Current Psychology (2026) 45:445
https://doi.org/10.1007/s12144-025-08737-4

Express yourself! A comparison of how autistic boys and girls communicate through joint attention and expressive Language

Grace Hodge[1] · Vicky Yiran Zhao[1] · Debbie Aitken[2]

Received: 26 August 2024 / Accepted: 8 October 2025

Abstract
Language and communication differences are core characteristics of autism, but few studies have explored the associations of joint attention and communication behaviours in young autistic children. The current study explores caregiver-reported measures of expressive language and joint attention behaviours from birth to age 3, noting differences between autistic and non-autistic children, as well as gender differences. Secondary data analyses exploring links between different aspects of expressive language and joint attention on the Longitudinal Study of Australian Children population cohort. *multivariate test of means* statistical analysis conducted in StataMP17 to explore the associations of expressive language, joint attention, autism, and gender. Statistically significant differences between autistic and non-autistic children for all but one of the variables regarding joint attention and expressive language. Differences in social pretend play and number of words known at age 3 between autistic and non-autistic children were most statistically significant. Joint attention measures are effective in differentiating autistic and non-autistic boys. Social pretend play at age 3 is also effective in differentiating autistic and non-autistic girls, and autistic boys and girls. It is highly likely to be able to differentiate between autistic boys and girls through social pretend play behaviours at age 3. These differences were observed despite the small sample size of only girls, and the analyses suggested that social pretend play behaviours may be more important differentiators of autistic boys and girls than speech or language outcomes. The implications of these findings for education and diagnostic approaches are discussed.

Keywords Autism spectrum disorder · Language · Joint attention · Young children · Gender

This study explores the relationship between two facets of communication: joint attention and expressive language, in autistic children from birth to age 3. Historically, autism spectrum disorder (ASD) research has predominantly focused on boys (Osterling & Dawson, 1994), and recent studies continue to reflect androcentric sampling practices (e.g., Guo et al., 2024; Chien et al., 2015; Wass et al., 2015). Consequently, this statistical analysis specifically investigates potential differences in communication behaviours between autistic girls and boys. Addressing this critical research gap, particularly within younger populations, is essential for developing inclusive, developmentally informed educational frameworks and effective early intervention strategies.

The importance of language in autism diagnosis

Some of the reviewed literature makes distinctions between Asperger's Syndrome and autism, uses terms such as high or low functioning, and current diagnostic classification systems, such as the DSM-5, still consider autism in terms of 'severity' (Mehling & Tassé, 2016). The authors of this paper will not be making those distinctions. Instead, we will refer to autism spectrum disorder (ASD) and autistic individuals in general, as this reflects preferences of those in the autistic community (Kenny et al., 2016) and current discourse implores that autism is a spectrum, not a linear scale (Bradshaw et al., 2021).

✉ Vicky Yiran Zhao
yz462@cam.ac.uk

[1] (Faculty of Education), University of Cambridge, Cambridge, UK

[2] Department of Education, University of Oxford, Oxford, UK

Published online: 17 February 2026

There is a large amount of heterogeneity in the language abilities of autistic children, and research is still expanding our understanding of autistic language use and ability. For example, it was previously reported that half of autistic people have no spoken language (Rutter, 1978) before this was revised to report that one third to one half of autistic adults have no speech (Bryson, 1996; Lord & Paul, 1997). It is now understood that the actual value of autistic individuals who are nonverbal is much smaller, with earlier diagnoses seeming to promote verbal ability (Charman & Stone, 2006). Now, seventy-five to ninety% of autistic children are suggested to acquire speech if they receive appropriate support during the preschool years (Smith et al., 2000).

Whilst there are many dimensions to language, this study will focus on expressive language. Expressive language refers to orally productive speech (Bruce et al., 2022), the use of talking, naming objects and producing gestures. Receptive language on the other hand refers to the child's ability to understand language (Putri et al., 2020).

It has been reported that autistic children between 2 and 5 years old generally have a greater impairment in receptive than expressive language ability (Hudry et al., 2010), thus serving as an important criterion for ASD diagnoses. A meta-analysis conducted by Kwok et al. (2015) argued that this discrepancy is not a useful marker of ASD, as it is not a common enough occurrence. However, it must be noted that the literature in Kwok et al. (2015) involved predominantly male samples. Therefore, the conclusion may instead be that expressive language advantage is not a common occurrence in autistic males, but its prevalence in female autistic language is a continued uncertainty.

Kwok et al. (2015) also suggest that a relative advantage in expressive language abilities is demonstrated in studies with young children, toddlers, and preschoolers as participants, whereas studies finding no such advantage tend to involve older participants. We would query whether this reduction in expressive and receptive language ability disparity with age may be a consequence of more proficient masking abilities, especially in girls (Hamilton & Roberts, 2025; Munroe & Dunleavy, 2023; Cola et al., 2020; Burns & Tierney, 2023). The possibility that expressive language use develops before receptive language in autistic children is interesting in and of itself. We therefore argue that just because these language differences may not be maintained into later life, does not mean that they are not still important markers for young autistic children, which is why our study focuses on children 3 years old and younger.

As noted above, common diagnostic manuals and criteria specifically note language use as an autistic feature, however ICD10 (2019) does differentiate Asperger syndrome; stating that there is 'no general delay or retardation in language' (WHO, 2019, F84.5). As previously noted, this study will not differentiate between Asperger syndrome and autism, as the umbrella term of ASD is considered more neurodiversity-affirmative. Even so, the description in ICD10 specifically refers to the language as 'general' and therefore there may still be differences in more specific language between autistic and typically developing (TD) children, as this review hopes to illuminate. TD children are those who appear to meet expected milestones at the age that is appropriate for that milestone. For example, at ages 3 to 5 years old, TD children meet the expected milestone of beginning to use word combinations, form sentences, and use complex markers (Tager-Flusberg et al., 2009).

The American Psychological Association (1994) stated that "impairment in communication for social purposes is a hallmark feature of autism spectrum disorder" (Kwok et al., 2015, p.202). Not only does this statement highlight how language use and ability are considered central to understanding autism, but the specification of 'for social purposes' is especially important. The focus on an impairment in the social aspects of language suggests that it may not be language use itself that is the central issue for autistic individuals, but the use of language to connect with others. From this perspective, it should be considered that having a greater impairment in receptive rather than expressive language would not be surprising. Receptive language requires a greater understanding of pragmatics and another individual, whereas expressive language does not have to serve a social purpose and can remain self-focused.

This emphasis on the social role of language links to the second focus of this paper: joint attention. Joint attention skills have been linked to later language development (Salo et al., 2018). Thus, joint attention skills may mediate the relationship between autism and language use.

Joint attention within autistic populations

Joint attention refers to the ability to share attention with another individual regarding an event or object (Carpenter et al., 1998). Joint attention is often considered to be twofold: a child can respond to a communicative partner's direction, responding to joint attention (RJA), or a child can attempt to gain the attention of the communicative partner, initiating joint attention (IJA). TD children are generally seen to develop joint attention behaviours within the first year of life, through shifting gaze to follow their caregiver's focus at 6 months old (Morales et al., 1998) and following pointing gestures between 9 and 12 months old (Deák et al., 2000). In contrast to TD children, difficulties in joint attention are often considered to be strong, distinctive indicators of autism in young children, as such difficulties are often not observed in children with other forms of developmental

delay (Mundy et al., 1994; Charman & Stone, 2006). However, Kissine et al. (2023) reported that whilst joint attention does predict language acquisition in autistic children, some autistic children with low joint attention still develop language abilities.

Joint attention ability facilitates language learning through creating social-learning situations. For example, a child may follow the eye gaze of a caregiver to support fast-mapping. Whilst autistic children are suggested to display basic gaze following at 2 years old (Charwarska et al., 2003) and RJA difficulties may reduce with age, difficulties in IJA often remain robust (Sigman et al., 1999). Interestingly, previous literature has suggested that RJA predicts expressive language growth over time but does not predict receptive language (Frost et al., 2022). Thus, it could be inferred that the relative advantage of expressive language use rather than receptive language in autistic children may be facilitated by their use of RJA and lack of IJA.

