Domino Effects of Bilingualism in Autism Spectrum Disorders? Executive Functions, Complement Clauses and Theory of Mind

Stephanie Durrleman, Ianthi Maria Tsimpli, and Eleni Peristeri

1. Introduction

A defining characteristic of Autism Spectrum Disorder (ASD) is a deficit in Theory of Mind (ToM) (Baron-Cohen, 1991; Tager-Flusberg, 2007). ToM refers to the ability to understand the mental states of others and grasp that these can be different from one's own (see 1).

(1) Visual illustration of the cognitive flexibility involved in ToM

Many individuals on the spectrum struggle to take the points of view of others into consideration, resulting in social delays (Peristeri et al., 2021a; Peterson et al., 2007), which are described in the DSM-5 (American Psychiatric Association. 2013). However, ToM in this population can be improved thanks to various other factors, such as better complement clauses (Durrleman & Franck, 2015; Schroeder et al., 2021), vocabulary (Fisher et al., 2005; Milligan et al., 2007), and the linguistic experience of bilingualism (Andreou et al., 2020; Baldimtsi et al., 2020).

To start with complements, individuals with ASD with better ToM skills have been shown to be those with better complementation skills. Put differently, when children with ASD master sentential complements such as (1) and (2), they tend to perform better during tasks assessing ToM.

(1) One guy thinks that the number is a 6…

(2) The other guy says that the number is a 9…

 Proceedings of the 46th annual Boston University Conference on Language Development, ed. Ying Gong and Felix Kpogo, 180-193. Somerville, MA: Cascadilla Press.

Another factor that has been shown to be related to success in ToM performance is better vocabulary, because this increases access to conversations, which are important sources of evidence about mental states (Harris, 1996; Peterson & Siegal, 2000). However, the link between ToM and vocabulary may rather stem from mastery of mental state vocabulary, including epistemic verbs such as *to think*, *to believe* (Miller, 2006). Mental state verbs take complement clauses (de Villiers & Pyers, 2002), i.e. the cognitive architecture required by this lexicon amounts to embedding propositional attitudes (de Villiers, 2007, 2021). As such, difficulties with mental state lexicon would arguably be isomorphic to syntactic challenges required to understand the world from another person's point of view.

ToM in ASD has also very recently been shown to be higher in bilinguals with ASD than their monolingual peers (Peristeri et al., 2021b). It seems that the linguistic experience of bilingualism enhances ToM, which makes sense intuitively, since bilinguals have to constantly take their interlocutors' knowledge into account so as to select the correct one of their languages to apply in a given context. However, another way to conceive of how bilingualism can boost ToM is via executive functions (EF) (Gonzalez-Barrero & Nadig, 2019), since in ASD it has been shown that bilingualism enhances EF, which in turn enhance ToM (Peristeri et al., 2021b). Thus, the boost in bilingualism may stem from the fact that speaking two languages presupposes a great deal of practice inhibiting one to flexibly swap to the other. Put differently, the EF skills inhibition and cognitive flexibility arguably underlie the ability to inhibit one's own perspective so as to flexibly swap to that of another person, and in this way EF allow developing a theory of another's mind (Demetriou et al., 2018; Joseph & Tager-Flusberg, 2004; Kimhi et al., 2014; Pellicano 2007, 2010; Tager-Flusberg & Joseph, 2005).

Nevertheless, the EF-ToM link may be even more complex because EF, which we saw were reportedly enhanced in bilinguals, also predict complementation skills in clinical (Delage & Frauenfelder, 2020) as well as in language-unimpaired populations (Grosse Wiesmann et al., 2017), and complementation predicts ToM in ASD (Durrleman et al., 2019). In light of this, we ask here if bilinguals with ASD may achieve cascading benefits associated with bilingualism, in that EF boosts would in turn improve complementation, which would in turn enhance ToM? We also ask what role vocabulary as a proxy for language proficiency may play when bilingual children with ASD face ToM tasks.

This work thus explores EF, sentential complements and ToM in instances of children with ASD growing up with two languages. More specifically, we investigate the mediating effect of complement clauses in the relation between EF, vocabulary and ToM, in monolingual and bilingual children with ASD and high language proficiency (in terms of vocabulary).

