

Home Literacy Exposure in the Heritage Language Enhances Theory-of-Mind Development: A Study on Greek-Italian Bilingual Children

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1. Introduction

Theory of Mind (ToM, henceforth) is the cognitive ability to interpret others' behavior by attributing them mental states, such as intentions and, most importantly, beliefs (Premack & Woodruff, 1978). Studies on ToM distinguish between a first-order and a second-order ToM. First-order ToM refers to the understanding that others may have false beliefs about reality. For example, if they think that a piece of chocolate is in the cupboard and not on the table (where it is in fact), one expects them to act accordingly and look for the chocolate in the cupboard. Second-order ToM refers to the understanding that people have false beliefs about others' beliefs. For example, people may know that the chocolate is on the table, but others may think that they know it is in the cupboard and, as a result, expect them to look for the chocolate in the cupboard (see Verbrugge & Mol, 2008: 492). These different levels of complexity of ToM correspond to a given developmental sequence, whereby first-order ToM develops by the age of 4 and second-order ToM by the age of 6 (Grueneisen et al., 2015).

Within this general tendency, the rate of development of ToM may be subject to variation among children, whereby certain variables tend to accelerate this development. Literacy exposure at home is one of these factors: it refers mostly to joint reading activities involving children and their parents (or caregivers or others family members; Adrian et al., 2005; Ratner & Olver, 1998; Ruffman et al., 2002). For example, Adrian et al. (2005) tested 34 children ranging in age between 4 and 5 years with a first-order false belief ToM task and found that children's performance was predicted by the frequency with which they were read storybooks by the parents at home. Likewise, Ratner & Olver (1998) observed the interactions between 4 mothers and their children ranging in age between 3 and 4

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years during four successive readings of a folk tale of deception. The authors found that across the four readings, the children became more and more autonomous in the comprehension of the deceptions in the story, i.e., understanding these deceptions did not need any support from the parents. This is particularly relevant for the present study because the understanding of deception relies on the development of ToM (Frith & Frith, 2005).

The observation that book-reading boosts the development of ToM is not unexpected, given that children's books tend to be rich in mental state words and explanations of how the characters' beliefs and emotions drive their behaviors and experiences (Nicolopoulou et al., 2006). Moreover, children's books often feature ironic situations, which usually involve a discrepancy between what is known by the reader and by the different characters, respectively (Dyer et al., 2000). Therefore, while being read stories, children are very likely to engage in conversations with their parents related to the relationship between the characters' mental states and their actions. This interaction may prove fruitful for the development of children's ToM abilities.

The present study builds on the previous observation that literacy exposure at home benefits children's development of ToM. However, it examines home contexts in which a heritage language is spoken (HL, henceforth). We aim to understand whether in these contexts, the benefits of literacy exposure at home for ToM development depend on the language used during home literacy practices. Heritage Speakers (HSs) constitute a bilingual population that normally acquires two languages in migration contexts: The HL is acquired at home from birth, whereas the societal language (SL) is usually acquired when children enter kindergarten and, later on, school. In most cases, HSs become more and more dominant in the SL across the lifespan. This may affect the development of the HL (Benmamoun et al., 2013; Rothman, 2007; Torregrossa et al., 2022a).

Over the past few years, several studies have highlighted the importance of providing HSs with formal education in the HL—along with the education that they normally receive in the SL—, in order to promote HL maintenance across the lifespan and allow them to develop literacy in both the HL and the SL (see Carreira & Kagan, 2018). Several studies have shown that literacy in the HL benefits children's school achievements in the SL (Cummins, 2000; Francis, 2012; MacSwan et al., 2017). Furthermore, bilingual education, in general, seems to enhance the development of children's cognitive abilities, such as executive functions (see Bialystok, 2018 for an overview).

Most of these studies are concerned with the linguistic and cognitive benefits related to the implementation of biliteracy programs in the school. In this paper, we aim to investigate whether the same benefits are visible in association with the use of certain home literacy practices. Based on the above observation of a relation between literacy practices at home and ToM development, we will investigate whether children's ToM abilities benefit more if these practices involve the HL or the SL.

We will address these issues by testing a group of school-aged children living in Greece, speaking Italian as a HL and attending a bilingual school where Italian is the main medium of instruction. In particular, we will triangulate the results of

a parental questionnaire tapping into children's literacy exposure in Greek and Italian and of a ToM task. Before introducing the study, we will review previous studies that have investigated the positive effects of biliteracy on young bilingual speakers' development of cognitive abilities.

