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The Impact of a Child's Sibling Position on Speech Fluency in 5- to 6-Year-Old Children

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Abstract

Introduction. The study examined the relationships between a child's sibling position and language development (based on active vocabulary volume and narratives' production). **Methods.** Six hundred seventy-four preschoolers (M = 70.2 months, SD = 4.01, 50.7% boys) from Moscow, Kazan, and Sochi (Russia) participated in the study. The children's parents filled out a form about the child's age, sex, and sibling position. Children were asked to create a story based on a series of pictures and were tested on their active vocabulary using a verbal fluency test and Raven's matrix test on nonverbal intelligence. We then analyzed how sibling position was interrelated with language development. **Results.** A regression model was built where the dependent variable was the child's speech rate, and the main predictor was the sibling position while controlling for such factors as the level of nonverbal intelligence, sex (gender), and age of the child. The results were interpreted via language input the child receives in the family. The study showed that the highest speech rate was observed in older and only children, and that sibling position significantly contributed to the rate of speech, but less strongly than the gender factor. **Discussion.** In future research we find it important to control sibling similarities within a family when comparing children with different sibling positions from different families.

Keywords

preschool age, sibling position, birth order, speech rate, narratives, gender differences

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Introduction

The cultural-historical approach postulates that the most important factor in a child's cognitive and emotional development is the social environment and the children's interaction with their environment because in the interactive process, interpsychic functions, being internalized, become intrapsychic (Hakkarainen & Bredikyte, 2021; Oshchepkova et al., 2021, Vygotsky, 1991). The child's main social environment is the family. Numerous studies have shown the definite role of family (specifically, parents' input) in cognitive and language development (Anderson et al., 2021; Clark, 2009; Kidd, & Donnelly, 2020).

The family's role in language development was studied thoroughly: the impact of socioeconomic status (Pungello et al., 2009) and mother-child interaction (Stolt et al., 2014). However, the impact of a child's sibling position has received relatively little attention.

The present study aims to determine the impact of sibling position on language development. This impact plays an increasingly important role in children's cognitive development in general because language strongly affects executive functions in preschool children.

Sibling Position

In a family a child has a sibling position. This means that the child is born first and stays the only child or has siblings, is born later and has older or younger siblings, or is a twin. So a child can have one of the following sibling positions: only child, firstborn child (eldest), later-born (middle), or last-born child (youngest) (Tsvetkova et al., 2022). Besides the notion of sibling position, there is a notion of birth order. This term takes into account only the child's birth order, meaning the child can be firstborn (regardless if she is an only child or has younger siblings) or later-born (and has older siblings and also possibly younger siblings or a twin).

The influence of birth-order on children's cognitive and language development was studied in numerous studies, although the results are inconsistent (Berglund et al., 2005;

Ketrez et al., 2017; Nafissi & Vosoughi, 2015; De Haan et al., 2014). Pine (1995) discovered that firstborns learned their first 50 words significantly earlier than secondborns. However, there was no significant difference in the age of acquisition of 100 first words. It was also shown that the influence of the birth-order factor is much less significant than sex (gender) and maternal education (Zambrana et al., 2012).

The Sibling Position effect on cognitive and language development

The main conclusion of the meta-analysis on the birth-order effect on language development made by Nafissi and Vosoughi (2015) is as follows: "The debate continues. Maybe further researches can clarify this interesting line of research with more scrutiny in the near future" (Nafissi & Vosoughi, 2015; 1968). However, several studies have shown that firstborns were better in language tests, and later-borns were better in conversational abilities (Hoff-Ginsberg, 1998; Keller et al., 2015).

Sibling position's influence on cognitive development has been examined in numerous studies and has been proven to be an important factor of developmental particularities (Abdulla Alabbasi et al., 2021; Luo et al., 2022), but the effects in different studies were not identical. For example, Almazova and Mostinets (2023) found that the level and structure of executive functions in the only and youngest children in the family are more similar to each other than in the oldest and only children or in the oldest and youngest children. Contrariwise, no significant difference was found between only children and firstborn children with siblings nor between middle- and later-born children in divergent thinking (Abdulla Alabbasi et al., 2021). Whereas the confluence model, built by Zajonc and Markus (1975) demonstrated positive as well as negative effects of birth order on intellectual development, a necessarily negative effect of family size, and a handicap for the last born and the only child (Zajonc & Markus, 1975).