2. Method
2.1. Participants

Thirty-five 10-year-old bilinguals with ASD (ASDbi), and 35 age-matched monolinguals with ASD (ASDmono) participated in the study. There were no significant differences between the two groups in chronological age, F (1, 69) = .033, p = .857. Children's PIQ scores were measured by the Greek version of the Wechsler Intelligence Scale for Children (Wechsler, 1992; adaptation to Greek from Georgas et al., 2003); there was no significant Group effect in PIQ scores, F (1, 69) = .376, p = .542. The two groups were also matched on socio-economic status (SES) indexed by maternal education level (Ebert et al. 2019), F (1, 69) = .783, p= .380, which was calculated on a five-point Likert scale (1=primary school education, 2=compulsory secondary education, 3=upper secondary education, 4=professional training, 5=tertiary education). Finally, the children's autism severity was measured through the Autism Diagnostic Interview-Revised (ADI-R; Rutter, LeCouteur, & Lord, 2003); there was no difference between ASDmono and ASDbi children in autism severity, F (1, 69) = .783, p= .380, F (1, 69) = 3.255, p = .08. Table 1 below presents the groups' descriptive statistics of background variables.

Table 1. Descriptive statistics (Means and *SD*s) of background variables

Group	age	PIQ	SES	Autism severity (ADI-R)	Home Language History (% in Greek)	Current Language Use (% in Greek)
ASDmono (N = 35)	10;5 (*1.8*)	90.8 (*11.4*)	2.2 (*1.4*)	36.3 (*8.4*)	-	-
ASDbi (N = 35)	10;4 (*1.7*)	93.7 (*14.4*)	2.5 (*1.2*)	34.6 (*4.7*)	52.6 (*13.3*)	62.3 (*10.1*)

Note: ASDmono = monolingual children with ASD; ASDbi = bilingual children with ASD; PIQ = Performance IQ; FIQ = Full IQ; SES = socio-economic status; ADI-R = Autism Diagnostic Interview-Revised; N = number

Children with ASD, both bilingual and monolingual, were recruited with a previous diagnosis of ASD by a licensed clinician (i.e. a child psychiatrist). In addition, all ASD participants had a PIQ of at least 75. Furthermore, according to parental and school reports, participants had no history of language delay. The bilingual children with ASD were Russian-Greek speakers and they were also simultaneous bilinguals (2L1), with dominance and high proficiency in Greek. ASDbi children's home language history (i.e., the child's exposure to each language from birth up to the age of four) and current language use (i.e., literacy and language preference in everyday life with family members or friends) (Torregrossa et al., 2021) metrics are presented in Table 1.

2.2. General Procedure

Following informed parental consent, we administered four tasks in two sessions to both groups of children. The tasks assessed language abilities, EF and ToM. More specifically, for language, we evaluated expressive vocabulary and complement clause repetition; for EF, we used an online 2-back task, and for ToM we administered a low-verbal first-order false-belief task. The tasks were presented in a fixed order and children were tested individually at their school or home. All the tasks were administered in Greek.

2.3. Experimental Tasks
2.3.1. Language ability tasks
2.3.1.1. Expressive vocabulary

Stimuli. The children's expressive vocabulary in Greek was assessed through an expressive vocabulary test, standardized for 3- to 10-year-old Greek-speaking monolingual children (Vogindroukas, Protopapas, & Sideridis, 2009; adaptation to Greek from Renfrew, 1997). It includes 50 black-and-white pictures of common objects that each child was asked to name individually. Each correct answer earns one point, with a maximum score of 50. The test was terminated when the participant failed to respond correctly to five consecutive trials.

2.3.1.2. Complement clause repetition task

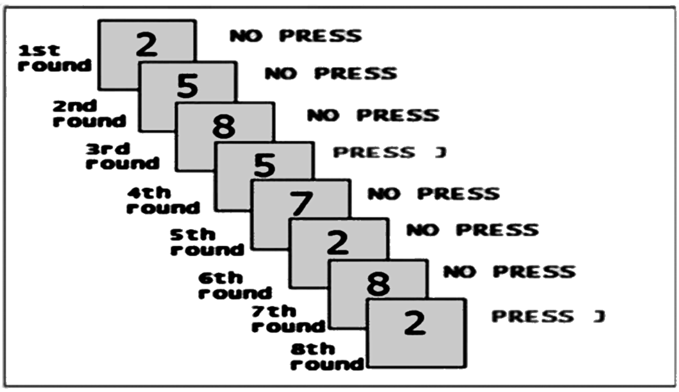
Stimuli. Regarding complements, these were assessed via a Sentence repetition task (Marinis & Armon-Lotem, 2015), which has been developed within the COST Action IS0804. There were 32 sentences to repeat, of which 11 were complements. The focus of the present study was on complement clauses. More specifically, there were 11 complement clauses introduced with the following complementizers: *oti* (used in declarative complements, corresponding to the English complementizer that), *pjos* and *ti* (introducing indirect interrogative complements, equivalent to English who or what) and *na* (a Mood (subjunctive) marker, which introduces verb complements frequently, and is equivalent to infinitival or gerundive complement clauses in English) (see (3) for an example).