Joint attention also plays a crucial role in the development of social pretend play, one of the key variables examined in this study. Social pretend play encompasses two dimensions: the symbolic transformation of actions and objects (i.e., pretend play) and the shared "as-if" stance adopted by two or more participants (i.e., the social component) (Fantasia et al., 2024). While social pretend play has been the focus of a growing body of research (e.g. Jaggy et al., 2023; Smits-van Der Nat et al., 2024; White et al., 2021) and is understood to develop during the first 3 years of life (De Haan et al., 2021), few studies examine how social pretend play emerges and evolves before 3 years old. However, in a recent study involving children aged 19 to 28 months, Fantasia et al. (2024) confirmed earlier findings that social pretend play begins early and gradually develops from a primarily individual activity to a co-constructed social practice.

Importantly for this study, autistic children often experience difficulties in social play with their peers (Fedewa et al., 2024; Westby, 2022). They are more likely to engage in solitary play (Anderson et al., 2004), initiate fewer social interactions (Corbett et al., 2010), and respond inconsistently to peer initiations (Wolfberg et al., 2015). These differences may reflect the complex interplay between joint attention and language in autistic development. Westby (2022), for instance, suggests that communication differences may limit autistic children's ability to engage in collaborative play. Nonetheless, Farhan (2025) found that in self-directed contexts, autistic children often demonstrate strong imaginative and creative play, possibly due to the reduction of social demands.

Further supporting the role of communication in social pretend play, Luo et al. (2022), in a study of 27-month-old TD children, reported positive associations between language abilities and both the duration of social pretend play and successful initiations. Given that autistic children show delays or atypical trajectories in language development and joint attention, it is essential to examine how these differences impact their engagement in social pretend play, especially IJA. Understanding these dynamics is crucial for a more nuanced picture of early communication development in autistic children and may also expand our understanding of autism-related gender differences, as will now be discussed in the following subsections.

Gender differences within autistic populations

Much autism research has historically focused on males, potentially contributing to delays in diagnosis for autistic girls. For instance, Howlin and Asgharian (1999) found that girls are typically diagnosed around age 11, while boys are diagnosed by age 5.5. More recently, McCrossin (2022) estimated that 80% of autistic girls remain undiagnosed by age 18 and suggests the actual male-to-female autism prevalence ratio may be closer to 3:4, rather than the widely cited 4:1. Though not yet replicated, this could seek to explain other research which continues the narrative of a much higher prevalence in boys. For example, Roman-Urrestarazu et al. (2022) identified higher diagnosis rates in boys across all ethnic groups using data from over seven million students. However, their operationalization of autism included formally diagnosed children and those receiving autism-specific support, possibly overlooking autistic girls who often fall under the radar of diagnosis (Evans et al., 2019). We therefore suggest that the differences in age of diagnosis may stem from a limited understanding of autistic female development and the use of diagnostic criteria based on male presentations. Girls may also mask autistic traits more effectively (Hamilton & Roberts, 2025; Munroe & Dunleavy, 2023; Cola et al., 2020; Burns & Tierney, 2023).

The female autism phenotype (FAP) (Hull et al., 2020) represents how although autistic girls share core characteristics with boys, they often display them differently. For example, girls may show more motivation for social relationships but struggle to maintain them (Cola et al., 2022; Sedgewick et al., 2016; Halsall et al., 2021; Hiller et al., 2014). In their study of 69 boys and 69 girls, all considered 'high functioning,' Hiller et al. (2014) found both groups met diagnostic criteria but in different ways. Girls' restricted interests, sometimes more commonly known as 'special interests' (Nowell et al., 2021), were often rated as more 'random' (e.g., rocks, stickers). This may seek to explain why the restricted interests of girls are often overlooked, as they may be deemed more socially acceptable or 'quirky'

(Bourson & Prevost, 2022). Similarly, Wood-Downie et al. (2021) found autistic girls showed greater social reciprocity than boys. While both studies used gender-balanced samples, the average age of participants in Hiller et al. (2014) was 8 years old, and 10 years old in Wood-Downie et al. (2021). There is therefore a need to examine how gender differences present in younger autistic children. Given the inconsistent results in the existing literature on autistic girls, our research on gender differences within ASD in the early years using a prospective longitudinal design is particularly important to enhance our understanding of this topic.

Joint attention and autistic girls

To draw these ideas together, we will now discuss the link between autism, gender, and joint attention, as is the focus of our study. Autistic girls may exhibit distinct patterns of joint attention and social engagement that differ not only from autistic boys but also across developmental stages. From a developmental perspective, Montagut-Asunción et al. (2022) found that early joint attention behaviors (IJA and RJA) at 8–12 months were linked to the emergence of autistic traits at 18 months, regardless of gender. However, Dean et al. (2023) found that while elementary-aged autistic girls were more likely to display joint engagement with peers compared to boys, this engagement was associated with increased feelings of loneliness. This paradox, greater social involvement coinciding with heightened loneliness, links to the previously cited findings of autistic girls masking proficiencies (Hamilton & Roberts, 2025; Munroe & Dunleavy, 2023; Cola et al., 2020; Burns & Tierney, 2023). Autistic girls may engage in joint attention or social interactions as part of masking strategies, which can become emotionally taxing and unsustainable over time. Indeed, Dean et al. (2023) noted that although elementary girls showed higher rates of mutual engagement, they struggled to sustain this engagement, possibly due to social burnout. As a potential consequence, autistic high school girls were more solitary, potentially reflecting the long-term costs of early masking efforts.

This suggested gender difference in joint engagement is also reflected in younger populations, with Chawarska et al. (2016) reporting that high-risk infant girls showed greater attention to social stimuli (faces and social scenes) compared to boys, suggesting a potential female protective factor rooted in early social orienting. Similarly, Harrop et al. (2015) observed that autistic girls exhibited slightly higher frequencies of both IJA and RJA than boys at age 3, although these differences were not statistically significant. Together, these findings could imply that autistic girls may demonstrate relatively strong early joint attention and social orienting skills, which could enhance access to social experiences, but also place them at risk for later emotional exhaustion due to persistent masking and unmet social expectations. As such, investigating these potential gender differences forms an integral part of our study, as will now be discussed in the methodology.

Methods

This paper has identified the following gaps in the literature: firstly, how expressive language and joint attention are expressed in autistic children under 3 years of age and secondly, how these outcomes and behaviours may present differently in autistic girls. To address these gaps, this study uses a quantitative design to statistically analyse longitudinal data on autistic girls, pre-diagnosis, and compare their language and joint attention behaviours to those of autistic boys and non-autistic children.

The overall research question is as follows: *between birth and age 3*, *what is the relationship between joint attention and expressive language in autistic girls*, *and is there a significant difference between these communication behaviors in autistic girls and boys?*

Each section of the statistical analysis will be separated into three research questions.

Firstly, *are there any differences between autistic children and non-autistic children regarding their language outcomes from birth to age 3?* (RQ1).

Secondly, *are there any gender differences within these language outcomes?* (RQ2).

Thirdly, *are there any gender differences in these language outcomes within the autistic sample?* (RQ3).

Participants

This study involves secondary data analysis on the first three waves of the birth cohorts of the Longitudinal Study of Australian Children (LSAC), release 8. LSAC utilizes developmental data from 5,107 children and their families across Australia, as part of a current longitudinal study of children born in 2003/2004. Sampling utilized participants enrolled from the Medicare Australia database, with new data collected from the cohort every 2 years, tracking several outcomes such as cognitive and psychosocial development. Data is collected from parents, carers and childcare providers via face-to-face interviews and self-report measures. In wave one (birth to age 1), LSAC had data for 5,107 children (The Australian Institute of Family Studies, 2020), 4,666 of whom had no history of hearing problems, epilepsy and attention deficit disorders and so could be used in this analysis. These specific exclusion criteria were applied due to

their known potential to independently influence language acquisition, communication abilities, and social development. As our study sought to investigate communication behaviors of autistic children, by excluding these cases, the analysis aimed to reduce confounding variables and more accurately isolate developmental patterns relevant to ASD.