1.1. Biliteracy and cognitive development

The term biliteracy refers broadly to children's development of literacy skills in two languages (Bialystok, 2018; Francis et al., 2006). Biliteracy can take different forms, including programs in which two languages are used as medium of instruction. For example, in some programs, the HL is taught as language subject or used as a medium of instruction together with the SL. These programs are aimed at favoring literacy development in the HL as well as maintenance of the HL in the migrant community (Beaudrie et al., 2014; Carreira & Kagan, 2018, 2011). The term biliteracy includes also literacy-related activities to which HL children are exposed outside of the school, such as HL classes, reading activities, etc.

Studies have shown that bilingual education programs benefit not only children's academic achievements, but also their cognitive skills (Bialystok & Barac, 2012; Carbonara et al., 2023). For example, exposure to bilingual education is associated with advantages in terms of executive functions. Esposito & Baker-Ward (2013) administered two executive function tasks to 120 children living in the U.S. and attending kindergarten, the second grade and the fourth grade. Half of them attended an English immersion program, whereas the other half attended a dual-language program in which both the majority language of the community (English) and the minority one (Spanish) were used as medium of instruction. The authors found no difference between the two groups among the children in kindergarten. By contrast, the second- and fourth-graders enrolled in the dual-language program outperformed their peers enrolled in the English-only program. This indicates that extended experience in dual-language education is beneficial for the development of executive functions. Similarly, Kaushanskaya et al. (2014) compared 19 second-graders attending a monolingual English education program with 19 age-matched peers attending a Spanish-English program and found that the children who attended the bilingual program outperformed the others in a task of verbal working memory and a word learning task.

Recent studies have examined the benefits of bilingual programs on children's metacognition, intended as a variety of cognitive activities that take other cognitive activities as their objects (Kuhn, 1999, 2005). For example, biliteracy is associated with advantages in metalinguistic abilities, which involve reflecting on one's own linguistic intuitions (Kuile et al., 2011; Torregrossa et al., 2022b). Likewise, children exposed to biliteracy seem to be more aware of the strategies involved in learning an additional language (Cenoz, 2003) and produce more elaborate narratives (Bongartz & Torregrossa, 2020; Carbonara et al., 2023). ToM also involves metacognition (see Section 1). However, no study so far has examined whether children exposed to biliteracy have an advantage in ToM.

There is some evidence that bilingualism *per se* is associated with an advantage in ToM (Barac et al., 2014; Schroeder, 2018 for meta-analyses). Several accounts have been proposed in order to explain this advantage (Yu et al., 2021). Bilinguals' advantage in ToM may be linked to their advantage in executive functions. Inhibition is one of the main components of executive functions. It plays a role also in inhibiting one's own belief about reality (or about others' beliefs) in order to reflect on others' mental states (Devine & Hughes, 2014). Since bilinguals have an advantage in executive functions (e.g., Bialystok et al., 2010), this advantage may lead to an advantage in ToM, too. However, no study thus far has directly examined the link between executive functions and ToM among bilinguals, to our knowledge at least.

Other proposals have linked bilinguals' advantage in ToM to an advantage in metalinguistic awareness: the understanding that the same concept can be labelled in two different ways depending on the language may raise the awareness that two people can have different beliefs about reality (Diaz & Farrar, 2017). Finally, the socio-pragmatic account links bilinguals' advantage in ToM to their complex language practices. In their interactions with other persons, bilinguals have to figure out which language can be used with which person. In other words, bilinguals have to take the perspective of others, which may boost their ToM abilities. Fan et al. (2015) tested three groups of 24 children (age range: 4;03-6;11) with a perspective-taking task. The first group included monolingual English children, the second group Spanish-English bilingual children, and the third group children who were exposed to a multilingual environment but were not bilingual themselves. The results show that the bilinguals and the children exposed to a multilingual environment outperformed the monolinguals significantly. Crucially, the children who were living in a multilingual environment performed as well as the bilinguals, despite exhibiting lower executive-function abilities.

In this study, we do not compare bilinguals with monolinguals. Rather, we show to what extent variation in their ToM abilities could be motivated by their literacy practices in one language or the other. All children who participated in this experiment attended a Greek-Italian bilingual school. Therefore, we will tap into their literacy practices outside of the school. The foundation of this study is the hypothesis that children's ToM abilities benefit from literacy exposure in the HL outside of the school. Furthermore, we will examine whether the supposed beneficial effect of home literacy exposure in the HL is visible across all orders of ToM (first- and second-order) or only in association with the second-order type, given its greater complexity (see Section 1).