(3) i nosokomes ipan oti i ptisi tu jiatru ehi kaθisterisi
the nurses said that the flight the.GENITIVE doctor. GENITIVE has delay
"The nurses said that the doctor's flight is delayed."

Children's performance on the repetition of complement clauses was scored for overall accuracy. According to this scoring scheme, participants were awarded a score of 3 if they made no errors while repeating the sentence, a score of 2, if they made one error, a score of 1, if they made two errors, and zero points, if they made three or more errors. The maximum accuracy score was 44.

2.3.2. Executive function task: 2-Back Task

Stimuli and Procedure. Children's working memory and updating abilities were measured using a variation of the classic N-back task (Smith & Jonides, 1999). In this version, children viewed a sequence of digits on a computer screen and were instructed to press a certain button when the number on the screen was the same as the one that appeared two trials (2-back) before, and not press any button if the item was different (see 2). Children completed 20 practice trials before completing the actual task. Each digit was presented for 500 msecs with an inter-stimulus interval of 2500 msecs. Across 60 trials, 20 were the 'correct hit' trials. Though the task measured both accuracy and reaction times, the current study only focuses on the children's accuracy scores (i.e., composite score of the number of corrects hits minus wrong hits).



(2) Visual illustration of trials in the 2-back task

2.3.3. Low-verbal first-order false-belief task

Stimuli. This ToM paradigm tested false belief attribution (adapted from Forgeot d' Arc & Ramus, 2010). Participants watched a series of short videos including four successive phases. In the 'Beginning' phase, which was identical to all experimental conditions, the participant was introduced to the main protagonist and the situational context. The subsequent 'Change' phase involved five experimental conditions. The 'Mentalistic/Seen change' and the 'Mentalistic/Unseen change' conditions depicted a change in the situational context that was respectively witnessed or not by the main agent. In contrast, in the 'Mentalistic/No change' condition, no change was involved in the state of the world. The 'Mechanistic/Unseen Change' condition involved a change in the state of the world that was not linked to the main agent's mental state. Finally, the 'Mechanistic/No change' condition involved no change in the situational context of the story. In the 'Suspense' phase, which was common to all experimental conditions, participants viewed the main agent of the scenario coming to the front. Finally, the 'End' phase had two alternative endings, the 'Mentalistic end' that required the child to track and predict the main agent's action by false belief attribution, and the 'Mechanistic end' in which participants were required to verify the outcome of a physical event that did not necessitate false belief attribution. As such, the two alternative ends in the mentalistic experimental conditions depicted two opposite actions performed by the main agent, while the alternative ends in the mechanistic experimental conditions depicted two different resulting states (see Forgeot d' Arc & Ramus, 2010 for further details on the task's design).

For example, the 'Cake' scenario depicts a plate with cake on a table. A boy appears, sits at a chair on the right side of the table, eats all the cake and moves away ('*Beginning' phase*). Then comes a girl (Boy B). She sits down at a chair on the left side of the table and moves the empty plate in front of her ('*Change' phase*). This change is either witnessed or not by the mother of the children ('*Seen/Unseen Change'*). The mother scolds the boy ('*Mentalistic end A'*). The mother scolds the girl ('*Mentalistic end B'*). The boy has crumbs around his mouth ('*Mechanistic end A'*). The girl has crumbs around her mouth ('*Mechanistic end B'*).

The task included ten stories in five experimental conditions, with two different endings coming to a sum 100 video-based scenarios. Participants completed the task during two sessions within four days. Before the task, children completed a 10-trial familiarization session involving two 'Mentalistic/Unseen Change', two 'Mentalistic/Seen Change', two 'Mentalistic/No Change', two 'Mechanistic/Unseen Change', and two 'Mechanistic/No Change' trials.

Procedure. After being presented with the 'End' phase, the child saw a question mark [?] in the middle of the computer screen and was asked whether the end of the story was appropriate or not. The child was asked to respond as quickly and accurately as possible by pressing a 'Yes' or a 'No' (a green- or a red- colored button, respectively) on a response box. Response times (i.e. time in msecs from the appearance of the question mark to the child's button-press) and accuracy (%) of judgments were recorded via E-Prime software (Schneider, Eschman, & Zuccolotto, 2012).

Data analysis. The current study focuses on the children's accuracy scores only. We analyzed accuracy on both the 'Mentalistic Unseen change', which required false belief attribution, and the 'Mechanistic Unseen change' condition, in which participants had to judge whether the change in the physical world obeyed physical causation rules. As such, the 'Mechanistic Unseen change' condition was treated as the control condition in the task. Accuracy scores were computed as follows: first, calculation of the percentage means of correct and false decisions, and then subtraction of the wrong answers from the percentage mean of the correct decisions.

