Positive Effects of Bilingualism on Social Cognition in Autism Spectrum Disorder: A Study of Social Exclusion and Theory of Mind

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1. Introduction

Autism Spectrum Disorder (ASD) is characterized by impairment in social cognition (Baron-Cohen, 2001; Sigman & Ruskin, 1999; Tager-Flusberg, 2000). Social cognition is a complex cognitive construct that refers to the capacity to process information about other minds in interactive situations, including the perception and interpretation of intentions, perspectives and beliefs (Frith, 2008). Indeed even subgroups with ASD within the range of normal intelligence still struggle to make sense of both verbal and non-verbal social and emotional cues (Bauminger, 2002), yielding cascading negative effects throughout the population regarding the establishing and maintaining of relationships with peers (Bauminger, Shulman, & Agam, 2003; Travis & Sigman, 1998).

A critical cornerstone of social cognition is Theory of Mind (ToM), which refers to one's ability to understand and predict the behavior of others by inferring their mental states, such as emotions, beliefs, desires and intentions (Baron-Cohen, Leslie, Frith, 1985; Colle, Baron-Cohen, & Hill, 2007; Wellman, 1990). Emotion recognition in individuals with ASD is closely related to their comprehension of cues in dynamic social contexts (Speer et al., 2007), and their ability to appreciate and understand social norms (Davidson et al., 2018). Similarly, a large body of research shows that belief attribution in individuals with ASD relates to their motivation to participate in social activities (Burnside, Wright, & Poulin-Dubois, 2017). Thus, deficits in ToM appear to underlie impoverished reciprocal relations in ASD (Senju, 2013). In turn, ToM skills and, more specifically, the ability to reflect on one's and others' emotional experiences, has been found to rely on children's language abilities, especially vocabulary (Scheeren et al., 2012; Siller et al., 2014).

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In the last two decades, bilingualism has been found to boost typically developing (TD) children's ToM, yielding more appropriate responses to others' feelings and thoughts (Goetz, 2003; Kovács, 2008; Schroeder, 2018). Preliminary work suggests that bilingualism may also improve ToM in children with ASD (Andreou et al., 2020; Baldimtsi et al., 2020), however, more work is needed to determine if this improvement leads to more appropriate social adaptive functioning skills. The current study aims to shed light on this issue through assessing whether bilingualism improves these children's responsiveness to social exclusion and whether this improvement would be associated with ToM or/and vocabulary performance.

2. Method

2.1. Participants

A total of 100 children divided into four groups participated in this study. The sample included 25 monolingual Greek-speaking children with ASD (ASD-Mono), 25 bilingual children with ASD (ASD-Bi), 25 TD monolingual Greek-speaking children (TD-Mono), and 25 TD bilingual children (TD-Bi). The children were matched across groups for chronological age and gender (17 boys in each group). There were no significant differences between groups in age (F (3, 99) =1.222, p=.534). Children's verbal IQ (VIQ), performance IQ (PIQ) and full IQ (FIQ) 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 either IQ score (F (3, 99) = .113, p = .737 for VIQ, F (3, 99) = .461, p = .499 for PIQ, F (3, 99) = .122, p = .728 for FIQ). The groups were also matched on socio-economic status (SES) (mother's years of education). There was no significant Group effect in SES, F (3, 99) = 1.263, p = .288. Table 1 below presents the groups' descriptive statistics of background variables.

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

Group	age	VIQ	PIQ	FIQ	SES
ASD-Mono (N = 25)	10;6 (*0.9*)	82.6 (*11.9*)	92.6 (*13.2*)	82.5 (*11.8*)	9.8 (*2.1*)
ASD-Bi (N = 25)	10.8 (*1.0*)	85.5 (*12.2*)	93.3 (*5.8*)	87.4 (*7.9*)	9.0 (*3.1*)
TD-Mono (N = 25)	10;0 (*0.9*)	81.2 (*9.8*)	91.8 (*8.9*)	85.1 (*10.3*)	9.9 (*2.5*)
TD-Bi (N = 25)	10;3 (*1.3*)	83.4 (*9.6*)	93.4 (*10.1*)	88.2 (*8.4*)	9.8 (*2.3*)

Note: ASD-Mono = monolingual children with ASD; ASD-Bi = bilingual children with ASD; TD-Mono = monolingual children of typical development; TD-Bi = bilingual children of typical development; VIQ = Verbal IQ; PIQ = Performance IQ; FIQ = Full IQ; SES = socio-economic status; N = number

Both TD groups were recruited from mainstream school settings and spoke Greek fluently. Eligibility criteria included normal hearing, no emotional, mental, neurodevelopmental or language impairment as per parent and teacher report. The bilingual TD children were Albanian-Greek speakers and they were simultaneous bilinguals (2L1).