Language development in children begins from birth. At preschool age, language development is measured in different ways. The aspects most studied are active or passive vocabulary and narrative ability (Gao et al., 2023; Souza & Cáceres-Assenço, 2021). Active and passive vocabulary and narrative ability grow significantly at this age (Oshchepkova & Shatskaya, 2023). So the factors that influence language improvement in preschool children are in demand. Numerous studies showed that the external input is one of the most important factors of language development (Meredith & Catherine, 2020). The family proved to be the most important source of language input (Hoff-Ginsberg, 1998; Holzinger et al., 2020).

As mentioned earlier, sibling position within the family is one of the most critical characteristics of a child. Consequently, the influence of a child's sibling position on their language development is one of the questions that needs to be studied more thoroughly. Yet the mentioned studies (Hoff-Ginsberg, 1998; Keller et al., 2015) do not permit to give definite answer to the research question if sibling position is interrelated to language development.

Speech rate, or narrative fluency, has mostly been studied within the context of L2 and been associated with overall speaking proficiency (Arslan et al., 2023). Narrative fluency in first language acquisition has been rarely studied, and studies about sibling position's impact on speech rate are missing. It was also shown that fluency rates in conversation could depend on age, gender, topic, and other factors (Bortfeld et al., 2001).

The Research Question of the current study is whether there is influence of sibling position on language development, particularly on narrative ability, while controlling for such factors as the level of nonverbal intelligence, sex (gender), and age of the child.

Methods

Participants

Six hundred seventy-four preschoolers (*M* = 70.2 months, *SD* = 4.01, 50.7% boys) participated in the study. The children attended senior kindergarten groups in Moscow, Kazan, and Sochi (Russia). Their parents filled out a form about the child's sex (gender), age, diseases, bilingualism, and sibling position. There were four positions: only child, firstborn child (eldest), later-born (middle), and last-born child (youngest). Children with medical diagnoses and bilinguals with Russian 2L were excluded from further research.

Assessments and Measures

Two instruments were used for language development assessment: a verbal fluency test and a narrative production test.

The verbal fluency test consisted of two subtests: general and semantic (action naming). In the first, a child is asked to name all the words they know in one minute. In the second, the child is asked to name as many actions as possible in one minute. One point was given for each correct answer and 0.5 points for each word combination. If a child repeats what they has already said or pronounces nonsense, 0 points were given.

For the narrative production test, children were given a series of pictures from the MAIN method (Multilingual Assessment Instrument for Narratives) (Gagarina et al., 2019) and asked to create a story based on this series of pictures. Each child's story was transcribed and assessed regarding the microstructure of the narrative (its vocabulary and grammar) (1–10 points), the macrostructure of the narrative (its adequacy and completeness) (1–10 points) (Veraksa et al., 2020) and the speech rate (the ratio of words number to story time) (Kartushina et al., 2022).

Children were also tested on nonverbal fluid intelligence levels. The child's nonverbal fluid intelligence was assessed with Raven's Colored Progressive Matrices (Raven & Court, 1998), in which the children were asked to match a missing piece that corresponded with three other pieces. The number of correctly completed tasks was counted, and time was

not considered. Every correct answer received a point; the final score could vary between 0 and 36.

Procedure

The study was conducted individually in a bright, quiet room of the preschool educational institutions attended by children at the time of testing. One meeting lasting 15–25 minutes was organized with each child. Children were free to stop the test at any time. All children received a small gift (sticker) for their participation. All techniques were presented to children in the same established order. Assessment was carried out by specially trained testers (undergraduate and graduate students of the Faculty of Psychology). All parents were informed about the study's aims and gave written consent for their children's involvement in the research. The study was approved by the Ethics Committee of the Faculty of Psychology at Lomonosov Moscow State University (Approval No: 2022/23).

Results

Descriptive statistics

We compared the number of children in each sibling position in the first stage. Only children comprised 26.1% of the children, 19.4% older children, 10.1% middle, and 44.4% youngest (Table 1). As can be seen, the group of younger children was the most numerous. Descriptive statistics for the speech rate in different sibling positions show that the highest rate was characteristic for older and only children (Table 2).