As shown in Table 1, the sample sizes for each of the variables vary. For example, the sample size for the play variable at ages 2 and 3 was 1,399, whereas the sample size for the vocabulary variable at ages 2 and 3 was 3,469. This is partly because children's play at age 3 was reported by childcare practitioners, and so data was only collected for children who attended daycare for more than 8 h per week (Gialamas et al., 2014). Only 81 autistic children and 1318 non-autistic children had available data on all measures, which is partly due to the play measures only being administrated through childcare questionnaires (Zhao & Gibson, 2022).

The sample of children for the variables at age 1 were more consistent, with a range of 3 and a mean sample size of 4,534. Although the sample sizes vary, there are still multiple benefits of studying this data because parents and teachers often have different insights. Therefore, collecting data from these two groups of respondents may enrich the findings, as one group may have noticed something the other did not, especially as they will spend different times and hours of the day with the child. This representation problem may affect any generalizations made from these findings, as will be discussed in the limitations section of this paper.

Between age 7 (wave four) and age 15 (wave eight), caregivers were asked about their children's diagnostic information, e.g. "*does study child have any of these ongoing conditions? … Autism*, *Asperger's*, *or other autism spectrum*". The authors extracted 249 children with parent-reported autistic conditions from waves one and two of the LSAC dataset.

Table 1 RQ1: are there any differences between autistic children and non-autistic children regarding their Language outcomes (joint attention and expressive Language) from birth to age 3.

Outcomes		Autistic Mean(SD)	Non-autistic Mean(SD)	*p*
Joint Attention	Emotion and use of eye gaze at ages 0/1	6.5(1.1) *N*=216	6.7(1.1) *N*=4,317	<0.05
	Social-pretend play at ages 2/3	8.9(2.7) *N*=81	10.9(1.7) *N*=1,318	<0.001
Expressive language	Use of gestures at ages 0/1	2.8(2.4) *N*=214	3.4(2.9) *N*=4,320	<0.01
	Use of communication at ages 0/1	4.2(1.9) *N*=215	4.4(1.9) *N*=4,319	0.25
	Use of sounds at ages 0/1	0.6(0.9) *N*=216	0.8(1.0) *N*=4,320	<0.05
	Number of words known at ages 2/3	41.5(26.8) *N*=174	54.9(24.4) *N*=3,295	<0.001

Demographic variables

Sex was reported by parents at birth. Although this analysis will be distinguishing boys and girls using this measure, it is important to note that gender dysmorphia has a higher prevalence in autistic populations than in non-autistic groups (De Vries et al., 2010; David et al., 2023). Therefore, the participants in this study may identify differently from their gender assigned at birth later in life. However, for the purpose of this study, as the focus is on children below 3 years of age, gender assigned at birth is appropriate terminology and differentiation.

Please refer to Tables 1, 2 and 3 for further demographic information.

Joint attention measures

At ages 0/1, emotion and use of eye gaze was measured using the Communication & Symbolic Behaviour Scale Developmental Profile–Infant/Toddler Checklist [CBS-DP] (Wetherby & Prizant, 2001). At ages 2/3, social-pretend play was measured through combining 4 of the 6 "object and social play" variables from the LSAC dataset. Specifically, the item "when you look or point to a toy across the room, does the child look at it?" reflects responding to joint attention (RJA). Items such as "when this child plays with toys, does he/she look at you to see if you are watching?" and "does this child smile or laugh while looking at you?" reflect initiating joint attention (IJA), by indicating the child's attempts to share attention or affect (Carpenter et al., 1998; Mundy et al., 1994). The item "do you know when this child is happy and when this child is upset?" was included as a broader indicator of emotional expressivity, which is closely linked to joint attention development (Mundy et al., 1994).

At ages 2 and 3, social pretend play was measured using practitioner-reported items assessing cooperative and symbolic interactions with peers, including playing simple give-and-take games, building together, engaging in pretend games using props, and participating in group games with rules. While these items do not directly measure joint attention, they reflect social-cognitive outcomes that joint attention supports and are therefore treated as downstream indicators of early joint attention abilities (Fantasia et al., 2024; Luo et al., 2022). This is also the reason behind selecting these four variables owing to their clear focus on social and cooperative play that capture both symbolic and interactive dimensions of social pretend play. The remaining two "object and social play" variables were excluded because they either focused primarily on solitary play or did not sufficiently reflect the social-cognitive aspects that are most relevant as downstream indicators of joint attention development in early childhood. These four variables were

Table 2 RQ2: Are there any gender differences?

	Outcomes	Boys			Girls		
		Autistic Mean(SD)	Non-autistic Mean(SD)	*p*	Autistic Mean(SD)	Non-Autistic Mean(SD)	*p*
Joint Attention	Emotion and use of eye gaze at ages 0/1 Boys (N=2,321) Girls (N=2,212)	6.5(1.1) N=167	6.7(1.1) N=2,154	<. 05	6.6(1.1) N=49	6.7(1.1) N=2,163	<. 50
	Social-pretend play at ages 2/3 Boys (N=711) Girls (N=688)	8.5(2.7) N=59	10.6(1.9) N=652	<. 001	9.8(2.5) N=22	11.2(1.5) N=666	<. 001
Expressive Language	Use of gestures at ages 0/1 Boys (N=2.320) Girls (N=2,214)	2.7(2.4) N=166	3.2(2.7) N=2,154	<. 05	3.1(2.6) N= 48	3.6(3.0) N=2166	<. 50
	Use of communication at ages 0/1 Boys (N=2,323) Girls (N=2,211)	4.2(1.9) N= 167	4.4(1.9) N=2,156	<. 50	4.3(1.7) N= 48	4.4(1.9) N=2,163	64
	Use of sounds at ages 0/1 Boys (N=2,323) Girls (N=2,213)	0.6(0.9) N= 167	0.8(1.0) N=2156	<. 50	0.8(0.9) N=49	0.9(1.1) N=2164	.53
	Number of words known at ages 2/3 Boys (N= 1,769) Girls (N= 1,700)	41.3(27.5) N= 129	52.2(24.8) N=1,640	<. 001	42(24.7) N=45	57.5(23.7) N=1,655	<. 001

Table 3 RQ3: Between autistic boys and autistic girls are there any differences in joint attention and expressive language?

Outcomes		Boys Mean(SD)	Girls Mean(SD)	*p*
Joint Attention	Emotion and use of eye gaze at ages 0/1	6.5(1.1) N= 167	6.6(1.1) N= 49	.9
	Social-pretend play at ages 2 /3	8.5(2.7) N= 59	9.8(2.5) N= 22	< .1
Expressive language	Use of gestures at ages 0/1	2.7(2.4) N= 166	3.1(2.6) N= 48	.4
	Use of communication at ages 0/1	4.4(1.9) N= 167	4.3(1.7) N= 48	.9
	Use of sounds at ages 0/1	0.6(0.9) N= 167	0.8(0.9) 0.8(0.9)	.3
	Number of words known at ages 2 /3	41.3(27.5) N= 129	42(24.8) N= 45	.9

Autistic children only

Table 4 Joint attention measures

Variable	Questions asked to parents or childcare practitioners
Emotion and Use of Eye Gaze at ages 0/1 (Measured via parent reports)	• *Do you know when this child is happy and when this child is upset?* • *When this child plays with toys, does he/she look at you to see if you are watching?* • *Does this child smile or laugh while looking at you?* • *When you look or point to a toy across the room, does the child look at it?*
Social Pretend Play at ages 2/3 (Measured via childcare practitioner reports)	*How well does the study child*: • *Play a simple give-and-take game with another child, like rolling a ball back and forth.* • *Cooperate with another child to do something together, like building a tower together with blocks.* • *Play pretend games with other children, by using props, like dressing up or using kitchen tools when playing house.* • *Play group games with other children that have rules, like tag, hide-n-seek, or duck-duck goose.*

combined by calculating the sum of their individual scores, resulting in a composite score where higher values indicate greater social pretend play ability.