Children with ASD, both bilingual and monolingual, were recruited with a previous diagnosis of ASD by a licensed clinician (i.e. a child psychiatrist) and theis diagnosis was systematically confirmed with the Autism Diagnostic Interview-Revised (Rutter, LeCouteur, & Lord, 2003). In addition, all ASD participants had a non-verbal IQ of at least 75. Furthermore, according to parental and school reports, participants had no history of language delay. The bilingual children with ASD were Albanian-Greek speakers and they were also simultaneous bilinguals (2L1).

2.2. General Procedure

Following informed parental consent, we administered three tasks in two sessions to all four groups of children: an expressive vocabulary task, a social exclusion experimental paradigm widely known as the Cyberball game (Williams & Jarvis, 2006), and an online low-verbal first-order false-belief task (Forgeot d'Arc & Ramus, 2011). 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. Expressive vocabulary task

Materials. 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.

2.3.2. 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 following 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 ‘Hat’ scenario depicts a green house which is opposite to a yellow house, and a man walking nearby (*Beginning phase*). The man’s hat is blown away by the wind towards the chimney on the roof of the green house, and he goes to fetch a ladder. The wind then blows the hat to the chimney of the roof of the yellow house (*Change phase*). This change is either witnessed or not by the man (*Seen/Unseen Change*). The man brings the ladder to the green house (*Mentalistic end A*). The man brings the ladder to the yellow house (*Mentalistic end B*). The hat falls down on the street from the chimney of the green house (*Mechanistic end A*). The hat falls down on the street from the chimney of the yellow house (*Mechanistic end A*).

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.

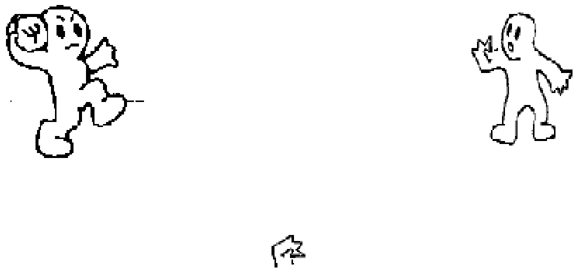
2.3.3. Cyberball game

Stimuli. Cyberball is a computer-based game of ball toss in which participants are either excluded from (*Exclusion/Ostracism condition*) or included (*Inclusion condition*) in the game by two other computer-generated avatars (Williams, Cheung, & Choi, 2000; see 1). Players are represented on the computer screen by cartoon drawings, while the participant identifies with the character located at the bottom center. The game comprises 70 throws, lasting around 3 minutes. The probability that the other players throw the ball to the participant systematically varies according to the experimental condition; in inclusion, the child receives the ball 1/3 of the time throughout the game, while in exclusion/ostracism the participant receives the ball only twice, i.e. the other two players toss the ball back and forth while the participant waits for the ball.

Procedure. In the current study, each child played both versions of the game. Right after playing each version of the game, i.e. inclusion or exclusion, the child was asked to fill–in a self-report questionnaire that comprised two sections, the Needs Threat Scale and the Mood scale. Participants were asked to indicate their personal experience on a rating scale ranging from [1] “not at all” to 5 “very strong”. Specifically, in the Needs Threat Scale, children rated the extent to which inclusion and exclusion affected four needs, namely, self-esteem, belonging, control and meaningful existence. The Need Threat Scale consists of 20 statements; five questions pertaining to each need. In the Mood Scale, children rated how good/bad, happy/sad, friendly/unfriendly and angry/pleased they were currently feeling, on the same 1-to-5 scale. Mood ratings were taken after inclusion and exclusion.

Scoring. Regarding inclusion, responses to reversed items had to be recoded in order to obtain the total score of the scale. This process assumes that the two extremes of the Likert-scale (e.g. “Not at all” and “Very strong”) give exactly the same score in the construct being measured. For example, the statement ‘I felt insecure’ in the self-esteem need in the inclusion condition was reversed, and a score of [1] on this statement was recoded as a [5]. Accordingly, in the Mood scale, the rating [2] on the ‘Unfriendly’ feeling was reversed, and a score of [2] was recoded as a [4]. Likewise, rating [1] on the Bad, Angry and Sad feelings were recoded as scores of [5] for the Inclusion condition.

