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Psychological Assessment

Theory of mind complex task: Validity based on relationships with external variables

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Abstract

Most research on Theory of Mind (ToM) focuses on preschool years, with few studies targeting later years, especially in the national context. This study aimed to investigate evidence of the validity of a Theory of Mind Complex Task from the relationship with the external variables: age, type of school, and vocabulary. Ninety-eight children, aged between 6 and 9, from private and public schools participated. Results showed age and school effect, with better performance of children from private schools. There was a positive, significant, and moderate magnitude correlation with vocabulary. This study provides the first sources of evidence of task validity, indicating that age and type of school were relevant variables for ToM performance, and therefore should be considered in the elaboration of future norms.

Keywords: theory of mind; validity; social cognition; age; type of school.

TAREFA COMPLEXA DE TEORIA DA MENTE: VALIDADE BASEADA NAS RELAÇÕES COM VARIÁVEIS EXTERNAS

Resumo

A maior parte das pesquisas sobre a teoria da mente (ToM) concentra-se nos anos pré-escolares, sendo poucos os estudos direcionados aos anos posteriores, principalmente em contexto nacional. O objetivo deste estudo foi investigar evidências de validade de uma tarefa complexa de ToM a partir da relação com variáveis externas: idade, tipo de escola e vocabulário. Participaram 98 crianças, entre 6 e 9 anos de idade, de escolas privadas e públicas. Os resultados obtidos mostraram efeito de idade e de escola, com melhor desempenho das crianças de escolas privadas. Houve correlação positiva, significativa e de magnitude moderada com vocabulário. Este estudo disponibiliza as primeiras fontes de evidências de validade da tarefa, indicando que idade e tipo de escola se mostraram variáveis relevantes para o desempenho em ToM, as quais, por isso, devem ser consideradas na elaboração de normas futuras.

Palavras-chave: teoria da mente; validade; cognição social; idade; tipo de escola.

TAREA COMPLEJA DE LA TEORÍA DE LA MENTE: VALIDEZ BASADA EN RELACIONES CON VARIABLES EXTERNAS

Resumen

Las investigaciones sobre la teoría de la mente (ToM) se centra en los años preescolares, especialmente en el contexto nacional. El objetivo de este estudio fue investigar la evidencia de la validez de una tarea compleja de la ToM a partir de la relación

con variables externas: edad, tipo de escuela y vocabulario. Participaron 98 niños, de edades comprendidas entre 6 y 9 años, de escuelas privadas y públicas. Los resultados mostraron efecto de la edad y escolar, con un mejor desempeño de los niños de escuelas privadas. Hubo una correlación de magnitud moderada, positiva y significativa con el vocabulario. Este estudio proporciona las primeras fuentes de evidencia de la validez de la tarea, indicando que la edad y el tipo de escuela son variables relevantes para el desempeño de la ToM y, por lo tanto, deberían considerarse en la elaboración de normas futuras.
Palavras clave: teoria de la mente; validez; cognición social; edad; tipo de escuela.

1. Introduction

Theory of mind (ToM) refers to the ability to attribute different mental states to oneself and others (Happé, Cook & Bird, 2017). This ability allows the individual to predict and explain behaviors based on the inference of desires, beliefs, and emotions (Wellman, 2018), being one of the important factors influencing the social adaptation and relationship with peers (Slaughter, Imuta, Peterson, & Henry, 2015). ToM is known to develop in association with fewer behavior problems and higher rates of mental health during childhood (Gonçalves, 2017; Imuta, Henry, Slaughter, Selcuk, & Ruffman, 2016), which makes its assessment necessary.

The assessment of ToM in childhood is commonly based on the false-belief paradigm (Oliveira & Mecca, 2016; Osório, Castiajo, Ferreira, Barbosa, & Martins, 2011). In general, these tasks have the format of stories or vignettes, in which the character has a belief that does not match reality (Osório et al., 2011; Wellman, Cross, & Watson, 2001). Throughout their development, children are expected to become more adept at attributing false beliefs to others and predicting their behavior based on these inferences (Oliveira & Mecca, 2016; Wellman et al., 2001; Wellman, 2018).