2. The study

2.1. Research questions

The study addresses the following research questions:

Q1: Does home literacy exposure in the HL favor the development of ToM abilities among school-aged children having Italian as HL and Greek as SL?

Q2: Is the effect of home literacy exposure in the HL on children's ToM abilities modulated by the complexity of the task (first- vs. second-order false belief)?

2.2. Participants

37 bilingual children (21 females), ranging in age from 8;02 to 11;08 (M : 9;04; SD : 12 months) took part in the experiment. The study was conducted in a bilingual school of Athens (Greece), where both Italian and Greek were offered as language subjects and all other subjects were taught in Italian. 34 participants were born and raised in Greece. The remaining 3 arrived in Greece at the age of 1, 7 and 8, respectively. The sample includes 22 simultaneous bilinguals (being exposed to both Italian and Greek from birth), and 14 sequential bilinguals.¹ Among the sequential bilinguals, 6 acquired Greek from birth and were first exposed to Italian at the age of 3 (i.e., when they entered kindergarten), 6 acquired Greek from birth and were first exposed to Italian at the age of 6 (e.g., when they entered elementary school), 1 acquired Italian from birth and was first exposed to Greek at the age of 8. 1 acquired another language from birth, was first exposed to Italian at the age of 3 and first exposed to Greek at the age of 7. None of the children had hearing, visual or speech impairment. The parents provided their informed consent before the experiment.

2.3. Background questionnaire

In order to assess the amount of children's home literacy exposure in Greek and Italian, we administered a background questionnaire to the parents. For the analysis of this paper, we present only the information contained in the following two modules of the questionnaire (for the general design of the questionnaire, see Caloi & Torregrossa, 2021; Torregrossa et al., 2021; Torregrossa et al., 2022a):

Early literacy experience. This module related to the reading of books to the child by family members in the preschool years (question: "In which language(s) did you or other family members read books with stories and fairytales to your child, before she entered the school?"). We listed four family members (mother, father, sibling 1 and sibling 2). For each family member, three answers were possible, as related to the language(s) used during the reading activities ("mainly Italian", "mainly Greek" or "both"). The total score for this module corresponded to the number of persons who read books to the child (for example, if books were read by both parents and a sibling, the total score was 3). We derived a sub-score for Italian and Greek, based on the number of persons who read books "mainly in Italian" and "mainly in Greek", respectively. If the answer was "both", we assigned 0.5 points to Italian and 0.5 points to Greek. Then we divided the language specific sub-score by the total score of the module, thus obtaining a ratio for Italian and Greek, respectively. Finally, we calculated the difference between the two ratios. Therefore, the final value of this module ranged between +1 (home

¹ Information about first exposure to input was missing for one participant.

early literacy experience only in Italian) to -1 (only in Greek), with a positive score indicating dominance in home early literacy exposure in Italian and a negative one dominance in Greek.

Current literacy experience. This module was related to the literacy practices outside of the school (e.g., reading books, reading and writing emails and text messages) performed by the child at the moment of testing. This module was divided into two sub-modules: *language use across literacy-related activities* and *frequency of language use across literacy-related activities*.

The *language use across literacy-related activities* sub-module targeted the language(s) used in 7 literacy-related activities: counting, writing shopping lists, reading aloud alone, reading aloud in front of others, texting on the phone, writing emails and writing postcards. The corresponding question was: “in which language(s) does the child do the following activities?”. The total score corresponded to the number of activities that the child performed. As in the previous module, the answers “mainly Italian”, “mainly Greek” and “both” were possible. We derived two language specific sub-scores and a final value based on the same procedure employed for the previous module.

The *frequency of language use across literacy-related activities* sub-module targets the frequency with which the child performed four literacy-related activities (watching TV, visiting websites, playing videogames, reading books/magazines/comics) in Italian or Greek. The corresponding question was: “How often does the child does this activity in Italian/Greek?”. Four answers were possible: “often” (3 points), “sometimes” (2 points), “rarely” (1 point) and “never” (no points). The maximum possible score in this sub-module was 12 for Italian or Greek, corresponding to the case in which parents answered “often” for all the four activities. We derived two sub-scores for Italian and Greek respectively, based on the sum of the frequency scores across the activities. Then, we calculated the ratios between these scores and the maximum score (i.e., 12). Finally, we finally subtracted the Greek ratio from the Italian one, as we did in the previous modules.