Data analysis. Total scores on the Need Threat and Mood Scales (collapsing over need- and feeling-type) were analyzed separately for inclusion and exclusion.



(1) The Cyberball game (Williams, Cheung & Choi, 2000)

3. Results

3.1. Expressive vocabulary task

Table 2 provides descriptive statistics for the groups' scores on the Need Threat and the Mood Scale in the inclusion and exclusion condition.

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

Group	Expressive vocabulary (max. score: 50)
ASD-Mono	41.3
(*N* = 25)	(*4.4*)
ASD-Bi	36.8
(*N* = 25)	(*5.2*)
TD-Mono	42.7
(*N* = 25)	(*3.2*)
TD-Bi	34.8
(*N* = 25)	(*7.1*)

Note: ASD-Mono: monolingual children with Autism Spectrum Disorder; ASD-Bi: bilingual children with Autism Spectrum Disorder; TD-Mono: typically-developing monolingual children; TD-Bi: typically-developing bilingual children; *SD:* standard deviation; *max.*: maximum; *N* = number

A Bilingualism x Disorder (2 x 2) factorial between-subject analysis of variance (ANOVA) were performed for expressive vocabulary (Bilingualism levels: monolinguals, bilinguals; Disorder levels: ASD, TD). There was a significant effect of Bilingualism, F (1, 76) = 28.632, $p < .001$, $\eta^2 = .27$, indicating that monolingual children with and without autism scored significantly higher than their bilingual peers. Neither the Disorder effect, F (1, 76) = .078, $p = .781$, $\eta^2 = .01$, nor the Bilingualism x Disorder interaction effect, F (1, 76) = 1.440, $p = .154$, $\eta^2 = .07$, was found to be significant.

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

Table 3 provides descriptive statistics for the groups' accuracy performance in the 'Mechanistic Unseen change' and the 'Mentalistic Unseen change' condition.

Table 3. 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 (%)
ASD-Mono	53.3	87.3
(*N* = 25)	(*23.2*)	(*9.6*)
ASD-Bi	83.6	92.0
(*N* = 25)	(*7.9*)	(*7.5*)
TD-Mono	86.0	89.1
(*N* = 25)	(*11.1*)	(*7.0*)
TD-Bi	87.8	96.2
(*N* = 25)	(*15.2*)	(*4.9*)

Note: ASD-Mono: monolingual children with Autism Spectrum Disorder; ASD-Bi: bilingual children with Autism Spectrum Disorder; TD-Mono: typically-developing monolingual children; TD-Bi: typically-developing bilingual children; *SD:* standard deviation

Two Bilingualism x Disorder (2 x 2) factorial between-subject analyses of variance (ANOVA) were performed separately for the mentalistic and mechanistic trials. For the mentalistic trials of the task, there was a significant effect of Bilingualism, F (1, 76) = 35.729, p < .001, η^2 = .31, indicating that bilingual children with and without autism scored significantly higher than their monolingual peers, as well as a significant Disorder effect, F (1, 76) = 20.259, p < .001, η^2 = .15, which stemmed from the fact that children with ASD scored lower than TD children. There was also a significant Bilingualism x Disorder interaction effect, F (1, 76) = 30.192, p < .001, η^2 = .28. To unpack the significant interaction, we ran independent samples *t*-tests. The ASD-Mono group was found to score significantly lower than both the ASD-Bi, t (48) = 5.938, p < .001, and the TD-Mono group, t (48) = 3.660, p < .001.

For the mechanistic trials, there was no significant Bilingualism effect, F (1, 76) = .670, p = .416, η^2 = .02, nor a significant Disorder effect, F (1, 76) = .098, p = .755, η^2 = .01. Similarly, the Bilingualism x Disorder interaction effect was not found to be significant, F (1, 76) = .175, p = .677, η^2 = .01.

3.3. Cyberball game

Table 4 provides descriptive statistics for the groups' mean ratings in the Need Threat and Mood Scale of the inclusion and the exclusion condition in the Cyberball game.

