "Day-Night" task, the number of errors was counted, so, a negative correlation meant that the children with a higher verbal mental age had made fewer mistakes in this task). The children aged 3 years old with a higher verbal mental age showed better results in control of actions and cognitive

control, but at older age this was no longer observed. Thus, verbal mental age was significant for the development of control of behaviour only at its initial stages.

7. Conclusion

The role of verbal mental age in the development of ToM and behavioural control varies along with chronological age. The connection between verbal mental age and theory of mind is observed in 3-4-year-old children, and between verbal mental age and behavioural control only in 3-year-old children. It is likely that at the age of 5 the development of these abilities is no longer connected with the level of verbal mental age. Studying these questions is the aim for a future research.

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