As a last step, we derived the final value of the whole module *current literacy experience* as the mean between the values of the two sub-modules. Again, a positive score indicates dominance of current literacy experience in Italian, and a negative one dominance in Greek.

After deriving the two separate scores for *early literacy experience* and *current literacy experience*, we checked for correlation between them. The Pearson correlation test revealed that the two measures were strongly correlated with each other ($r(34) = .63, p < .001$). Therefore, we calculated the mean between the two values to get a single index of home literacy exposure for each child. This is the final value we used in our statistical analysis (see Section 2.5).

2.4. Theory of Mind task

Children’s ToM-abilities were assessed using *The Silent Film Task* designed by Devine & Hughes (2013). The task consists of five short clips from the silent movie *Safety Last* by Harold Lloyd (Roach et al., 1923). After watching each clip,

children were asked to provide an explanation for the character's behavior. The first clip includes two questions, the remaining four include one question each. Four out of six questions assess first-order ToM and two second-order ToM. For example, the first clip features two men who hide from a woman who is looking for them to collect the money for the rent from them. As the woman enters the room, she looks for them all around the room without realizing that they are hiding behind two coats hung on the wall. The first question following the clip is: "Why do you think the men hide?" and the expected answer is: "The men wanted the woman to believe they were not in". The second question is: "What do you think the woman is thinking?" and the expected answer is: "She thinks the men are not home". Therefore, the first question targets a second-order false belief, while the second one targets a first-order one.

Each child could choose whether they wanted to perform the task in Greek or Italian. Greek was chosen by 29 participants; the remaining 8 chose Italian. Children were tested individually in a quiet room of the school. The clips were included in a power point presentation and shown on a laptop. Children's responses were recorded and later transcribed for the analysis.

For the coding of children's answers, we adopted a binary scoring system: 1 point was assigned if the answer provided by the child included explicit reference of false belief (of first- or second-order), whereas 0 points were assigned if the answer was not explicit about false belief, was irrelevant or incorrect.² The answers were independently scored by two evaluators. The inter-rater agreement percentage was 83%. It should be noticed that the aim of Devine & Hughes (2013) was to develop an 'advanced' task for ToM. Therefore, their task does not only assess children's development of first- and second-order ToM, but also their ability to explicitly reason about others' beliefs. This task is particularly suitable for children who are older than 6 years, who would perform at ceiling in traditional tasks of first-order and second-order ToM.

2.5. Results

Table 1 summarizes the mean, standard deviation and the range of participants' home literacy exposure scores and participants' performance in the ToM task, considering the two false-belief types.

² Our scoring system differs from the one adopted by Devine & Hughes (2013). The authors used a tripartite system, according to which a correct answer containing explicit reference to false belief is assigned 2 points, a factually correct answer with no explicit reference to false belief was assigned 1 point, and an incorrect or irrelevant answer was assigned 0 points. For example, an answer such as "They did not want to pay the rent" to the question "Why did the men hide?" related to clip 1 would receive 1 point because it refers to the right motivation but does not make reference to false belief. We followed the same evaluation criteria, but collapsing the scores "0" and "1" into a single category, since we are most interested in the explicit mentioning of false belief.

Table 1: Descriptive statistics related to participants' literacy exposure values (early, current and mean) and performance in the ToM task, distinguishing between first-order and second-order false belief.

	Mean	SD	Min	Max
Early literacy	-0.04	0.66	-1	+1
Current literacy	+0.12	0.28	-0.44	+0.78
Mean of literacy scores	+0.03	0.42	-0.61	+0.83
Accuracy in first order false-belief (0-4)	1.6	0.96	0	3
Accuracy in second order false-belief (0-2)	0.5	0.56	0	2

As explained in Section 2.3, a negative score for home literacy exposure corresponds to dominance in Greek, while a positive score to dominance in Italian. Therefore, the data show that on average, the children were slightly more exposed to literacy in Greek in their pre-school years (0-3), whereas they were more exposed to literacy in Italian at the moment of testing. The mean of these two measures reveals that our sample of children was relatively balanced across the two languages.