Table 4. Groups' Mean ratings (and *SDs*) in the Need Threat and Mood Scales in the Inclusion and Exclusion condition of the Cyberball game

Group	Inclusion		Exclusion	
	Need Threat	Mood	Need Threat	Mood
ASD-Mono	3.8	2.8	2.0	3.3
(*N* = 25)	(*1.5*)	(*1.4*)	(*1.5*)	(*1.6*)
ASD-Bi	3.9	3.4	2.7	3.0
(*N* = 25)	(*1.4*)	(*1.6*)	(*1.6*)	(*1.7*)
TD-Mono	3.7	3.1	2.7	2.7
(*N* = 25)	(*1.3*)	(*1.4*)	(*1.4*)	(*1.3*)
TD-Bi	3.7	2.9	2.6	2.3
(*N* = 25)	(*1.5*)	(*1.8*)	(*1.3*)	(*1.1*)

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

First, a repeated measures analysis was run with Condition (inclusion, exclusion) as the within-subjects variable, and Bilingualism (monolinguals, bilinguals) and Disorder (ASD, TD) as the between-subjects factors separately for the Need Threat and the Mood scale ratings. Regarding Need Threat ratings, there was a significant effect of Bilingualism, F (2, 27) = 5.129, p = .024, η^2 = .18, which stemmed from the fact that the bilingual children with and without autism exhibited lower Need threat levels than their monolingual peers. On the other hand, the effect of Disorder was not found to be significant, F (2, 27) = .421, p = .516, η^2 = .02. There was also a significant three-way Bilingualism x Disorder x Condition interaction, F (8, 27) = 5.783, p = .016, η^2 = .20. To unpack the significant interaction, we ran paired t-tests to compare Need Threat ratings between inclusion and exclusion within each group. The analyses showed that the Need threat levels across all experimental groups were significantly higher after exclusion as compared to inclusion (t(49) = 27.095, p < .001 for the TD-Mono; t(49) = 35.407, p < .001 for the TD-Bi; t(49) = 38.196, p < .001 for the ASD-Mono; t(49) = 23.842, p < .001 for the ASD-Bi). Further independent samples t-tests revealed that Need Threat mean ratings for the ASD-Mono group in exclusion were significantly lower relative to both ASD-Bi (p < .001) and TD-Bi children (p < .001), while there was no significant Group effect in the inclusion condition (p = .088).

Regarding Mood ratings, there was a significant effect of Disorder, F (2, 27) = 5.203, p = .023, η^2 = .18, which stemmed from the fact that the children with ASD (both monolinguals and bilinguals) exhibited higher Mood fulfillment levels than their TD peers. On the other hand, the effect of Bilingualism was not found to be significant, F (2, 27) = .270, p = .603, η^2 = .01. There was also a significant three-way Bilingualism x Disorder x Condition interaction, F (8, 27) = 5.835, p = .016, η^2 = .20. To unpack the significant interaction, we ran paired t-tests to compare Mood ratings between inclusion and exclusion within each group. The analyses showed that the Mood fulfillment levels in the TD groups (both monolingual and bilingual) as well as the ASD-Bi children were significantly lower after exclusion as compared to inclusion (t(49) = 2.852, p = .04 for the TD-Mono; t(49) = 5.039, p = .026 for the TD-Bi; and t(49) = 2.867, p = .04 for the ASD-Bi). Crucially, the ASD-Mono group exhibited a significant Condition effect in the opposite direction relative to the rest of the experimental groups, i.e. Mood fulfillment levels after exclusion were significantly higher than after inclusion, t(49) = 3.985, p = .047.

3.4. Relationships between performance in the Cyberball game, ToM and language ability

A series of single-step regression analyses investigated possible associations between each group's ratings in the inclusion and the exclusion condition of the Cyberball game, ToM skills and language ability. The dependent variables in the regression models were Need Threat and Mood rates separately for inclusion and exclusion. The predictors were accuracy in the mentalistic trials of the low-verbal first-order false belief task and scores in the expressive vocabulary task. We only report on the significant regressions.

Significant effects were only found for the children with ASD. More specifically, in the Need Threat measure of the Cyberball game, the overall model was significant for the ASD-Mono group for both inclusion, F (3, 49) = 4.814, p = .003; R^2 = .16, and exclusion, F (3, 49) = 6.745, p < .001; R^2 = .18. A single predictor, namely, expressive vocabulary accounted for the variance in Need Threat in both inclusion, β = .122, p = .006, and exclusion, β = .141, p < .001. On the other hand, for the ASD-Bi group, the overall model was significant for exclusion only, F (3, 49) = 9.441, p < .001; R^2 = .24. Variance in Need Threat was accounted for by accuracy in the mentalistic trials of the false belief attribution task, β = .263, p < .001.

Regarding Mood rates, there was a significant effect for the ASD-Mono group in exclusion only, F (3, 49) = 6.947, p < .001; R^2 = .21. Variance in Mood was accounted for by expressive vocabulary, β = .358, p = .002.