Children at around 4 and 5 years of age having a typical development can successfully perform tasks of false belief (Wellman, 2018; Wellman et al., 2001). From the age of 6, more complex aspects of ToM emerge (O'Hare, Bremner, Nash, Happé, & Pettigrew, 2009; Souza & Velludo, 2016), such as the understanding of second-order mental states (inference that the child makes about a character's mental state of a third character), detecting gaffes and more sophisticated mental states (Devine & Hughes, 2013). In turn, such development associates with different factors, such as age, language, quality of pedagogical and social interaction

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experiences, family context, socioeconomic level (SEL), among others (Grazzani, Ornaghi, Conte, Pepe, & Caprin, 2018; Hughes & Devine, 2015; Mecca, Gonçalves, Pontes, & Dias, 2016; Rodrigues, Pelisson, Silveira, Ribeiro, & Silva, 2015; Souza & Velludo, 2016). Thus, such variables should be considered when investigating the development of ToM.

Concerning age, there is a significant effect of this variable on the performance of ToM tasks (Rodrigues et al., 2015; Oliveira, 2016; Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999). A study using the task *Faux Pas* (for identifying gaffes) with a sample of children aged between 7 and 11 having typical development and autism spectrum disorder (ASD) showed that there was progression in performing the task as age increased in the typical group (Baron-Cohen et al., 1999). However, the most recent findings reported by Devine and Hughes (2013) suggest that the age may vary depending on the type of task used. In a study with children aged between 8 and 13, the authors observed that there was no influence of age on *Strange Stories* (a complex task comprising vignettes in which the child has to identify the character's mental state before they can understand the character's action). In the task *Silent Films* (short film clips from a classic silent comedy describing cases involving deception, misunderstanding, and false beliefs), age proved to be an influencing variable.

For the type of school, Rodrigues et al. (2015) found that children aged between 4 and 5 attending private schools perform better than children from public schools in tasks that aimed at assessing different desire and belief, false belief, and detecting real emotion and apparent emotion. According to the authors, these results can be explained by possible differences in the experiences that children attending public and private schools have, since different socioeconomic and even cultural contexts come into play. Still, these findings cannot be compared to other national studies, due to the lack of research in the field in Brazil.

One of the challenges in assessing ToM in Brazil's national context is the scarcity of instruments relying on studies that examine psychometric properties (Mecca, Dias, Oliveira, & Muniz, 2018). Due to the absence of standardized tests, with studies having valid evidence that could guide the interpretation of scores, there are different tasks used in the literature that differ as to their presentation, form, and length of administration, as well as the manner they describe and

make records of scores (Ahmadi, Jalaie, & Ashayeri, 2015; Mecca et al., 2018; Osório et al., 2011).

Still, it should be mentioned that much of the research on ToM development has been conducted on tasks that evaluated singular aspects of ToM, which prevented investigators from recording changes over time and led to unreliable and almost unrepresentative measurements of the construct (Devine & Hughes, 2013; Osório et al., 2011; Mecca et al., 2018).

Considering such limitations, Mecca et al. (2018) developed the Theory of Mind Test for Children (TMEC), which consists of four distinct tests: understanding of perspective, attribution of thought, attribution of basic emotions (with these subtests being designed to assess explicit aspects of ToM that are developed during the preschool period), and finally, a fourth task, which investigates more complex attributions, such as second-order ToM, gaffe detection, and subtle aspects of communication that denote more refined mental states (Baron-Cohen et al., 1999; Corcoran, Mercer, & Frith, 1995; O'Hare et al., 2009).

TMEC subtests were developed based on existing assumptions and have a gradually increasing level of difficulty, starting with simple tasks and going all the way up to more complex tasks. According to Mecca et al. (2018), the instrument initial objective was to assess children aged betwenn 4 and 6, but the authors chose to include the ToM from complex situations and emotions task, because children up to the age of 5 successfully complete simpler (first-order) ToM tasks, according to the cited literature. Accordingly, the inclusion of a more complex task would allow the use of the test in children of other ages and avoid a ceiling effect in preschoolers, a hypothesis previously corroborated in the study by Oliveira (2016).

The first studies including the four TMEC tests indicated there was evidence of content validity for children aged beween 4 and 6 (Mecca et al., 2018), as well as evidence of validity based on relationships with external variables, such as language and intelligence (Oliveira, 2016), executive functions (Dias, Batista, & Mecca, in press), maternal education (Pontes, 2016), and mental health indicators (Gonçalves, 2017). Regarding age, when comparing performance among children aged 4, 5, and 6, a progression of scores was noted, especially from 4 to 6 years of age. In the last test, which evaluates complex aspects of ToM, there is a significant increase in performance as age increases. Still, children aged 6, on average, correctly answered 4 to 5 vignettes among the 7 making up the test (Oliveira, 2016). This

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indicates that the type of attribution called for by the test may involve a longer course of development, i.e., along school years.