Table 1
Descriptive Statistics for Sibling Positions

	Only	Eldest	Middle	Younger
%	26.1	19.4	10.1	44.4
M (month)	70.1	70.6	70.5	70.1
Sd (month)	3.93	4.32	4.01	3.92

Table 2
Descriptive Statistics for Speech Rate in Different Sibling Positions

Siblings position	Mean	Median	SD
Older	.874	.880	.280
Youngest	.790	.797	.297
Only child	.867	.846	.264
Middle	.743	.765	.270

Language development in different sibling position

The differences in the parameters of language development between sibling position groups were later analyzed (verbal fluency and narrative aspects) using the one-way Kruskal–Wallis analysis since the Shapiro-Wilk normality test and Levene's test for homogeneity showed that the sample did not follow a normal distribution for any of the language (narrative) parameters. The results showed that there were significant differences between sibling position groups only in the speech rate measure ($\chi^2 = 18.397$, $p < 0.001$, $\varepsilon^2 = 0.03$), but no significant differences were found in general verbal fluency test ($\chi^2 = 7.883$, $p = 0.05$, $\varepsilon^2 = 0.01$), semantic verbal fluency (actions naming) ($\chi^2 = 0.933$, $p = 0.817$, $\varepsilon^2 = 0.001$), narrative length ($\chi^2 = 5.350$, $p = 0.148$, $\varepsilon^2 = 0.008$), nor the narrative's duration ($\chi^2 = 7.265$, $p = 0.064$, $\varepsilon^2 = 0.01$), narrative macrostructure ($\chi^2 = 1.825$, $p = 0.609$, $\varepsilon^2 = 0.002$), or narrative microstructure ($\chi^2 = 1.713$, $p = 0.634$, $\varepsilon^2 = 0.002$).

Speech rate in different sibling positions

Next, we analyzed the speech rate assessment since significant differences were found between children with different sibling positions (see section 3.2). We built a regression model to answer the second research question: what impact does this factor have on children with different sibling positions with regard to the child's sex (gender), age, and level of nonverbal intelligence? The dependent variable was the child's speech rate, and the main predictor was the sibling position while controlling for such factors as the level of nonverbal intelligence, sex (gender), and age of the child.

The final regression model was significant ($R = 0.252$, $R2 = 0.064$, $AdR2 = 0.057$, $F = 8.95$, $p < 0.001$). As a result, the most significant factor for speech rate was the sex of a child ($t = 3.84$, $p < 0.001$). Results showed that the speech rate is significantly higher in girls than boys (Figure 1).

It was also shown that the child's age is also a significant factor: the older the child, the higher their rate of speech ($t = 3.146$, $p = 0.002$). The sibling position factor showed its significance in the following cases: a significant difference was found between younger and older children in favor of the older ones ($t = -2.911$, $p = 0.004$), as well as between middle and older children in favor of the older ones ($t = -3.121$, $p = 0.002$). No significant differences were found between only and older ($t = -0.283$, $p = 0.777$). At the same time, the highest rate of speech was observed among older ($M = 0.874$, $SD = 0.280$) and only children ($M = 0.867$, $SD = 0.264$); it was lower among younger children ($M = 0.790$, $SD = 0.297$) and the lowest among middle-aged children ($M = 0.743$, $SD = 0.270$) (Figure 2).