This approach aligns with developmental research positioning joint attention as foundational to both language acquisition and social pretend play (Charman & Stone, 2006). The questions asked of parent and childcare providers to construct these variables are stated in Table 4 below.

LSAC generated a composite score for each variable through summing the question responses.

Expressive language measures

To measure expressive language, four variables from the dataset were utilized: use of gestures, use of communication, use of sounds, and number of words known.

The *Use of gestures*, *Use of Communicat*ion, and *Use of Sounds* variables were measured at ages 0/1 using the Communication & Symbolic Behaviour Scale Developmental Profile–Infant/Toddler Checklist [CBS-DP] (Wetherby & Prizant, 2001). LSAC generated a composite score for each variable through summing the question responses (Table 5).

Number of words known was measured at ages 2/3 using the MacArthur-Bates Communicative Development Inventories-III shortened version [MCDI-III] (Fenson et al., 2007). Using a 98-item vocabulary list of words of varying difficulty parents indicated on a yes or no response format whether they have heard their child use that word: 0 No; 1 Yes. The measure is then scored by adding the number of yes responses.

Procedures

To address each research question, a multivariate tests of means (MANOVA) using mvtest in StataMP 17 was conducted to examine group differences across multiple dependent variables simultaneously (Stata, 2023). MANOVA was the most appropriate analytical strategy for this study for two reasons. First, our research questions required comparisons across several groups (e.g., boys vs. girls, autistic vs. non-autistic samples) on multiple outcome variables. Second, MANOVA reduces the inflation of Type I error that would result from running multiple separate *t*-tests by accounting for the correlation structure among dependent variables and controlling the family-wise error rate. While exploratory pilot *t*-tests provided preliminary insights, we selected MANOVA to ensure a more statistically rigorous and integrated analysis of the outcome variables.

Prior to conducting the MANOVA, we assessed the key assumptions of the model. Univariate normality was examined for each dependent variable using Shapiro-Wilk tests and Q-Q plots. While some variables showed mild deviations, there were no extreme violations. Multivariate normality was evaluated by inspecting residual plots and distributional patterns, which were broadly consistent with this assumption. Homogeneity of covariance matrices was tested using Box's M test, which did not indicate statistically significant differences in covariance structures across groups. Given these findings, we proceeded with MANOVA.

We also used listwise deletion, the default approach for mvtest in Stata. Consequently, only participants with complete data for the variables included in each analysis were retained, resulting in varying sample sizes across variables and tables (e.g., N for autistic children ranged from 81 to 216 in Table 3). Notably, smaller sample sizes for variables such as social pretend play at age 3 reflect the fact that these data were reported by qualified home-based or center-based carers, rather than parents (Gialamas et al., 2014), limiting the available sample to 1,499 children with valid play measures. The LSAC dataset does not provide detailed reasons for missing data (Australian Institute of Family Studies, 2020). We chose not to apply imputation methods due to the substantial heterogeneity within the autistic population, where imputation could introduce randomness and bias rather than accurately represent individual variability. Instead, we relied on the complementary nature of practitioner and parent reports to provide a more comprehensive and nuanced picture of children's abilities.

Table 5 Expressive Language measures

Variable	Questions asked to parents
Use of Gestures at ages 0/1	• *Does this child wave to greet people?* • *Does this child pick up objects and give them to you?* • *Does this child show objects to you without giving you the object?* • *Does this child point to objects?* • *Does this child nod his/her head to indicate yes?*
Use of Communication at ages 0/1	• *Does this child let you know that he/she needs help or wants an object out of reach?* • *When you are not paying attention to this child, does he/she try to get your attention?* • *Does this child do things just to get you to laugh?* • *Does this child try to get you to notice interesting objects - just to get you to look at the objects, not to get you to do anything with them?*
Use of Sounds at ages 0/1	• *Does this child use sounds or words to get attention or help?* • *Does this child string sounds together, such as uh oh, mama, gaga, bye bye, bada?*

Results

Are there any differences between autistic children and non-autistic children regarding their language outcomes (joint attention and expressive language) from birth to ages 2 and 3?

Table 1 demonstrates the mean, standard deviations, and *p*-values between categorical and continuous variables for autistic and non-autistic children. A multivariate test of means rather than a t-test was chosen because a t-test works best on normally distributed variables (Kim & Park, 2019), and the distribution of the variables was uncertain.

Overall, there were statistically significant differences between autistic and non-autistic children for all variables regarding joint attention and expressive language, apart from the 'use of communication' variable which was non-significant ($p=.25$). In particular, the differences between autistic and non-autistic children in terms of social pretend play at age 3 and the number of words known at age 3 showed the strongest association ($p<.001$). On average, non-autistic children ($N=174$) knew a total of 54.9 words

by age 3 whereas autistic children (N=3,295) knew a total of 41.5 words. However, the standard deviation for autistic children was higher than the standard deviation for non-autistic children (26.8 vs. 24.4). As the data is more spread out from the mean, this suggests that there is more variation within the autistic children group regarding how many words are known.

There is also a statistically significant difference between autistic and non-autistic children regarding use of gestures at ages 0/1 (p<.01). On average, autistic children (N=214) are reported by their parents to use fewer gestures than non-autistic children (N=4,320) (mean=2.8 vs. mean=3.4). The differences between emotion and use of eye gaze and use of sounds in autistic and non-autistic children aged 0/1 are both statistically significant at the p<.05 level. The means demonstrate that the parents reported less frequent eye gaze and sounds for autistic children (means=6.5 and 0.6) than for non-autistic children who were reported to demonstrate these behaviours more frequently on average (means=6.7 and 0.8) (Fig. 1).

Are there any gender differences?

Table 2 demonstrates the mean, standard deviations, and p-values between categorical and continuous variables for autistic and non-autistic children, by gender. To explore this research question, a multivariate test of means on the variables was conducted, as done for research question 1. The *if* command in StataMP 17 was used to run the analyses for girls and boys separately so that both autistic and non-autistic joint attention and expressive language could be compared by gender. This research question highlighted the difference in sample sizes, with consistently more autistic boys than girls sampled for each of the variables. Importantly, each variable had differing sample sizes, depending on how many children provided data. The play variables for example were taken from early childhood centres, so if the child did not attend one of these centres, then there is no data available for that child, which is why the sample sizes for the play variables may be slightly smaller than the other variables.

Within autistic and non-autistic boys, emotion and use of eye gaze was statistically significant at the p<.05 level whereas the girls' sample of this variable was not statistically significant. This suggests that the differences in emotion and use of eye gaze between autistic and non-autistic boys are more significant than the differences in emotion and use of eye gaze between autistic and non-autistic girls. However, for the other joint attention variable, social pretend play, the statistical significance for both boys and girls is the same (p<.001).