This hypothesis is also anchored in the study by O'Hare et al. (2009). The authors used vignettes similar to those making up the TMEC for children aged between 7 and 12. The results showed that there was no ceiling effect on the score. The results reported in the field literature that ToM continues its development throughtout adolescence and adult life (Corcoran et al., 1995; Happé et al., 2017; Souza & Velludo, 2016).

Considering the scarcity of tasks for assessing ToM, as well as the lack of studies using TMEC test 4 for school-age children in the Brazilian context, this study aims to investigate evidence of validity based on the relationship with external variables for the ToM task from complex situations and emotions. To meet that end, it was designed to investigate the effect of age and type of school on test performance, in addition to the relationship with vocabulary assessment in a sample of school-age children. Finally, and in an exploratory manner, the difficulty gradient of the items will be checked as the percentage of correct answers. The study may provide evidence about the applicability of the task to this new age group.

2. Method

2.1 Participants

The participants were ninety-eight children (58.16% female) aged between 6 and 9 (A = 7.47 years; SD = 1.01), students from the 1st to the 4th year of elementary school attending public (N = 51) and private schools (N = 47) in Porto Alegre, Brazil.

The exclusion criteria were: school failure, oral language complaints (speech changes or delay, among others), uncorrected sensory difficulties (auditory and/or visual), previous history of diseases (psychiatric, neurological or known syndromic conditions; as evaluated by the Health, Sociodemographic and Cultural Factors Questionnaire for Child Neuropsychological Assessment), IQ below 80 as assessed by the Wechsler Abbreviated Scale of Intelligence (WASI) and symptoms of inattentiveness, hyperactivity and impulsivity as assessed according to the cutoff point in the Swanson-Nolan-Pelham – IV Questionnaire (MTA-SNAP-IV). Based on these criteria, 27 children were excluded (one with a diagnosis of anxiety disorder;

eight with an IQ < 80 as per the WASI; five with indicators of inattentiveness and/or hyperactivity above the cutoff point according in the MTA-SNAP-IV; two with disabilities due to uncorrected hearing loss; three with specific learning disorder; three with ASD; four with oral language problems; and one child who had suffered traumatic brain injury), resulting in a final sample comprised of 98 children.

For a better characterization of the sample, Table 2.1.1 shows information on their intellectual and socioeconomic level (SEL), both of which were significantly higher in students from private schools.

Tabela 2.1.1: Characterization of groups (attending private or public schools) according to intellectual and socioeconomic levels.

	Private		Public		
	M	SD	M	SD	*t*
WASI Total IQ	109.77	14.24	92.63	9.18	7.13**
WASI Vocabulary	57.26	11.23	45.08	7.42	6.43**
WASI Matrix Reasoning	53.04	8.22	46.45	6.06	5.53**
Total BECC	37.89	7.85	22.40	7.85	9.61**

Note. M = Mean; SD = standard deviation; WASI = Wechsler Abbreviated Scale of Intelligence; BECC = Brazil's Economic Classification Criterion.
** $p < 0.01$

2.2 Instruments

- *Questionnaire on Health, Sociodemographic and Cultural Factors for Child Neuropsychological Assessment* (Fonseca, Jacobsen, & Pureza, 2015): investigates the child's demographic data, clinical and educational history. Answered by the child's parents/guardians and used for characterizing the sample and identifying children who meet the study's exclusion criteria. It includes Brazil's Economic Classification Criterion – BECC (Associação Brasileira de Empresas de Pesquisa, 2016), for assessing the SEL.
- *Swanson-Nolan-Pelham – IV Questionnaire – 'Multimodal Treatment Study for ADHD' – MTA version (MTA-SNAP-IV)*: public domain questionnaire, formulated as based on the *Diagnostic and Statistical Manual of Mental Disorders: DSM-IV* criteria, with the objective of assessing Attention deficit/hyperactivity disorder

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symptoms. It is comprised of the description of the 18 symptoms making up criterion A of the disorder and is used even in non-clinical contexts for identifying indicators of inattentiveness and hyperactivity. Each item needs to be scored on a Likert scale containing four levels of severity (not a little, just a little, a lot, and too much). It was answered by the parents, and the cut-off point (at least 6 items marked as 'a lot' or 'too much') was considered for each dimension for exclusion purposes. The Brazilian version was adapted and validated by Mattos, Serra-Pinheiro, Rohde, and Pinto (2006).