3. Results

3.1. Expressive vocabulary task

Table 2 provides descriptive statistics for the groups' scores in the expressive vocabulary task.

Table 2. Groups' Mean scores (and *SD*s) in the expressive vocabulary task

Group	Expressive vocabulary (max. score: 50)
ASDmono (N = 35)	34.8 (*4.3*)
ASDbi (N = 35)	32.3 (*6.6*)

Note: ASDmono: monolingual children with Autism Spectrum Disorder; ASDbi: bilingual children with Autism Spectrum Disorder; *max.*: maximum; N = number

A one-way between-subject analysis of variance (ANOVA) was performed for expressive vocabulary. Though the monolinguals with ASD scored higher than their bilingual peers, the Group effect was not found to be significant, F (1, 69) = 2.882, p = .095, η^2 = .22, indicating that both groups performed similarly.

3.2. Complement clause repetition task

Table 3 provides descriptive statistics for the groups' scores in the repetition of complement clauses.

Table 3. Groups' Mean scores (and *SD*s) in the complement clause repetition

Group	Expressive vocabulary (max. score: 44)
ASDmono (N = 35)	17.4 (*9.2*)
ASDbi (N = 35)	21.9 (*6.3*)

Note: ASDmono: monolingual children with Autism Spectrum Disorder; ASDbi: bilingual children with Autism Spectrum Disorder; *max.*: maximum; N = number

A one-way between-subject analysis of variance (ANOVA) was performed for accuracy in complement clause repetition. The analysis revealed a significant Group effect, F (1, 69) = 4.669, p = .035, η^2 = .28, which was due to the fact that the ASDbi group scored significantly higher than their monolingual peers.

Regarding error analysis, we should note that there were qualitative differences between the two groups, since the repetition errors of the ASDmono children mainly consisted of omissions of the complementizer or/and the epistemic verb (see (4) for an example), while ASDbi children tended to mainly replace the epistemic verbs with other (mainly epistemic) verbs (see (5) for an example).

Target complement clause:
i nosokomes ipan oti i ptisi tu jiatru ehi kaθisterisi
the nurses said that the flight the.$_{\text{GENITIVE}}$ doctor. $_{\text{GENITIVE}}$ has delay
“The nurses said that the doctor’s flight is delayed.”

(4) Repetition output (ASDmono, male, 9;6 years;months)
i ptisi tu jiatru ehi kaθisterisi
the flight the.$_{\text{GENITIVE}}$ doctor. $_{\text{GENITIVE}}$ has delay
“The doctor’s flight is delayed.”

(5) Repetition output (ASDbi, male, 9;7 years;months)
i nosokomes tu jiatru θimate oti i ptisi
the nurses the.$_{\text{GENITIVE}}$ doctor. $_{\text{GENITIVE}}$ remember that the flight

tu jiatru ehun kaθisterisi
the.$_{\text{GENITIVE}}$ doctor. $_{\text{GENITIVE}}$ have delay
“The nurses of the doctor remembers* that the flight of the doctor are* delayed.” (*grammatical error)

3.3. Executive function task: 2-Back Task

Table 4 provides descriptive statistics for the groups’ accuracy performance in the 2-back task.

Table 4. Groups’ Mean accuracy scores (%) (and *SD*s) in 2-Back task

Group	Composite accuracy (%) (correct hits % minus false hits %)
ASDmono	23.3
(*N* = 35)	(*26.6*)
ASDbi	43.4
(*N* = 35)	(*23.5*)

Note: ASD-Mono: monolingual children with Autism Spectrum Disorder; ASD-Bi: bilingual children with Autism Spectrum Disorder; *SD:* standard deviation; *N* = number

A one-way between-subject analysis of variance (ANOVA) was performed for accuracy in the 2-back task. The analysis revealed a significant Group effect, F (1, 69) = 9.378, p = .003, η^2 = .73, which was due to the fact that the ASDbi group scored significantly higher than their monolingual peers.

3.4. Low-verbal first-order false-belief task

Table 5 provides descriptive statistics for the groups' accuracy performance in the 'Mechanistic Unseen change' and the 'Mentalistic Unseen change' condition of the low-verbal first-order false-belief task.