In terms of expressive language ability, a similar pattern is observed. For the expressive language variable, use of gestures, collected when the children were less than one year old, the differences between autistic and non-autistic children were statistically significant in the sample of boys (p<.05), but not in the girl's sample. It must therefore be considered that there may be gender differences in the early expressive language of autistic boys in girls, which will be discussed in the next section. However, the variable documented at age 3, number of words known, was statistically significant at the p<.001 level for both boys and girls. For both boys and girls, autistic children knew significantly fewer words than non-autistic children before age 3. The

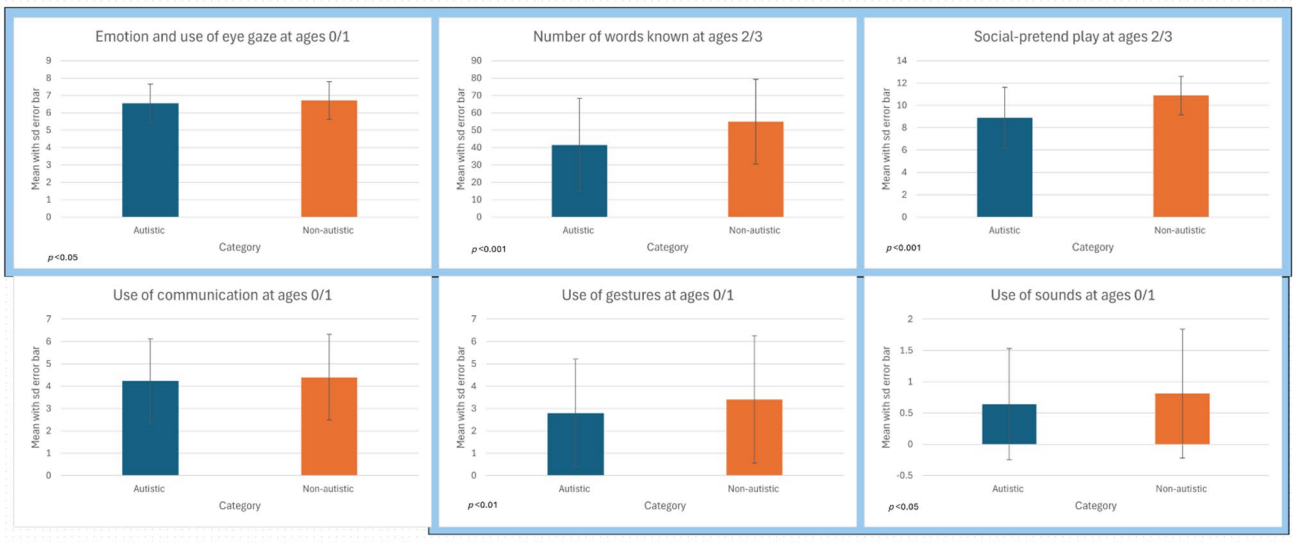

Fig. 1 Are there any differences between autistic children and non-autistic children regarding their language outcomes (joint attention and expressive language) from birth to ages 2 and 3?. Note. Graphs with a blue outline indicate statistical significance

use of communication and use of sounds variables were not statistically significant in either sample (Fig. 2).

Between autistic boys and autistic girls are there any differences in joint attention and expressive language?

A multivariate test of means on the variables was also conducted to explore this research question. Table 3 demonstrates the mean, standard deviations, and p-values between categorical and continuous variables for autistic boys and girls. However, the sample was reduced to include autistic children only, in order to compare the outcomes for autistic boys and girls. The statistical significance of the differences between autistic boys and girls in terms of joint attention and expressive language outcomes were very weak. Social pretend play at age 3 was the only marginally significant difference, $p<.1$, with autistic girls having a greater mean on the social pretend play scores than autistic boys. However, this finding should be interpreted with caution due to the small sample size for autistic girls ($n=22$), which limits statistical power and reduces the stability and reliability of the result. The small sample increases the risk of Type II errors for non-significant findings and means that marginally significant results may be fragile. This potential difference has important implications for autism diagnosis and will be discussed further in the Discussion section.

None of the other variables for joint attention or expressive language were statistically significant. In the sample of autistic children identified from the LSAC there were no statistically significant differences in joint attention and expressive language between boys and girls from birth to age 3 (Fig. 3).

Discussion

Overall, the results of this analysis indicate that there is potential to differentiate between autistic boys and girls through social pretend play behaviours at age 3. These differences were observed despite the small sample size of only 22 girls and the analyses suggested that social pretend play behaviours may be more important differentiators of autistic boys and girls than speech or language outcomes. However, it is critical to acknowledge potential confounding variables that may influence these findings, such as socioeconomic status (SES), ethnicity, parental education, and access to early childhood education settings. These factors may affect both the expression of behaviors and their observation by caregivers or educators.

Are there any differences between autistic children and non-autistic children regarding their language outcomes (joint attention and expressive language) from birth to age 3?

There were statistically significant differences between autistic and non-autistic children for all but one of the variables regarding joint attention and expressive language. The differences between autistic and non-autistic children in terms of social pretend play at age 3 and the number of words known at age 3 were most significant of all the variables. This suggests that these variables may be

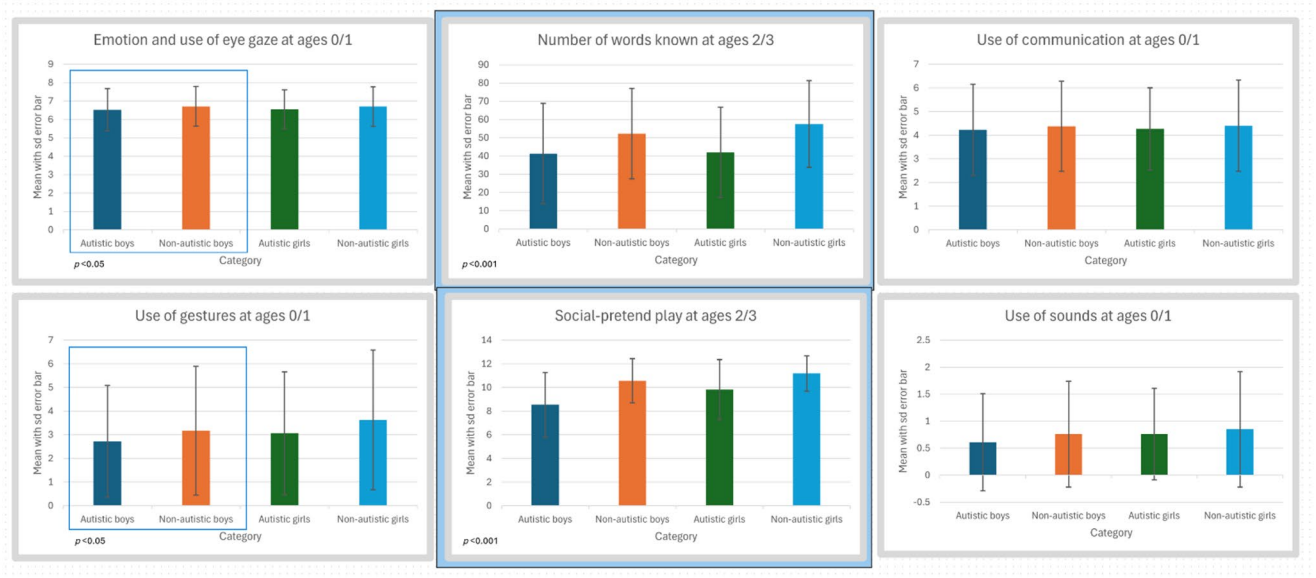

Fig. 2 Are there any gender differences?. Note. Variables with a blue outline indicate statistical significance