- *Wechsler Abbreviated Scale of Intelligence – WASI* (Wechsler, 2014): a brief intelligence assessment instrument which provides information on total, execution, and verbal IQs. IQ indexes were estimated by using two subtests: vocabulary, which assesses crystallized intelligence, language, and semantic memory, and the matrix reasoning subtest, which assesses fluid intelligence and the understanding of rules. As a cut-off point, an IQ below 80 was considered as an exclusion criterion. Additionally, the performance (raw score) in the vocabulary subtest was considered for the statistical analyzes.
- *Theory of Mind Test for Children – TMEC* (Mecca et al., 2018): originally developed with the aim of assessing the ability to attribute mental states or ToM in preschool children. The TMEC is comprised of four subtests that evaluate different aspects of ToM: 1. perspective understanding; 2. attribution of thought and knowledge; 3. attribution of basic emotions; and 4. ToM from complex situations and emotions. In this study, only subtest 4 was used, and it consisted of seven vignettes assessing more sophisticated aspects of ToM, including the child's ability to understand lies, misunderstandings, inverted emotions, pretending/fantasy, double-bluffing, explicit inappropriate behavior/"gaffes", and implicit intention. Raw scores were considered for reality understanding (RU; a general measure of understanding of the situation that can be used as a baseline) and mental state understanding (MSU) indexes.

2.3 Procedures

The study is part of the broader project "Developmental and socio-cultural factors predicting school performance: basis for intervention in reading comprehension" approved by the Research Ethics Committee (Certificate of Presentation for Ethical

Appreciation – CAAE: 82073317.9.0000.5336; Approval Number: 2618039). Initially, authorization was requested from the educational institutions before conducting the research. Following that, those legally responsible for the children were invited and those who agreed to them participating in the study were asked to sign a Voluntary Informed Consent Form; the children were also asked to sign the Informed Consent Form.

Parents/Guardians were then asked to answer a Questionnaire on Health, Sociodemographic and Cultural Factors for Child Neuropsychological Assessment and the MTA-SNAP IV. The children were assessed individually in a room provided by the schools in two sessions: in the first session, WASI was administered and, in the second session, the ToM task from complex situations and emotions was used.

Statistical analyzes were performed in the aid of the IBM SPSS Statistics 23 software. Descriptive statistics measurements such as mean, standard deviation and percentage of correct answers were performed. For result comparison according to age groups and type of school, a two-way ANOVA, followed by Tukey's post hoc tests were employed. The relationship between ToM Task performance and vocabulary was analyzed by using Pearson's correlation and partial correlation, along with an age control.

3. Results

Initially, differences in the ToM task performance were investigated according to age and type of school. Table 3.1 shows the results obtained. Significant differences in age and type of school were found for the MSU Index, but not for the RU Index. Relative to type of school, it was found that students from private institutions scored significantly higher in the MSU Index than did students from public schools. Tukey's post hoc analysis showed a discrepancy in performance as assessed by the MSU Index between children aged 6 to 7 and those aged 9, the latter performed better than the former. There was no significant difference among the other age groups. No effect was observed for the age/type of school interaction: either on the RU index [$F(3.90) = 1.838$; $p = 0.146$] or on the MSU index [$F(3.90) = 1.028$; $p = 0.384$]. Although it is not included in the study's objective, the effect of gender on performance was also investigated, but no effect, either principal or interaction effects with age and type of school, was observed ($p > 0.05$).

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Table 3.1. Descriptive and inferential analyzes of the RU and MSU indexes as a function of age and type of school.

		RU Index		MSU Index	
	n	M	SD	M	SD
Age		*F (3.94) = 1.01*		*F (3.94) = 3.69**	
6 years	20	5.55	1.19	2.95	1.76
7 years	30	5.3	0.98	2.83	1.39
8 years	30	5.7	1.31	3.67	1.78
9 years	18	5.89	1.07	5.5	1.68
Type of School		*F (1.96) = 3.35*		*F (1.96) = 8,13***	
Private	47	5.83	0.98	4.04	1.79
Public	51	5.35	1.26	2.84	1.48

Bivariate relationships were found to be all positive and significant and of low magnitude between vocabulary and the RU index, and moderate between vocabulary and the MSU index. After the age control, the relationships remained significant, but were all of a low magnitude. Thus, higher scores in the vocabulary subtest, which assesses crystallized intelligence, language, and semantic memory, were associated with higher scores in the RU (text comprehension) and MSU (mental state understanding) indexes.

Table 3.2 shows the relationships found between the ToM task's RU and MSU indexes and (raw) performance in the vocabulary measurement, as assessed both by Pearson's analysis and by a partial analysis, with an age control (in years). The relationship between the ToM task's indexes themselves was positive and moderate ($r = 0.60$; $p < 0.001$), even after controlling for age ($r = 0.59$; $p < 0.001$).