Table 5. Groups' Mean accuracy scores (%) (and *SD*s) in the 'Mechanistic Unseen change' and 'Mentalistic Unseen change' conditions of the online low-verbal first-order false belief task

Group	Mentalistic Unseen change (%)	Mechanistic Unseen change (%)
ASDmono (N = 35)	54.2 (*16.1*)	88.7 (*10.1*)
ASDbi (N = 35)	75.4 (*13.3*)	86.5 (*8.1*)

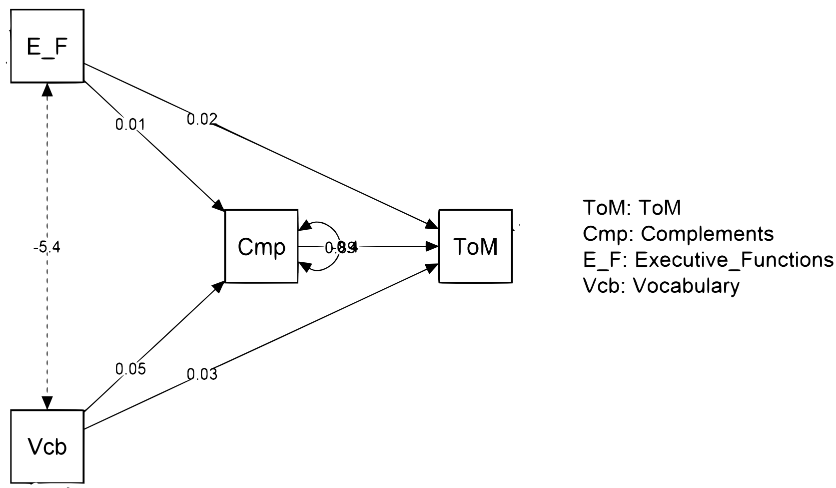
Note: ASD-Mono: monolingual children with Autism Spectrum Disorder; ASD-Bi: bilingual children with Autism Spectrum Disorder; *SD:* standard deviation; N = number

A repeated measures analysis with ToM as the within-subjects factor (Mechanistic/minus ToM vs. Mentalistic/plus ToM) and Group (monolinguals vs bilinguals) as the between-subjects factor was conducted. There was a significant Group effect, F (1, 69) = 16.160, $p < .001$, $\eta^2 = .22$, which was due to the fact that the bilinguals exhibited considerably overall accuracy in the low-verbal first-order false belief task as compared to the monolingual group. There was also a significant ToM effect, F (1, 68) = 110.993, $p < .001$, $\eta^2 = .66$, which stemmed from the fact that mechanistic trials were performed more accurately than mentalistic trials. Finally, there was a significant two-way interaction between ToM and Group, F (1, 68) = 28.922, $p < .001$, $\eta^2 = .33$. To unpack the significant interaction, we ran independent samples t-tests. The ASDmono group was found to score significantly lower than their ASDbi peers in the mentalistic condition of the task, t (69) = 5.491, $p < .001$. On the other hand, the two groups did not differ in the mechanistic trials, t (69) = .885, $p = .380$. Further within-group paired t-tests revealed that accuracy in the mentalistic condition of the task was significantly lower than the mechanistic accuracy for both ASDmono, t (34) = 10.638, $p < .001$, and the ASDbi children, t (34) = 3.906, $p = .001$.

3.5. Mediation analyses: Exploring whether Complementation mediates the effect of Language and Executive Functions on ASDmono and ASDbi children's ToM skills

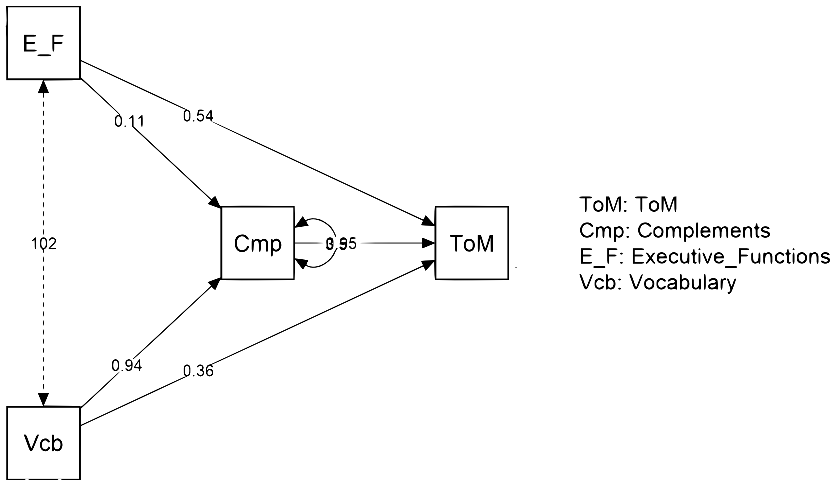
In order to see whether complement clauses might have acted as a mediator factor between language ability and executive functions as the two contributing predictors, and performance in the ToM/mentalistic trials of the low-verbal first-order false-belief task, we decided to run a mediation analysis for each group.