Figure 1
Differences in speech rate between boys and girls

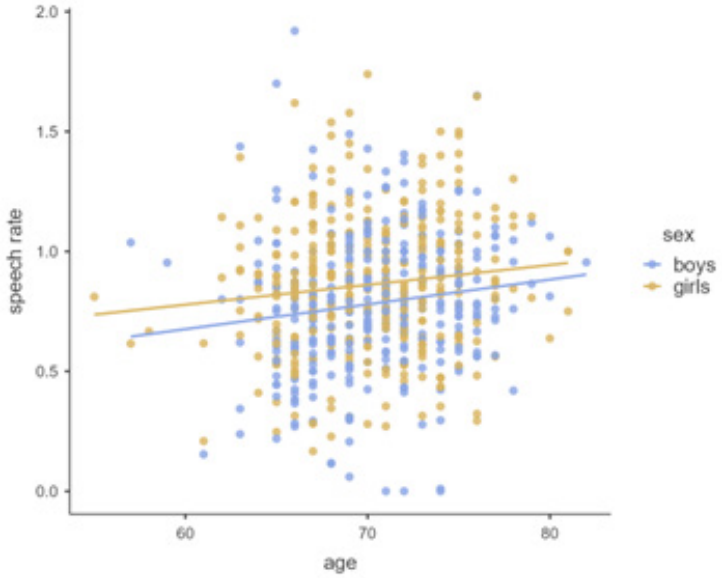
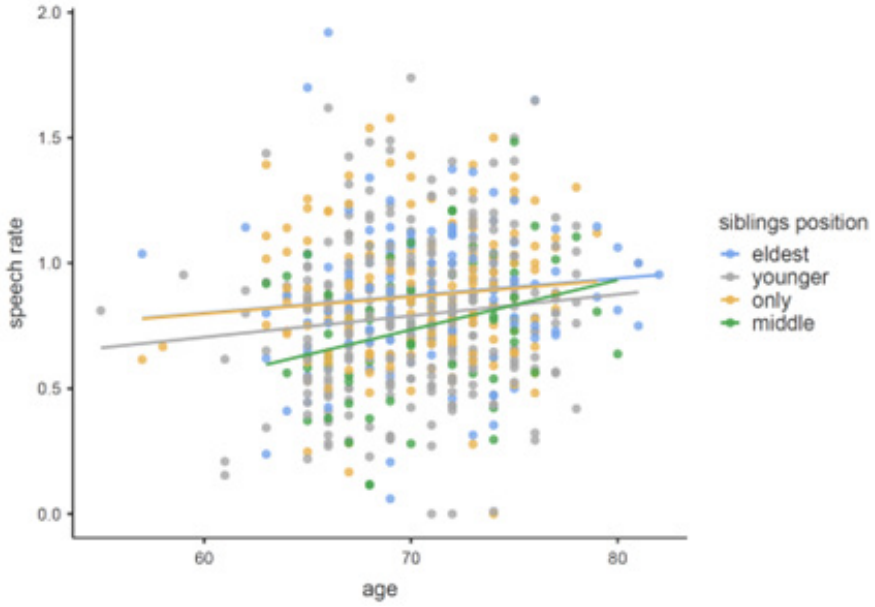


Figure 2
The difference in speech rate between children with different sibling positions



Nonverbal intelligence level was not a significant factor for speech rate (t = 0.540, p = 0.589) in the current linear regression model.

A Kruskal-Wallis analysis also found significant differences in speech rate between different sibling positions ($\chi^2 = 18.4$, $p < 0.001$; $\varepsilon^2 = 0.03$). Thus, according to the results of pairwise comparisons, the DSCF Post-Hoc Test showed that older children had a significantly higher speech rate than younger ($W = -4.247$, $p = 0.014$) and middle children ($W = -4.383$, $p = 0.010$). Only children had significantly higher speech rates than middle-born children ($W = -4.175$, $p = 0.017$) and younger children ($W = -4.132$, $p = 0.018$). At the same time, there are no significant differences in speech rate between only and older children ($W = -0.690$, $p = 0.962$).

Discussion

Contrary to studies (Pine, 1995; Schults et al., 2012), we found no difference in active vocabulary for children with different sibling positions. We suppose this is due to the children's age because differences were noticed in children before 36 months, and we studied children of 70 months. However, it was shown that language differences in first- and later-borns disappeared with age (Hoff-Ginsberg, 1998; Fenson et al., 1994). Moreover, our finding differed from other research on the impact of birth order on language development (Bornstein et al., 2004; Luo et al., 2022; McFayden et al., 2022; Skeat et al., 2010; Tomblin, 1990) in that we did not find sibling position impacted most language measures (active vocabulary, narrative's micro- nor macrostructure). The only measure that showed a significant correlation with sibling position is the speech rate (the ratio of the number of words in the narrative and the narrative's duration). The speech rate is a measure that depends on numerous factors: parental input (Guitar & Marchinkovski, 2001), age (Martins et al., 2007), gender (Van Borsel & De Maesschalck, 2008), language and culture (Narayan & McDermott, 2016).

The children's speech rate in our study proved to be much lower than that of other studies. For example, in (Martins et al., 2007), the speech rate of 5-year-olds was 64.1 words per minute, and for 7-year-olds was 73.2 words per minute. In our study, the average speech rate is 0.82 words per second or 49.11 words per minute. We suppose that this is due to Russian vs. English language particularities. Previous studies have shown that the speech rate in English is higher than in Russian (Ryabov et al., 2016).