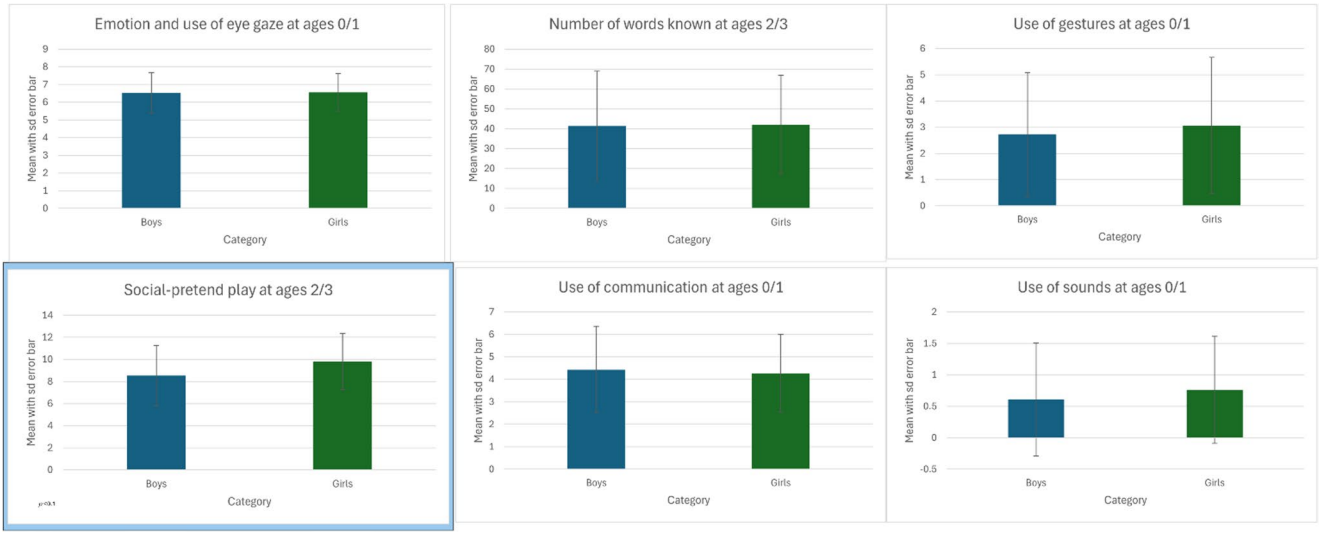

Fig. 3 Between autistic boys and autistic girls are there any differences in joint attention and expressive language?. Note. Variables with a blue outline indicate statistical significance

important markers for distinguishing between autistic and non-autistic children. This confirms previous research that autistic children often engage in less social pretend play than their non-autistic peers (Humphrey & Symes, 2011; Schupp et al., 2013). However, ethnic and cultural norms around play and language use, as well as variations in caregiver expectations or interaction styles, could influence the behaviors observed and reported in both autistic and non-autistic groups. Moreover, prior studies often focused on adolescents or included only male participants, whereas the current findings extend these insights to very young children and include autistic females; addressing a significant gap. Importantly, our results support the long-standing association between language difficulties and autism, and underline that social pretend play and vocabulary development are meaningful markers of developmental divergence. Still, language exposure, the richness of linguistic environments, and family SES can dramatically shape these developmental trajectories and may partially explain observed differences.

The observed association between joint attention and expressive language raises questions about causality. Autistic children's significantly reduced use of words compared to their TD peers may be linked to fewer opportunities to engage in social pretend play. Conversely, less involvement in social pretend play may be associated with fewer opportunities for expressive language practice or exposure to new vocabulary. The potential for these bidirectional associations, potentially embedded within environmental constraints such as limited peer interaction, differential adult input, or culturally mediated communication styles, complicate any assertions of causation.

Autistic children often struggle with social interactions and may be less comfortable using words to express themselves; both as key aspects of their autistic identity. This reflects the model proposed by Humphrey and Symes (2011), where negative peer interactions reduce motivation for future interactions, leading to underdeveloped social skills, which in turn perpetuate negative experiences. Whilst we cannot determine causation from our results, our findings of reduced vocabulary and expressive language align with the poorer social skills described in the Humphrey and Symes model (Appendix A). The implications of our findings in relation to this model are explored further in the following section.

A further important note to take from the analysis for RQ1 is that both variables are taken from wave two, when the children are 3 years old. These results therefore confirm that distinguishing or identifying autistic traits in the very early years is increasingly difficult (Camarata, 2014). However, there are still statistically significant differences between autistic and non-autistic children for variables taken from wave one at age 1 for both joint attention and expressive language outcomes. Thus, there do appear to be observable, noteworthy differences between these groups within the first year of life.

Whilst the use of communication variable was the only non-statistically significant variable, this is not overly surprising, as some of the questions or behaviours asked of in the questionnaires are slightly out of tune to an infant that is less than a year old. For example, the question: "Does this child do things just to get you to laugh?", may be influenced not only by the child's temperament but also the parents' parenting style and the home environment.

Are there any gender differences within these language outcomes (joint attention and expressive language)?

Autistic girls were compared against non-autistic girls and autistic boys were compared against non-autistic boys. Both joint attention measures (emotion and use of eye gaze and social pretend play) are effective in differentiating autistic and non-autistic boys. Social pretend play at age 3 is also effective in differentiating autistic and non-autistic girls. Therefore, social pretend play may be a differentiating factor for both boys and girls when seeking to identify autistic children from early markers. Joint attention measured by eye gaze at age 1 is less powerful for girls. Emotion and use of eye gaze is not effective at differentiating between autistic and non-autistic girls. This is not unexpected, as the emotional eye gaze measure is very general. Additionally, Jones and Klin (2013) suggested that within the first 6 months of age, autistic boys demonstrate a decline in eye fixation, whereas non-autistics do not. As Jones and Klin (2013) used male-only samples, it is important to consider whether this finding also extends to autistic girls.

Autistic females may be more proficient in learning and following social cues, as shown through their increased use of masking (Wood-Downie et al., 2021), including eye gaze (Whyte & Scherf, 2018). Recording or noticing joint attention in infants may also be harder to document than in toddlers because infants have less bodily autonomy. This is especially relevant when considering the variable requirements for the caregivers, as observing something such as eye gaze within the stressful, busy period of a newborn may be difficult to observe accurately or consistently.

Furthermore, the social pretend play variable data was collected from the child's daycare practitioner. Within childcare settings, making regular observations of the children in the setting is often compulsory and part of the everyday routine, with most providers making written observations weekly and monthly. Thus, arguably the data collected from these providers are likely to be accurate, reliable, and easier. Not only does the child have more bodily autonomy and is able to be more overt in their social interactions, but noticing and recording such behaviours is a natural part of the practitioner's role and expectation, unlike for a new mother.

Social pretend play also requires engagement with a peer, which is a more explicit behaviour which may make differences more distinct or identifiable. Girls may therefore need to be placed in a very social setting to differentiate based on joint attention. However, access to high-quality early childcare varies by SES, and cultural attitudes toward early childhood education may influence whether a child attends daycare and how much observational data can be collected. Subsequently, differences in setting and observation frequency may partly explain gendered patterns in the data.

The results from the expressive language outcomes reveal similar findings, with wave one variables (use of gestures, use of communication, and use of sounds) reflecting mostly not statistically significant differences. The only statistically significant wave one variable was use of gestures in the male sample, suggesting that use of gestures at age 1 may be an effective measure for differentiating autistic and non-autistic boys. It must therefore be noted that these measures of early expressive language may not be clear enough in identifying autistic children in the early years. This may be partly explained by the parents' experience as new parents and their levels of fatigue (Loutzenhiser et al., 2015), stress (Hughes et al., 2020), and overwhelm (Nyström & Öhrling, 2004), which may impede their ability to accurately notice or observe the sounds used by their new baby. Such variables may also be influenced by further confounding variables such as ethnic and cultural variations in infant-caregiver interaction norms.

Importantly, whilst no differences between the genders were observed at age 3, the differences between the number of words known for autistic and non-autistic children were highly statistically significant in both the boy and girl samples. Thus, expressive language at age 3 does appear to be an important factor to differentiate between autistic and non-autistic children, for both boys and girls. This finding is valuable because it can contribute to better understanding early diagnosis markers for autistic girls, as many of the other variables do not show statistically significant differences. This adds to the evidence that diagnosis for autistic girls is often difficult to achieve accurately and early.

This finding also confirms the diagnostic criteria of autism such as the general early language delays as a fundamental part of the diagnostic criteria, even from the earliest reports of autism. This variable required the parent to report how many words they had heard their child use. The focus is on expressive language and not receptive language. The variable is not reporting on whether the child understands and comprehends the words, but rather whether they produce them and use them. As Baron-Cohen (2010) argues that "communication is always social" (p.167), it is important to consider whether the comparatively limited use of language in autistic children is associated with the social difficulties that are a core diagnostic criterion of autistic individuals. As both the joint attention and expressive language variables were statistically significant between autistic and non-autistic 3-year-olds for both variables, there is an association, however the study cannot determine the directionality of the relationship.