Table 3.2. Relationship matrix between ToM and vocabulary performances.

			ToM	
			RU Index	MSU Index
Pearson's correlation	Vocabulary	*r*	0.29	0.47
		p	0.004	0.000
		N	98	98
Partial, with a variable control: age	Vocabulary	*r*	0.26	0.37
		p	0.011	0.000
		df	95	95

The percentage of correct answers in each ToM task's item was also analyzed by considering the RU and MSU indexes. These results are shown in Table 3.3, both for each individual age and in the general sample. The data indicate a progression in the number of correct answers for each type of content according to age group, as well as a difficulty gradient for these items. In relation to the RU index, given its role of examining the child's understanding of the situation expressed in the vignette, a high number of correct responses was expected, as seen in pretending/fantasy, double-bluffing, gaffe, and implicit intention from 6 years of age onwards. The items involving lies, misunderstandings, and inverted emotions, on the other hand, still seemed to be difficult for some age groups.

Regarding the MSU index, the "total" column allows us to outline a difficulty gradient for each item/vignette. Therefore, the contents were distributed from the most difficult to the easiest ones, as follows: inverted emotions, misunderstandings, double-bluffing, gaffe, lies, implied intention, and pretending/fantasy. Although not entirely linear, there is a tendency for a higher number of correct responses in successive ages for different contents. It is mainly at the age of 9 that this trend becomes most evident, with a relative fluctuation observed in younger children.

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Table 3.3. Percentage of correct answers in the RU and MSU indexes by age and in the total sample.

Item/vignette	Indexes	Ages				
		6	7	8	9	Total
Lie	RU	70	63.30	56.70	66.70	63.30
	MSU	40	36.70	56.70	66.70	49
Misunderstanding	RU	45	40	66.70	72.20	55.10
	MSU	25	26.70	43.30	55.60	36.70
Contrary emotions	RU	80	73.30	76.70	66.70	74.50
	MSU	25	26.70	33.30	33.30	29.60
Appearance/reality	RU	100	90	100	94.40	95.90
	MSU	75	80	90	77.80	81.60
Double bluff	RU	85	96.70	100	100	95.90
	MSU	45	36.70	50	61.10	46.90
Faux pas	RU	95	90	100	100	95.90
	MSU	45	36.70	50	61.10	46.90
Implicit intent	RU	80	76.70	86.70	94.40	83.70
	MSU	50	40	56.70	83.30	55.10

4. Discussion

This study aimed to find evidence of validity for the TMEC subtest ToM from Complex Situations and Emotions (Mecca et al., 2018) for school-age children. Specifically, evidence of validity based on relationships with external variables was investigated, such as the effect of age and the type of school institution on task performance, as well as the relationship with vocabulary, considering that previous studies in the literature report on such variables as being related to ToM (Ebert, Peterson, Slaughter, & Weinert, 2017; Grazzani et al., 2018; Oliveira, 2016; Rodrigues et al., 2015). This is the first study investigating the relationship between performance in the ToM from complex situations and emotions subtest with such variables in school-age children, given that all previous studies using TMEC were conducted with preschool children, a target group for which it had been originally designed (Dias, Batista & Mecca, in press; Mecca et al., 2018; Oliveira, 2016).

Evidence studies on the validity of ToM tests are necessary, due to the scarcity of national instruments and psychometric studies in Brazil with the already existing tasks for the age group targeted by this study (Mecca et al., 2018; Oliveira & Mecca, 2016; Osório et al., 2011). In this sense, this research is not only in line with the need to assess ToM at school age, given its relationship with mental health in childhood (Gonçalves, 2017; Imuta et al., 2016; Mecca et al., 2016; Slaughter et al., 2015), but it is also in line with the knowledge that ToM continues to develop further beyond preschool years (Devine & Hughes, 2013; O'Hare et al., 2009; Souza & Velludo, 2016). It also indicates that it can be influenced by environmental aspects, such as SEL and different cultural experiences (Hughes & Devine, 2015), for example, depending on the type of school (Rodrigues et al., 2015).

The findings of this research demonstrated the effects of these two factors that were investigated on the school children's ToM: age and school type. Concerning age, ToM performance in children aged between 6 and 7 differed significantly from children aged 9, while children aged 8 performed similarly to children of all ages investigated. Similar findings were also reported by Bock, Gallaway, and Hund (2015), according to whom children aged 7 underperformed as compared to children aged 9 and older in strange stories, a task that served as a model when designing the vignettes for TMEC. Calero, Salles, Semelman, and Sigman (2013) also observed significant differences between children aged 6 and 7, and children aged 8. Such results, in line with other studies, are indicative of evidence of validity for the ToM subtest from complex situations and emotions, based on age as a criterion. This finding has implications for future normative studies, should they include the use of TMEC standards and guidelines with reference to age.