For the ASDmono group, a mediation model was conducted on the relation between vocabulary as a proxy for Language ability, 2-back accuracy as an index of Executive function skills, Complement clause accuracy of the Sentence repetition task and accuracy in the ToM trials of the false belief task. We fit the model using vocabulary and 2-back accuracy as the predictors, ToM accuracy as the outcome variable and Complements accuracy as the mediator factor. Results of the mediation analysis are displayed in Figure 3. Vocabulary was significantly related to ToM, $R^2 = .353$, SE = .03, $p = .048$, and, crucially, also significantly correlated with Complements, $R^2 = .332$, SE = .05, $p = .049$. When both Vocabulary and Complements were fit into the model as predictors of ToM scores, this model did not show any significant indirect effect of mediation, Z = 1.07; SE=.018; $p = .303$.



(3) Visual illustration of the mediation analysis for the ASDmono group: the relation between Vocabulary and Executive Functions as mediated by Complements.

For the ASDbi group, Vocabulary was significantly related to ToM, $R^2 =$ .353, SE = .36, $p = .048$, and, crucially, also significantly correlated with Complements, $R^2 = .396$, SE = .94, $p = .039$. Also, 2-back accuracy was significantly related to ToM, $R^2 = .353$, SE = .54, $p = .048$, and significantly correlated with Complements, $R^2 = .332$, SE = .11, $p = 0.05$. When both Vocabulary and Complements were fit into the model as predictors of ToM scores, this model was significant, Z = 3.41; SE=.06; $p < .001$. Results of the mediation analysis are displayed in Figure 4.



(4) Visual illustration of the mediation analysis for the ASDbi group: the relation between Vocabulary and Executive Functions as mediated by Complements.

4. Discussion

This work investigated whether and how potential effects of bilingualism in the vocabulary, executive functions and complement clause production in children with ASD facilitates their meta-representational cognitive capacities, with cascading effects on ToM as assessed by false belief reasoning performance. The results of the study reveal positive effects of bilingualism on ASD children's false belief attribution, updating and complement repetition skills. Regarding the relation between these boosts, we asked two questions. The first was concerned with whether bilinguals would show improved EF and if these boosts would in turn improve complementation, which might then, in turn, enhance ToM. Indeed this preliminary exploration appears to suggest that enhanced updating skills yield a cascade of boosts in complementation which in turn boost ToM in bilinguals with ASD. Interestingly, these domino effects were not clearly observable in the monolingual children with ASD. Of course, more work is needed to draw firm conclusions on this, but our findings suggest that complements play a role mediating the EF and ToM boosts that can emerge in the context of dual language exposure. The second question of the study focused on whether language proficiency could also have a role to play in the resulting domino effects. Recent work exploring the relation between epistemic vocabulary size and complement clause abilities in TD bilingual children has revealed that variability in epistemic verb use, along with EF, predict complement clause frequency in the bilingual children's narratives (Tsimpli et al., 2014). In the current study, vocabulary appeared to be important for ToM in both monolingual and bilingual children with ASD, although its impact on complement clauses was more strongly observed in the bilingual group.

Overall, our findings suggests that having to tune into one's interlocutor to select the appropriate language in dual language settings boosts social awareness and the consolidation of mental state vocabulary in ASD, as has been claimed for TD children (Farrar et al., 2017). Crucially, the error patterns of monolingual children with ASD suggest a qualitative difference from their bilingual peers in the development of mental state verbs, although the two groups showed similar overall vocabulary skills. Possibly the comparative facility in bilinguals with mental state vocabulary, including epistemic verbs which select complements, allows achieving higher complementation skills, which in turn gives rise to improvements in ToM. More work on the developmental dependencies between these factors, for instance longitudinal studies, may help to shed further light on these bilingual advantages.

References

American Psychiatric Association. 2013. *Diagnostic and Statistical Manual of Mental Disorders, 5th edition*. American Psychiatric Association, Washington, DC.

Andreou, Maria., Tsimpli, Ianthi Maria., Durrleman, Stephanie., & Peristeri, Eleni. 2020. Theory of mind, executive functions and syntax in bilingual children with autism spectrum disorder. Languages (Special Issue on 'Atypical speech, language and communication development'). *Languages* 5(4): 67.

Baldimtsi, Eleni., Peristeri, Eleni., Tsimpli, Ianthi Maria., & Durrleman, Stephanie. 2020. The impact of bilingualism in theory of mind and executive functions in typically-developing children and children with autism spectrum disorders. In Brown, Meghan., & Kohut, Alexandra (Eds.), *Proceedings of the 44th annual Boston University Conference on Language Development* (pp. 40–52, vol. 1). Somerville: Cascadilla Press.

Baron-Cohen, Simon. 1991. The theory of mind deficit in autism: How specific is it? *British Journal of Developmental Psychology* 9 (2): 301-314.

de Villiers, Jill. 2007. The interface of language and theory of mind. *Lingua, 117*(11): 1858-1878.

de Villiers, Jill. 2021. *With Language in Mind*. Philosophy: Faculty Publications, Smith College, Northampton, MA.