Whilst causation cannot be asserted from our results, the differences in autistic children's language abilities may be

associated with the volume of language heard or the quality of the interactions. For example, if an autistic child has joint attention difficulties, is less social or does not react in the way the caregiver expects or desires, then the caregiver may reduce the amount they interact with that autistic child or the quality of interactions. As Romeo et al. (2018) suggest, it is not just the amount of language input that matters, but the quality of interactions, which may be influenced by broader social, cultural, and economic contexts. Thus, the difficulties in language use of autistic children may be partly a result of the poorer quality interactions they engage in, because of difficulties in joint attention behaviours, but also may be influenced by unmeasured confounds such as SES or ethnicity.

There is no scope to address this association in the current study, but future research could compare the quality of interactions between autistic and non-autistic children and their caregivers to better understand why autistic children may know fewer words than their non-autistic peers. Future research could also run regression analyses that control for SES, as the volume of language heard in early childhood is proposed to be associated with SES (Hart & Risley, 1995).

Between autistic boys and autistic girls are there any differences in joint attention and expressive language?

Social pretend play at age 3 was the only marginally significant difference observed. No differences were observed for any of the other variables. Whilst this may initially imply that there are no differences in joint attention or expressive language for boys and girls before age 3, the small number of autistic girls in our sample reduces the statistical power of these comparisons, meaning potential differences may have gone undetected. Therefore, the emergence of a marginally significant difference in social pretend play is particularly noteworthy, as it illustrates a trend despite the limited female sample size. This finding may suggest a robust gender-based difference in social pretend play between autistic boys and girls. However, with a small sample size, there's an increased risk of Type I error (false positive), so the small, marginally significant difference should be interpreted cautiously and replicated in a larger sample.

With this caution in mind, there are several implications of this finding. Firstly, social pretend play may be a more important factor for differentiating autistic boys and girls than speech or language behaviours. This importance of this finding is highlighted through such differences being observed with a small sample of only 22 autistic girls. Thus, with a larger sample size, these differences may have been more pronounced. Furthermore, these differences were observed before 3 years of age, during wave two of the LSAC data collection. Since the LSAC's collection of autism data between 2011 and 2020, the field of autism research has expanded dramatically with the number of autism diagnoses also increasing (Fombonne, 2018), alongside a greater understanding of the gender differences between the expression of autistic traits in boys and girls (Lai et al., 2015; Lai & Baron-Cohen, 2015). Thus, if similar data were to be collected again in future research, there is a potential for the sample sizes to be greater, as the knowledge of autistic presentation increases.

Secondly, the mean for social pretend play in autistic girls was higher than for autistic boys, suggesting that autistic girls engage in more social pretend play than autistic boys. This follows research that suggests that autistic females camouflaging or 'mask' more frequently (Hull et al., 2017), partly due to a desire to be liked. Therefore, autistic girls may engage in more social pretend play as a result of other social interaction variables such as camouflaging behaviors, as they copy the common behaviors of others in the social context. This follows results of Dean et al. (2017) who reported that autistic boys tended to play alone, whereas autistic girls would maintain proximity to peers as a form of camouflaging.

Another potential social interaction variable that could expand our understanding beyond social pretend play is *initiation strategies*. Within the literature on social pretend play, Luo et al. (2022), in a gender-mixed sample of TD 2-year-olds, found that while boys' successful social pretend initiations were variable, girls' initiation behaviors were more consistent. This suggests that boys and girls may approach social play interactions differently. For example, Luo et al. (2022) also observed improvement in initiation strategies over time, indicating developmental growth in social competence. In light of our preliminary finding that autistic girls may engage in more social pretend play than autistic boys, another possible social interaction variable is modeling: autistic girls may be more likely to observe and model the successful social strategies of their peers. This modeling may allow them to more effectively participate in play, in contrast to autistic boys who may be less inclined or able to adopt these strategies.

An additional social interaction variable to consider in regard to gender differences is social competence, with a recent meta-analysis reporting a positive association between pretend play and social competence (van Smits-Der Nat et al., 2024). Our findings may reflect this link, as autistic girls are frequently reported to exhibit higher levels of social awareness than autistic boys, often attributed to their increased use of social modelling and masking behaviors (Hull et al., 2017; Attwood, 2006; Wood-Downie et al., 2021). These masking behaviors may support greater

engagement in social pretend play among autistic girls, as observed in our study.

Motivational and social reciprocity variables may also help explain the gender differences in play. Westby (2022) and Fantasia et al. (2024) propose that reduced motivation to engage socially may contribute to differences in autistic children's play behaviors. Importantly, autistic girls may be more socially motivated than boys, with a stronger desire to initiate and maintain social relationships (Hiller et al., 2014). This heightened motivation may underpin their greater involvement in social pretend play, consistent with our findings. Additionally, autistic girls' potentially higher social motivation may stem from gendered expectations of behavior or different reinforcement mechanisms from caregivers and educators.

Additionally, while Fedewa et al. (2024) noted that autistic children's play is often stereotyped or repetitive, Bourson and Prevost (2022) suggest that the restricted interests of autistic girls are more likely to be perceived as socially acceptable or "quirky." This perception may afford autistic girls more opportunities for peer inclusion, allowing their solitary or interest-based play to more easily transition into socially shared pretend play. This could further contribute to the higher frequency of social pretend play observed in autistic girls in our study.

A further social interaction variable to consider is the use of non-verbal cues, such as gestures. Rynkiewicz et al. (2016) concluded that autistic girls may demonstrate more nonverbal communication behaviours than boys, which they suggest may be a facet of female camouflaging trends in autistic girls, as gestures are more frequent in neurotypicals (McKern et al., 2023). For our current findings, considering the variable of gestures could add an extra element of explanation for why social pretend play may be more frequent in autistic girls, as gestures, as opposed to eye-contact, are suggested to be used by autistic children to engage in successful joint attention during play (Yurkovic-Harding et al., 2022). Gestures are typically considered an important part of pretend play, with participants needing to use actions to demonstrate what they are pretending (for example, riding a bike or drinking a cup of tea). Therefore, children who employ more gestures as a form of communication may participate in more social pretend play. However, this analysis did not control for potential confounds such as SES, cultural background, and environmental support, which influence both opportunities for and styles of communication.

Taken together, these findings suggest that autistic girls' greater engagement in social pretend play may be driven by a combination of social modelling, heightened social motivation, and the socially permissible nature of their play interests, all of which may differentiate their developmental pathways from those of autistic boys.

Another consideration is whether the small sample size was partly influenced by the number of autistic children who attend daycare settings. Several lines of research have indicated that autistic children often struggle or feel overwhelmed in mainstream learning contexts (Goodall, 2018), with school refusal in autistic children a common occurrence (Totsika et al., 2020). Whether the same applies to early years education is uncertain, but the implication of research with older autistic individuals is that autistic children may struggle to adapt to an education setting and may therefore be more likely to stay at home or only attend part-time. If autistic boys are underrepresented in daycare contexts due to greater difficulty adapting to structured social environments, the dataset may disproportionately reflect those autistic children, especially girls, who are better able to mask or adapt, thereby skewing the apparent gender differences. If this is the case, then the data collected regarding social pretend play is limited because of this variable being collected by daycare practitioners. However, the sample sizes decrease for both autistic and non-autistic children for this variable. Whilst the ratios of non-autistic to autistic children increase slightly, it is unclear whether these differences are statistically significant without running further analyses.

Implications for theory and practice

The findings of this study imply empirical support for the cyclical model of social development proposed by Humphrey and Symes (2011), in which early negative peer experiences reduce social motivation, leading to poorer social skills, which in turn perpetuate peer rejection and further social withdrawal. This cycle may be particularly salient in the context of early childhood, where foundational skills in joint attention, expressive language, and social pretend play are first emerging.