In this sense, when observing the results obtained in this and other studies that investigated children in a close age range and by using similar tasks (e.g., Bock et al., 2015; Calero et al., 2013), it appears that there are clues to an important advance in ToM around the ages of 8 and 9, which helps the child to understand aspects of social interactions that are more complex and for which ToM is necessary. Furthermore, when considering other evidence in the field, these results suggest that there seems to be no linearity in this development, with performance overlaps in certain age groups and better-delimited discrimination (with 'developmental peaks') in others. This fact also became evident in the study by Oliveira (2016), who

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found significant differences in the performance of children aged 4 when compared to children aged 5 and 6 in the same task as used in this study.

These data provide clues regarding the development of complex aspects of ToM. The hypothesis that this progression may not be linear, i.e., that it may present with some periods of greater stability and others of higher growth that must, however, be examined and checked by further longitudinal studies, in the future, that follow up participants over the years and can provide information on such developmental aspects.

Still based on our findings and considering the MSU index, the number of correct answers seen in the older age group (9 years) ranged from 33.3% to 83.3%, which further suggests the possibility of future investigations that might go on to expand the age range and investigate the applicability of the task in children aged 10 – 12, for instance.

Regarding the effects of the type of school, students from private schools significantly outperformed those from public schools. Such results converge with the findings reported by Rodrigues et al. (2015), who found similar results in children aged 4 and 5. The type of school factor was still underexplored, especially in relation to ToM.

In Brazil, there is a clear overlap between the type of school and SEL, with a predominance of children from the most disadvantaged classes in public institutions (Engel de Abreu et al., 2015), a feature that was also confirmed in our sample. As far as SEL is concerned, Ebert et al. recently (2017) demonstrated its influence on ToM performance.

In fact, type of school is a complex, multifactorial variable, for which aspects as diverse as educational experience, quality of the school environment and the stimulation received all come into play in addition to SEL alone. All of these variables, in conjunction with family-related variables, can mediate and explain the association found with performance in ToM (Hughes & Devine, 2015; Pontes, 2016; Rodrigues et al., 2015). Our design, however, does not allow us to extrapolate interpretations beyond the finding that there is a relationship between these variables, which should be the target of future studies aiming to isolate and identify specific effects on performance in ToM. At any rate, understanding that variables associated with SEL and type of school can have an impact on children's neurodevelopment in general, and consequently also on

ToM, it is essential that research on child development and assessment take these variables into consideration.

It is also important to note that ToM relates to cognitive components, such as intelligence (Happé, 1994; Oliveira, 2016). In this study, the intellectual performance of children attending private schools was significantly better than that of students from public schools, which may imply better global cognitive functioning. Not controlling the effect of intelligence in the analyzes was an option, given that it would minimize the effect associated with the type of school. Research investigating the effect of the type of school on other cognitive components may reinforce the importance of investigating this factor in the development of ToM.

Another variable associated with the development of ToM is language (Mecca et al., 2016; Souza & Velludo, 2016), with previous evidence of the association of performance in ToM with vocabulary measurements (Oliveira, 2016), for instance. In this sense, we did expect to obtain findings with this study, even if those would be consistent with but a low to moderate relationship (after controlling for age). This is so because, even though language is considered an important predictor of ToM, there is a number of other variables that also do have an impact on the development of ToM, such as intelligence, executive functions, language of caregivers (Mecca et al., 2016; Souza & Velludo, 2016; Wellman, 2018), among others. In other words, since ToM is a complex construct and susceptible to various influences and interactions, a high degree of relationship with another cognitive domain would not be expected.

Also, it is also possible to hypothesize a relationship with type of school and/or SEL. For instance, such variables could have effects on language development (Engel de Abreu et al., 2015) and this, in turn, could be a mediating variable in the relationship between SEL and/or type of school and ToM. Again, this is a candidate hypothesis that might be targeted by future research and, in a country with such large discrepancies in terms of SEL as Brazil, early identification of its effects on neurodevelopment could have important implications for cognitive stimulation practices and public policies in Education.