4. Discussion

The current study investigated the effect of bilingualism on the experience of social inclusion and exclusion in children with ASD, as well as the way in which this experience was affected by children's ToM and language skills. The findings indicate that both monolingual and bilingual children with ASD were as able as TD controls to recognize when their needs were ignored by others, though the monolingual group with ASD reported significantly higher Need threat levels following social exclusion relative to the rest of the experimental groups. Also, exclusion was found to affect Mood fulfillment in TD monolinguals', TD bilinguals', and ASD bilinguals', since the three groups reported lower moods, i.e. significantly more elevated distress levels in contexts of exclusion than inclusion. On the other hand, the monolingual children with ASD showed difficulties in emotion regulation, since they showed lower Mood in the inclusion (vs. the exclusion) condition. Crucially, bilingual ASD children's performance in the Need Threat self-report scale was affected by their ToM (i.e. false belief attribution skills), while ASD-Mono children's self-reports on both Need threat and Mood fulfillment were rather affected by their expressive language skills in vocabulary. The overall results show a significant positive effect of bilingualism on school-age ASD children's social exclusion experiences, especially, at the level of emotional regulation, and a particular reliance on ToM boosts in this group.

More specifically, the effect of social exclusion on Need threat in Cyberball had the same direction across the experimental groups, which experienced greater threat in the exclusion settings as compared to the inclusion condition of the virtual game. This suggests that both groups with ASD exhibited monitoring of and sensitivity to signs of exclusion, and managed to recognize when they were being excluded from a social situation (see also Bolling et al., 2011; Partland et al., 2011; Sebastian, Blakemore, & Charman, 2009 for similar results with monolingual individuals with ASD). Crucially, though TD children and bilingual children with ASD reported similar effects of ostracism on Need threat, the monolingual group with ASD showed a significantly higher Need threat level. This result may reflect that monolinguals on the spectrum inaccurately appraise their actual threat levels in social contexts. Prior research has found that individuals with ASD are at a significantly greater risk of social anxiety than the general population (Seltzer et al., 2004) due to impairments in self-awareness and the perception of social threat (Capriola, Maddox, & White, 2017). The fact that Need threat levels for the ASD-Bi group were similar to the TD groups is surprising considering the stigmatization that Albanian-Greek children with ASD are frequently subjected to in the Greek society due to both their Albanian origin and autism (Pavlou, 2001; Veroni, 2019). This piece of evidence suggests that bilingualism affected autistic children's perception of rejection following exclusion, and probably mitigated 'hypersensitivity' to social threat, which is often found in individuals with autism (Seltzer et al., 2004). Crucially, the regression analyses revealed that belief attribution efficiency was influential in driving Need threat after exclusion for the bilingual children with ASD, since these children with higher accuracy on ToM exhibited lower Need threat levels in exclusion contexts. This is in contrast to their monolingual peers, for whom perception of Need threat was rather affected by their language skills, since children with higher expressive vocabulary scores showed lower Need threat levels following exclusion in the Cyberball game.

Regarding Mood, while the bilingual children with ASD tended to feel as their TD monolingual and bilingual counterparts did after exclusion, i.e. of lower moods, the monolingual children with ASD appeared to lack insight into how their experience of exclusion affected their Mood. Specifically, distress levels in the inclusion condition were more elevated as compared to the exclusion condition. Emotional dysregulation has been reported to be a core difficulty for many individuals with ASD (e.g. Mazefsky et al., 2013; Samson et al., 2014) and may explain impaired emotional self-reports in the Cyberball game. An alternative explanation may be that the monolingual children with ASD failed to understand the affective content of the emotion words in the self-report questionnaire. Interestingly, these children's Mood ratings were found to be significantly predicted by their expressive vocabulary scores, implying that children with impaired lexical abilities may have faced difficulty interpreting the affective terms in the questionnaire.

Overall, the findings from the current study show a significant positive effect of bilingualism on ASD children's experience of social exclusion in terms of both emotional regulation and the intensity of Need threat perception. Importantly, bilingualism effects in the experience of social exclusion were significantly affected by ASD children's belief attribution skills, which were in turn found to be higher than those of their monolingual peers with ASD. Bilingualism thus seems to have a down-regulation effect on the experience of social rejection in school-age children with ASD thanks to the boosts it yields in ToM (Schroeder, 2018). Future work should seek to further elucidate the mechanisms though which bilingualism acts a compensatory mechanism for the social cognition deficits in ASD.

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