Data were analyzed using a generalized linear mixed-effect model in R version 4.2.2 (R Core Team 2021). The binary dependent variable is the accuracy score (1 vs. 0) for each of the questions included in the ToM task (6 per child). The predictor variable was the interaction between false-belief type (first vs. second) and the child's home literacy exposure score (see Section 2.3). We sum-coded the two-level predictor of false-belief type as -0.5 and $+0.5$, and centered the continuous variable related to home literacy exposure. We included random slopes for participants for false belief order. The model was fitted using the *glmer* function in the 'lme4' package (Bates et al. 2015).³

The outcome of the analysis refers to the log odds of observing a correct answer. Table 2 reports the estimates, standard errors (SE), *z*-values and *p*-values for each predictor.

Table 2: Parameters of the generalized linear model with ToM score (1, 0) as the dependent variable and false belief type (first, second) and home literacy exposure score as predictors. The predictors, their estimates, standard errors, *z*-values and *p*-values are given. Significant effects are in marked in bold.

	Estimate	Std. Error	<i>z</i>	<i>p</i> (> <i>z</i>)
Intercept	-0.83	.16	-5.03	<.001
False-belief type (Second order)	-0.81	.33	-2.45	.01
Home literacy exposure	0.33	.16	2.03	.04
False-belief type x home literacy exposure	-0.08	.33	-0.26	.80

³ The model was: `m <- glmer(accuracy ~ false-belief type * home_literacy_exposure + (1 + false-belief type | child), family = binomial)`.

We found a significant main effect of false-belief type, indicating that the probability of observing an accurate answer decreases significantly if the question taps into second-order false belief. In other words, children performed significantly worse in second-order false belief than in first-order false belief.

We also found a significant main effect of home literacy exposure, which shows that the probability of observing an accurate answer in the ToM task increases significantly with increasing home literacy exposure in Italian. This pattern is visualized in Figure 1, which plots the predicted probabilities for the children to produce an accurate answer according to their degree of home literacy exposure.

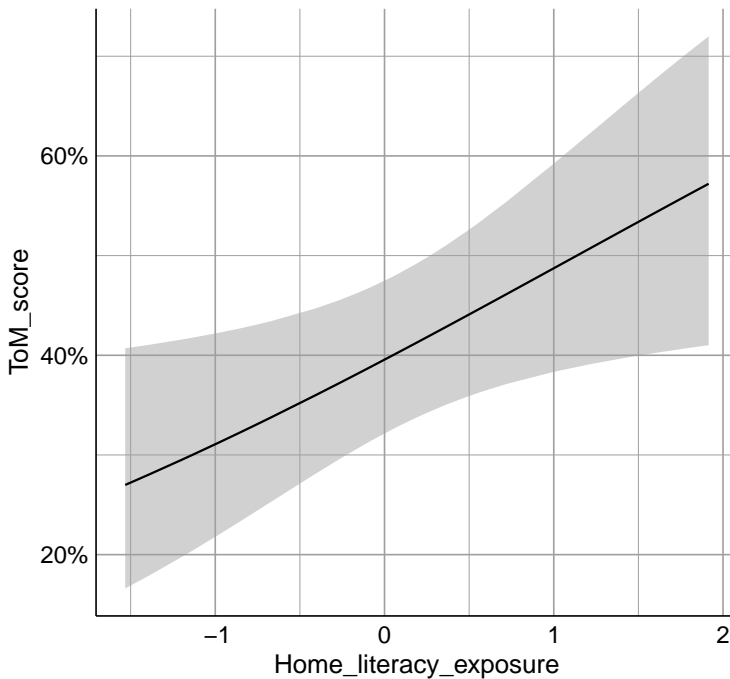


Figure 1: Predicted probability of an accurate answer in the ToM task according to children’s degree of home literacy exposure. Positive values indicate greater degrees of home literacy exposure in Italian, negative values indicate greater degrees of home literacy exposure in Greek. The predicted probabilities refer to the model described in fn. 3.

Finally, the interaction between false-belief type and home literacy exposure was not significant. This suggests that the effect of home literacy exposure on children’s performance in the ToM task does not vary based on the complexity of the task (first-order vs. second-order false belief).