In short, the findings of this research can contribute to the body of evidence about the development of more complex ToM abilities throughout childhood and not only in the preschool age group. In addition to these factors, the study emphasizes the importance of investigating, from the clinical and research

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standpoints, the type of school the child attends, in order to avoid mistakenly attributing deficits to children attending the public school system, but with similar performance to that of their peers. It is also intended to alert to the importance of employing cognitive stimulation practices that could be adopted in public schools in an attempt to minimize differences in performance in relation to children attending the private education system. Although incipient, this line of research has been growing in Brazil.

It should be noted that these data should be considered with caution, however, as they come from a study relying on a small sample and selected for convenience. Nevertheless, it has important implications for drawing up future guidelines for the clinical neuropsychological and school assessment of ToM, especially when providing the first evidence of validity of the ToM task from complex situations and emotions for school-age children and corroborating the applicability of the task for this new age group.

References

Ahmadi, S. Z. Z., Jalaie, S., & Ashayeri, H. (2015). Validity and reliability of published comprehensive Theory of Mind tests for normal preschool children: A systematic review. *Iranian Journal of Psychiatry*, *10*(4), 214. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4801491/#__ffn__sectitle

Associação Brasileira de Empresas de Pesquisa (2016). Critério Brasil 2015 e atualização da distribuição de classes para 2016. Retrieved from http://www.abep.org/criterio-brasil

Baron-Cohen, S., O'Riordan, M., Stone, V., Jones, R., & Plaisted, K. (1999). Recognition of Faux Pas by normally developing children and children with Asperger syndrome or high-functioning autism. *Journal of Autism and Developmental Disorders*, *29*(5), 407–418. doi:10.1023/A:1023035012436

Bock, A. M., Gallaway, K. C., & Hund, A. M. (2015). Specifying links between executive functioning and theory of mind during middle childhood: Cognitive flexibility predicts social understanding. *Journal of Cognition and Development*, *16*(3), 509–521. doi:10.1080/15248372.2014.888350

Calero, C. I., Salles, A., Semelman, M., & Sigman, M. (2013). Age and gender dependent development of theory of mind in 6- to 8-years old children. *Frontiers in Human Neuroscience*, 7, 281. doi:10.3389/fnhum.2013.00281

Corcoran, R., Mercer, G., & Frith, C.D. (1995). Schizophrenia, symptomatology and social inference: investigating theory of mind in people with schizophrenia. *Schizophrenia Research*, *17*, 5–13. Retrieved from http://www.schres-journal.com/article/0920-9964(95)00024-G/pdf

Devine, R. T., & Hughes, C. (2013). Silent Films and Strange Stories: Theory of mind, gender, and social experiences in middle childhood. *Child Development*, *84*(3), 989–1003. doi:10.1111/cdev.12017

Dias, N. M., Batista, L. S., & Mecca, T. M. (no prelo). Evidências de validade do Teste de Teoria da Mente para Crianças: Relação com funções executivas. *Revista Neuropsicologia Latinoamericana*.

Ebert, S., Peterson, C., Slaughter, V., & Weinert, S. (2017). Links among parents' mental state language, family socioeconomic status, and preschoolers' theory of mind development. *Cognitive Development*, *44*, 32–48. doi:10.1016/J.COGDEV.2017.08.005

Engel de Abreu, P., Tourinho, C., Puglisi, M., Nikaedo, C., Abreu, N., Miranda, M., Befi-Lopes, D., Bueno, O., & Martin, R. (2015). *A pobreza e a mente: perspectiva da ciência cognitiva*. Walferdange, Luxembourg: The University of Luxembourg. Retrieved from https://orbilu.uni.lu/bitstream/10993/20933/1/Engel de Abreu et al._Poverty and the Mind.pdf

Fonseca, R. P., Jacobsen, G. M., & Pureza, J. R. (2015). O que um bom teste neuropsicológico deve ter? In J. Salles, V. Haase, & M.-D. L. (Eds.), *Neuropsicologia do desenvolvimento: Infância e adolescência* (pp. 53–64). Porto Alegre: Artmed.

Gonçalves. B. (2017). *Teoria da mente e problemas de comportamento em pré-escolares: Um estudo correlacional*. Dissertação de mestrado, Centro Universitário Fieo, Osasco, SP, Brasil.

Grazzani, I., Ornaghi, V., Conte, E., Pepe, A., & Caprin, C. (2018). The relation between emotion understanding and theory of mind in children aged 3 to 8: The key role of language. *Frontiers in Psychology*, *9*, 724. doi:10.3389/fpsyg.2018.00724

Happé, F. (1994). Wechsler IQ profile and theory of mind in autism: A research note. *Journal of Child Psychology and Psychiatry*, *35*(8), 1461–1471. doi:10.1111/j.1469-7610.1994.tb01287.x

Happé, F., Cook, J. L., & Bird, G. (2017). The structure of social cognition: In(ter)dependence of sociocognitive processes. *Annual Review of Psychology*, *68*, 243–267. doi:10.1146/annurev-psych-010416-044046

Hughes, C., & Devine, R. T. (2015). A social perspective on theory of mind. In M. E. Lamb & R. M. Lerner (Eds.), *Handbook of child psychology and developmental science: Socioemotional processes* (p. 564–609). New Jersey: John Wiley & Sons.