De Villiers, Jill., & Pyers, Jennie. 2002. Complements to Cognition: A Longitudinal Study of the Relationship between Complex Syntax and False-Belief-Understanding. *Cognitive Development,* 17: 1037–1060.

Delage, Hélène., & Frauenfelder Ulrich. 2020. Relationship between working memory and complex syntax in children with Developmental Language Disorder. *Journal of Child Language* 47(3): 600-632.

Demetriou, Eleni., Lampit, Amit., Quintana, Daniel., Naismith, Sharon., Song, Yun., Pye, John., Hickie, Ian., & Guastella, Adam. 2018. Autism spectrum disorders: a meta-analysis of executive function. *Molecular Psychiatry* 23: 1198–1204.

Durrleman, Stephanie., Burnel, Morgane, De Villiers, Jill., Thommen, Evelyne., & Delage, Hélène. 2019. The impact of grammar on mentalizing: A training study including children with Autism Spectrum disorder and Developmental Language Disorder. *Frontiers in Psychology* 10: 2478.

Durrleman, Stephanie., & Franck, Julie. 2015. Exploring links between language and cognition in autism spectrum disorders: Complement sentences, false belief, and executive functioning. *Journal of Communication Disorders* 54: 15-31.

Ebert, Kerry., Rak, Diane., Slawny, Caitly., & Fogg, Louis. 2019. Attention in bilingual children with developmental language disorder. *Journal of Speech, Language, and Hearing Research* 62: 979–92.

Farrar, Jefferey., Benigno, Joann., Tompkins, Virginia., & Gage, Nicholas (2017). Are there different pathways to explicit false belief understanding? General language and complementation in typical and atypical populations. *Cognitive Development* 43: 49–66.

Fisher, Naomi., Happé, Francesca., & Dunn, Judy. 2005. The relationship between vocabulary, grammar, and false belief task performance in children with autistic spectrum disorders and children with moderate learning difficulties. *The Journal of Child Psychology and Psychiatry* 46(4): 409-419.

Forgeot, d'Arc Baudouin., & Ramus, Franck. 2011. Belief attribution despite verbal interference. *Quarterly Journal of Experimental Psychology* 64: 975–990.

Georgas, Dimitrios., Paraskevopoulos, Ioannis., Besevegis, Elias., Giannitsas, Nikolaos., & Mylonas, Konstantinos.1997. *Ελληνικό WISC-III: Wechsler κλίμακες νοημοσύνης για παιδιά* [Greek WISC-III: Wechsler intelligence scale for children]. Athens: Ellinika Grammata.

Gonzalez-Barrero, Ana Maria., & Nadig, Aparna. 2019. Can Bilingualism Mitigate Set-Shifting Difficulties in Children With Autism Spectrum Disorders? *Child Development* 90(4): 1043-1060.

Grosse Wiesmann, Charlotte., Friederici, Angela., Singer, Tania., & Steinbeis, Nikolaus. 2017. Implicit and explicit false belief development in preschool children. *Developmental Science* 20(5): e12445.

Harris, P. (1996). Desires, beliefs and language. In Carruthers, Peter., & Smith, Peter (Eds.), *Theories of theories of mind* (pp. 200 – 220). Cambridge, UK: Cambridge University Press.

Joseph, Robert., & Tager-Flusberg, Helen. 2004. The relationship between theory of mind and executive functions to symptom type and severity in children with autism. *Development and Psychopathology* 16, 137–155.

Kimhi, Yael., Shoam-Kugelmas, Dana., Agam Ben-Artzi, Galit., Ben-Moshe, Inbal., Bauminger-Zviely, Nirit. 2014. Theory of mind and executive function in preschoolers with typical development versus intellectually able preschoolers with autism spectrum disorder. *Journal of Autism and Developmental Disorders* 44(9): 2341-2354.

Marinis, Theodoros., & Armon-Lotem, Sharon. 2015. Sentence repetition. In Armon-Lotem, Sharon., de Jong, Jan., & Meir, Natalia (Eds.), *Assessing Multilingual Children*: Disentangling Bilingualism from Language Impairment (pp. 95–124). Bristol: Multilingual Matters.

Miller, Carol. 2006. Developmental relationships between language and theory of mind. *American Journal of Speech-Language Pathology* 15 (2): 142–154.

Milligan, Karen., Astington, Janet., & Dack, Lisa. 2007. Language and Theory of Mind: Meta-Analysis of the Relation Between Language Ability and False-belief Understanding. *Child Development* 78 (2): 622-646.

Pellicano, Elizabeth. 2007. Links between theory of mind and executive function in young children with autism: clues to developmental primacy. *Developmental Psychology* 43(4): 974-990.