Our study showed that the most significant factor for speech rate was the sex of a child (girls significantly outperformed boys). These results agree with other studies, showing that firstborn girls outperformed the other groups of children in speech fluency (Zambrana et al., 2012). Other studies (Eriksson et al., 2012) showed that girls outperformed boys in different language aspects. However, a Turkish study on speaking adults (Emrah Cangi et al., 2020) showed that males outperformed females in speaking and articulating rates.

The second most significant factor influencing our study's speech rate is the child's age (66 to 74 months). Martins et al.'s (2007) study found that the speech rate

of discourse (describing pictures) increased with age (from 5 to 17 years old) and was strongly correlated with semantic verbal fluency (naming of animals and food) and did not correlate with phonemic fluency. More precise research showed that the speech rate grows until adolescence and decreases in older adults (Nip & Green, 2013; Quené, 2007). In the present study, we confirmed the impact of age on speech fluency: in older children, speech fluency is higher.

The significance of the level of nonverbal intelligence was also discovered: in children with a low level of nonverbal intelligence, the speech rate was significantly lower than in children with an average rate. This corresponds with studies showing that language development is associated with executive functions (Kovyazina et al., 2021) and, more precisely, with nonverbal intelligence in preschoolers (Lacalle et al., 2023). However, since no significant difference was found between children with high and average levels of nonverbal intelligence, the relationship between speech rate and nonverbal intelligence needs to be retested in future studies, taking into account additional control variables.

The impact of sibling position on speech rate in our study showed no difference between an only child and older children, but a significant difference between only children on the one side and middle and younger children on the other side so as between older children on the one side and middle and younger children on the other side. This can be understood via the notion of birth order as only older children are firstborns, and middle and younger children are later-borns. Consequently, the explications of the difference between first- and later-borns can be applied to our study. As was shown by Hoff-Ginsberg (1998), mothers spoke more with firstborns and used longer and more complex phrases.

The data obtained are in accordance with the studies that showed better language development in firstborns (Pine, 1995; Schults et al., 2012). There are no published data about the interrelations between sibling position and speech rate in narratives, so we cannot compare our data with others.

Numerous studies (for example, (Ferjan Ramírez, 2024; Valitova, 2022) have discovered that parental input via child-parent interaction is a key predictor of a child's language development from a longitudinal perspective. The higher speech rate of firstborn children compared to that of later-born is in contrast with T. Kokkinaki's (2018) findings that "mothers of second-born infants are more likely to address verbal content to their infants (75.4%) compared to mothers of firstborn infants (65.5%)" (p. 1475). In addition, our result is inconsistent with the results obtained by Brody et al. (2003), who found that the oldest and middle children in the family are better at speech recognition from people of different genders and ages than the youngest and only children. We posit that only children growing up surrounded by adults or the youngest children interacting with older children show better language development. In other words, the only child will continue to speak mostly with adults in the family, and the older children take the role of an adult toward the younger ones, who are favorites and "babies" compared to other family members, but there is no known research known that supports this idea.

One more possible explanation is the fact that properties of the language input reflect properties of caregivers (Huttenlocher et al. 2007). For example, effects of birth order, such as its influence on IQ (e.g., Bellmont & Marola 1973), disappear when siblings are compared with each other (Wichman et al. 2006).

Conclusion

The child's interaction with their environment plays the definite role in cognitive and language development. Although child's interaction with mother is well studied, other family's positions are underestimated. The current study aimed to show the role of sibling position in child's language development.

The study showed that significant differences in language outcomes depending on sibling position were found only for the speech rate measure: the highest speech rate being observed in older and only children. Moreover, children in both these sibling positions have a significantly higher speech rate than that of the middle and younger children. At the same time, based on the results of the constructed regression models, sibling position significantly contributes to the rate of speech, but less strongly than the gender factor - in girls, the rate of speech is higher than in boys. The factor of the child's age also turned out to be significant: the older the child, the higher her speech rate.

Research on the influence of sibling position is still in progress, so the explanation of the effects found is still limited. It is necessary to compare language input via parent-child interaction in large families (including sibling communication) and in only-child families. Furthermore, it is important to control sibling similarities within a family when comparing children with different sibling positions from different families.

The results indicate that speech rate may depend on the time a mother speaks to a child: more frequently mother–child interaction takes place, more fluently the child speaks.

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Conflict of Interest Information

The authors have no conflict of interest to declare.