Imuta, K., Henry, J. D., Slaughter, V., Selcuk, B., & Ruffman, T. (2016). Theory of mind and prosocial behavior in childhood: A meta-analytic review. *Developmental Psychology*, *52*(8), 1192–1205. doi:10.1037/dev0000140

Mattos, P., Serra-Pinheiro, M. A., Rohde, L. A., & Pinto, D. (2006). Apresentação de uma versão em português para uso no Brasil do instrumento MTA-SNAP-IV de avaliação de sintomas de transtorno do déficit de atenção/hiperatividade e sintomas de transtorno desafiador e de oposição. *Revista de Psiquiatria do Rio Grande do Sul*, *28*(3), 290–297.

Mecca, T. P., Dias, N. M., Oliveira, P. V, & Muniz, M. (2018). Theory of Mind Test for Children: Content validity. *Psico-USF*, *23*(3), 393–407. doi:10.1590/1413-82712018230301

Mecca, T. P., Gonçalves, B., Pontes, J. M., & Dias, N. M. (2016). Cognição social: Relação com variáveis ambientais e desfechos comportamentais. In T. P. Mecca, N. M. Dias, & A. A. Berberian (Orgs.), *Cognição social: Teoria, pesquisa e aplicação* (pp. 90–99). São Paulo: Memnon.

O'Hare, A. E., Bremner, L., Nash, M., Happé, F., & Pettigrew, L. M. (2009). A clinical assessment tool for advanced theory of mind performance in 5 to 12 year olds. *Journal of Autism and Developmental Disorders*, *39*(6), 916–928. doi:10.1007/s10803-009-0699-2

Oliveira, P. V. (2016). *Evidências de validade e precisão do Teste de Teoria da Mente para Crianças*. Dissertação de mestrado, Centro Universitário Fieo, Osasco, SP, Brasil. doi:10.11606/D.59.2014.tde-06102014-213825

Oliveira, P. V., & Mecca, T. M. (2016). Ferramentas para avaliação de teoria da mente na infância. In T. P. Mecca, N. M. Dias & A. A. Berberian (Eds.), *Cognição social: teoria, pesquisa e aplicação* (pp. 110–125). São Paulo: Memnon.

Osório, A., Castiajo, P., Ferreira, R., Barbosa, F., & Martins, C. (2011). Metodologias de avaliação do desenvolvimento da cognição social da infância até a idade pré-escolar. *Análise Psicológica*, *29*(2), 259–274. Retrieved from http://www.scielo.mec.pt/pdf/aps/v29n2/v29n2a06.pdf

Pontes, J. M. (2016). *Ambiente familiar e teoria da mente em crianças pré-escolares*. Dissertação de Mestrado. Programa de Pós-graduação em Psicologia Educacional. Centro Universitário FIEO, Osasco, SP.

Rodrigues, M. C., Pelisson, M. C. C., Silveira, F. F., Ribeiro, N. N., & Silva, R. L. M. (2015). Evaluation of theory of mind: A study with students from public and private schools. *Estudos de Psicologia*, *32*(2), 213–220. doi:10.1590/0103-166X2015000200006

Slaughter, V., Imuta, K., Peterson, C. C., & Henry, J. D. (2015). Meta-analysis of theory of mind and peer popularity in the preschool and early school years. *Child Development*, *86*(4), 1159–1174. doi:10.1111/cdev.12372

Souza, D. H., & Velludo, N. (2016). O desenvolvimento da teoria da mente. In T. P. Mecca, N. M. Dias, & A. A. Berberian (Orgs.). *Cognição social: Teoria, pesquisa e aplicação* (pp. 42–53). São Paulo: Memnon.

Wechsler, D. (2014). *WASI – Escala Wechsler Abreviada de Inteligência*. São Paulo: Casa do Psicólogo.

Wellman, H. M. (2018). Theory of mind: The state of the art. *European Journal of Developmental Psychology*, *15*(6), 728–755. doi:10.1080/17405629.2018.1435413

Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development*, 72(3), 655–684. doi:10.1111/1467-8624.00304

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