Pellicano, Elizabeth. 2010. Individual differences in executive function and central coherence predict developmental changes in theory of mind in autism. *Developmental Psychology* 46(2): 530-544.

Peristeri, Eleni., Tsimpli, Ianthi Maria., & Durrleman, Stephanie. 2021a. Bilingualism Effects in the Theory of Mind of Children with Autism Spectrum Disorder in Social Exclusion Contexts. In Dionne, Danielle, & Vidal, Lee-Ann (Eds.), *Proceedings of the 45th annual Boston University Conference on Language Development* (pp. 626–638, vol. 2). Somerville: Cascadilla Press.

Peristeri, Eleni., Baldimtsi, Eleni., Vogelzang, Margreet., Tsimpli, Ianthi Maria., & Durrleman, Stephanie. 2021b. The cognitive benefits of bilingualism in autism spectrum disorder: Is theory of mind boosted and by which underlying factors? *Autism* 14 (8): 1695-1709.

Peterson, Candida., & Siegal, Matthew. 2000. Insights into a theory of mind from deafness and autism. *Mind and Language* 15: 123 – 145.

Peterson, Candida., Slaughter, Virginia., & Paynter, Jessica. 2007. Social maturity and theory of mind in typically developing children and those on the autism spectrum. *The Journal of Child Psychology and Psychiatry* 48 (12): 1243-1250.

Renfrew, Catherine. (1995). *Word Finding Vocabulary Test*. Bicester: Speechmark Publishing.

Rutter, Micha., Le Couteur, Ann., & Lord, Catherine. 2003. *Autism Diagnostic Interview–Revised (ADI–R) manual*. Los Angeles: Western Psychological Services.

Schneider, Walter., Eschman, Amy., & Zuccolotto, Anthony. 2012. *E-Prime User's Guide*. Pittsburgh: Psychology Software Tools, Inc.

Schroeder, Kristen., Durrleman, Stephanie., Çokal, Derya., Sanfeliu Delgado, Annabel., Masana Marin, Adela., & Hinzen, Wolfram. 2021. Relations between intensionality, theory of mind and complex syntax in autism spectrum conditions and typical development. *Cognitive Development* 59: 101071.

Smith, Edward., & Jonides, John. 1999. Storage and executive processes in the frontal lobes. *Science* 283: 1657–1661.

Tager-Flusberg, Helen. 2007. Evaluating the theory-of-mind hypothesis of autism. *Current Directions in Psychological Science* 16 (6): 311-315.

Tager-Flusberg, Helen., & Joseph, Robert. 2005. Theory of mind, language, and executive functions in autism: A longitudinal perspective. In Schneider, Walt., Schumann-Hengsteler, Ruth., & Sodian, Beate (Eds.), *Young children's cognitive development: Interrelationships among executive functioning, working memory, verbal ability, and theory of mind* (pp. 239–257). Lawrence Erlbaum Associates Publishers.

Torregrossa, Jacopo., Andreou, Maria., Bongartz, Christiane., & Tsimpli, Ianthi Maria. 2021. Bilingual acquisition of reference: The role of language experience, executive functions and cross-linguistic effects. *Bilingualism: Language and Cognition* 24: 694–706.

Tsimpli, Ianthi Maria., Andreou, Maria., Agathopoulou, Eleni., & Masoura, Elvira. 2014. Narrative production, bilingualism and working memory capacity: A study of Greek-German bilingual children. In Kotzoglou, Georgios., Nikolou, Kalomoira., Karantzola, Eleni., Frantzi, Katerina., Galantomos, Ioannis., Georgalidou, Marianthi., Kourti-Kazoullis, Vasilia., Papadopoulou, Christina., & Vlachou, Evangelia (Eds.), *Selected Papers of the 11th International Conference on Greek Linguistics* (pp. 1730–1742). Somerville: Cascadilla Press.

Vogindroukas, Ioannis., Protopappas, Athanasios., & Sideridis, Georgios. 2009. *Test of Expressive Vocabulary*. Chania: Glafki.

Weschler, David. 1992. *The Wechsler intelligence scale for children—third edition*. San Antonio, Texas: The Psychological Corporation.

Proceedings of the 46th annual Boston University Conference on Language Development

edited by Ying Gong
and Felix Kpogo

Cascadilla Press Somerville, MA 2022

Copyright information

ISSN 1080-692X
ISBN 978-1-57473-077-7 (2 volume set, paperback)

Ordering information

To order a copy of the proceedings or to place a standing order, contact:

Cascadilla Press, P.O. Box 440355, Somerville, MA 02144, USA
phone: 1-617-776-2370, sales@cascadilla.com, www.cascadilla.com