3. Discussion

The present study investigated the effect of home literacy exposure in the HL on the development of ToM abilities among school-aged bilingual children. Our main research question was inspired by two sets of findings emerging from previous studies. On the one hand, literacy exposure at home seems to improve children's ability to interpret others' actions in terms of their mental states (see Section 1). On the other hand, biliteracy enhances children's linguistic and cognitive development (Esposito & Baker-Ward, 2013; Kaushanskaya et al., 2014), boosting their metacognitive abilities (Carbonara et al., 2023, Kuile et al., 2021; Torregrossa et al., 2022b). For children speaking a HL, literacy exposure in the HL is particularly important because it corresponds to the language to which children are less exposed during their daily activities. In other words, while HL children living in Greece have plenty of opportunities to watch TV, visit websites, play videogames and read books in Greek, their opportunities to conduct the same activities in Italian are more limited. Therefore, the foundation of our study was the hypothesis that home literacy exposure in the HL benefits children's ToM abilities.

The results of the study confirmed this hypothesis. The statistical analysis reported in Section 2.5 revealed that home literacy exposure was a significant predictor of children's accuracy in answering the questions of the ToM task: a greater amount of home literacy exposure in the HL was associated with a greater accuracy in responding to the questions of the ToM task. In this sense, the results are in line with the results of previous studies showing the benefits of book reading activities in early childhood for the understanding of other people's mental states (Adrian et al., 2005; Dyer et al., 2000; Ratner & Olver, 1998; Ruffman et al., 2002). However, our measure of home literacy exposure went beyond the consideration of book reading, including other activities that may play a role in the development of literacy skills (see Section 2.3) as well as different reading modalities (e.g., reading aloud alone and reading aloud in front of others).

Compared to previous studies, the complex measure of literacy exposure considered in this study provided a more fine-grained analysis of home literacy exposure, which was more suitable for children in the age range considered in this contribution—which were older than the ones considered in previous literature (Section 1). From this point of view, our results showed for the first time that the effects of home literacy exposure extended beyond the preschool years into the years of schooling. In this sense, the present study underlines the importance of investigating the relationship between literacy and cognitive abilities not only among preschoolers, but also in middle childhood (Lecce & Devine, 2022 for a similar consideration).

It should be noticed that the children considered in this study were homogeneous in terms of their literacy practices at school, since they all attended a Greek-Italian bilingual school in which Italian was the main medium of instruction. In this sense, this group of children differed from other groups of HL children considered in previous literature on HL acquisition, who usually receive limited literacy exposure in the HL (Rothman, 2007; Montrul, 2015). We cannot

determine whether the type of biliteracy exposure at school considered in this study is associated with an advantage in ToM abilities, since we did not consider monolingual children or a comparable group of HL children attending a school in which the SL is the main language of instruction. Nevertheless, we were able to show that strengthening literacy exposure in the HL outside of the school benefitted ToM abilities. By contrast, home literacy exposure in Greek did not seem to enhance children's ToM abilities. This may be related to our previous observation that children had more opportunities to be exposed to literacy practices in Greek anyway.

The results of this analysis are in line with previous findings showing the benefits of biliteracy on the development of children's cognitive skills (Bialystok & Barac, 2012). In particular, it examined for the first time the positive effects of biliteracy on children's ToM skills. Based on the data of the present study, it is impossible to establish why biliteracy is connected with an advantage in ToM. For example, it may be the case that executive functions mediate the effects of biliteracy on ToM abilities (Section 1.1). Otherwise, children may experience more complex linguistic interactions through bilingual education programs. We would like to suggest that the positive effects of biliteracy on children's metacognitive abilities may also play a relevant role. By being exposed to two languages at school, children are encouraged to compare, more or less explicitly, their languages (the HL and the SL), which enhances their metalinguistic abilities (Carbonara et al., 2023; Torregrossa et al., 2022b).

Our second research question concerned whether home literacy exposure in the HL played a different role depending on the type of false belief considered. We expected home literacy exposure to benefit accuracy in answering questions of the second-order type, since they exhibit a greater complexity. We found a main effect of type of false belief, whereby children provided more incorrect answers with questions tapping into second-order ToM. This result confirms that questions tapping into second-order ToM are associated with a higher degree of complexity. In contrast, we found no interaction between home literacy exposure in the HL and type of false belief (Table 2). This suggests that ToM abilities benefitted from home literacy exposure in the HL across the board, independently of the complexity of the task. However, it should be reminded that the task used in this study did not only tap into children's ToM abilities but also in their ability to reason explicitly about false-belief. There is no doubt that the children in this study had already developed first- and second-order ToM. However, their explicit reasoning about false beliefs might still be developing. As a result, home literacy exposure might have boosted explicit reasoning, which was then used in answering both first-order and second-order ToM questions.

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