Our results indicate that differences in social pretend play and expressive language may already be evident by age 3, with autistic children, especially boys, engaging less frequently in socially reciprocal play. This reduced engagement may limit opportunities to practice and develop social-cognitive and communication skills, potentially reinforcing the kind of developmental loop Humphrey and Symes describe (Appendix A). Importantly, our data extends the model by suggesting this cycle may begin much earlier than previously considered and may manifest differently across genders.

For autistic girls, higher levels of social pretend play suggest a potential protective factor, possibly facilitated by masking or greater social motivation. While this might delay diagnosis, it may also buffer against the negative cycle of social exclusion. In contrast, autistic boys may be more vulnerable to early social disengagement, reinforcing

the importance of targeted early interventions that promote joint attention, play skills, and expressive communication.

From an educational perspective, these findings are important because they can facilitate and support the construction of a developmentally informed education system and early intervention. The outcomes observed at ages 2 and 3 were often more statistically significant than those collected at ages 0 and 1. This would suggest that practitioners working in early years settings are in a prime position to make key observations of the child's development, especially in social play. If early years practitioners can make these observations effectively, they can provide educators in schools with more useful information about the child, which can then facilitate and influence the support available for that child when beginning school. If educators can be aware of these differences in early autism markers, such as those reported in social pretend play, they can make recommendations in terms of support and potential diagnosis pathways.

Limitations

However, these implications need to be considered within the limitations of this study.

Firstly, the small sample size of autistic girls ($n=22$) significantly restricts the generalizability of the results. While the finding of marginally significant differences in social pretend play between autistic boys and girls by age 3 is noteworthy, it must be interpreted with caution. The small sample size increases the risk of Type I error and limits the robustness of the observed effect. Although the emergence of such differences despite the small sample suggests a potentially important distinction, future studies should include larger and more diverse samples, potentially from multiple cohorts or international datasets, to enhance robustness. This is necessary to validate whether social pretend play is a more reliable differentiator of autistic boys and girls than speech or language behaviours.

Secondly, while the use of multivariate tests of means (mvtest) was appropriate for this analysis, the study's conclusions would benefit from further validation using alternative statistical methods. In future work, approaches such as regression analysis or structural equation modelling could provide more nuanced insights into the relationships between the variables and strengthen the overall reliability of the findings.

Thirdly, the exclusive use of data from Australian children (The LSAC) may introduce cultural biases, as early childhood development, educational contexts, and social norms can vary across countries. These cultural differences may influence caregiver perceptions, child behaviour, and diagnostic practices. As such, caution should be exercised in generalising the findings to non-Australian populations. Additionally, this analysis did not consider ethnicity or SES. Even within the Australian population, there are likely to be groups that are excluded from the data, such as indigenous children, as well as children who do not attend daycare settings. Thus, the data collected may not accurately represent the autism behaviours of the whole population, but only a subset. Future research should therefore seek to include additional information about the heterogeneity or homogeneity of the study children, to improve understanding of bias within the sample outside of gender.

Considering the cultural context may also be particularly important in this study context, as some variables relied on caregiver-reported data, which is inherently subjective and vulnerable to recall bias. Factors such as parental stress, fatigue, cultural expectations and individual interpretation of questionnaire items may influence reporting accuracy. Interpreting and applying our findings should therefore be done with an awareness of these potential sources of bias.

Furthermore, the identification of autistic children was also based on parent-reported measures (diagnoses) when children were between 7 and 15 years old. While using prospective data on early behaviors prior to diagnosis is a strength, especially when considering the potential for underdiagnosis of autistic girls, the reliance on later parent-reported diagnosis (rather than direct clinical confirmation for the study's grouping) can also introduce further limitations. As diagnoses were not clinically confirmed within the study, they may therefore be affected by parental misreporting, recall inaccuracies, or the aforementioned sources of bias such as family culture.

Therefore, future studies should explore variables such as social pretend play across culturally and socioeconomically diverse populations, with a consideration of official diagnostic measures to determine whether observed gender differences and developmental patterns are consistent across contexts.

Conclusion

A strength of this study is its longitudinal data and prospective design, which is important because autism is typically diagnosed beyond infancy and even later in females. By identifying autistic participants later in childhood and retrospectively examining their data collected during infancy, this study captures early developmental information that studies relying solely on infants already diagnosed with autism would miss.

By using a statistical analysis of the LSAC dataset, this study as found marginally significant differences between autistic boys and autistic girls social pretend play behaviours by age 3. This is important because the girls' sample

was small ($n=22$), so finding such a trend suggests that this differentiation is noteworthy. Social pretend play may therefore be a more important factor for differentiating autistic boys and girls than speech or language behaviours.

Our findings underscore the need for early identification strategies that incorporate social pretend play observations, as well as interventions designed to interrupt the negative feedback loop by enhancing peer interaction experiences during critical developmental windows. Recognizing and addressing gendered patterns in these behaviours may also improve diagnostic accuracy and support more individualized approaches to intervention.

Future diagnostic criteria should consider social pretend play as an important area to emphasize in young children, especially in girls who may not display other autistic traits or diagnostic criteria as obviously as boys.

Appendix

Appendix 1. Fig. 4

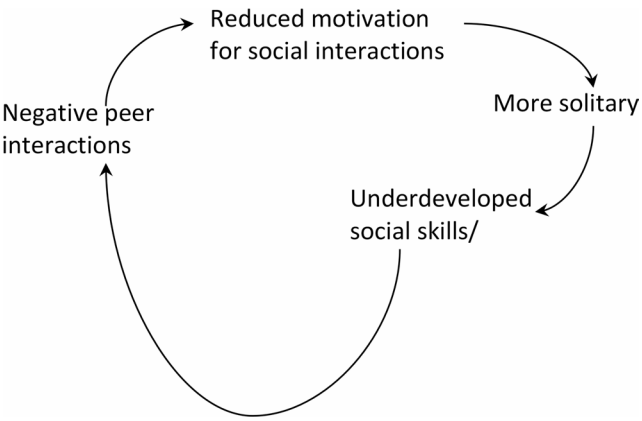

Fig. 4 Application of Humphrey & Symes (2011) Model

Funding No funding was received for conducting this study.

Data availability The secondary dataset used in this study was retrieved from the 'Growing up in Australia: the longitudinal study of Australian Children' dataset, release 8. This data set is available via application to the LSAC Dataverse: https://dataverse.ada.edu.au/dataverse/lsac. The authors made an application to access this data set and used it in accordance with the confidentiality deed poll.

Declarations

Ethical This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Committee of the University of Cambridge, Faculty of Education (Date: 30/10/23).

Conflict of interest The author has no relevant financial or non-financial interests to disclose.

References

Anderson, A., Moore, D. W., Godfrey, R., & Fletcher-Flinn, C. M. (2004). Social skills assessment of children with autism in free-play situations. *Autism, 8*(4), 369–385. https://doi.org/10.1177/1362361304045216

Attwood, T. (2006). The pattern of abilities and development of girls with asperger's syndrome. In T. Attwood & T. Grandin (Eds.), *Asperger's and girls* (pp. 1–7). Future Horizons.

Baron-Cohen, S. (2010). Empathizing, systemizing, and the extreme male brain theory of autism. *Progress in Brain Research* (Vol. 186, pp. 167–175). Elsevier.

Bourson, L., & Prevost, C. (2022). Characteristics of restricted interests in girls with ASD compared to boys: A systematic review of the literature. *European Child & Adolescent Psychiatry*. https://doi.org/10.1007/s00787-022-01998-5

Bradshaw, P., Pickett, C., van Driel, M. L., Brooker, K., & Urbanowicz, A. (2021). 'Autistic' or 'with autism'? Why the way general practitioners view and talk about autism matters. *Australian Journal of General Practice, 50*(3), 104–108. https://doi.org/10.31128/AJGP-11-20-5721

Bruce, M., McFayden, T. C., Ollendick, T. H., & Bell, M. A. (2022). Expressive language in infancy and toddlerhood: The roles of child temperament and maternal parenting behaviors. *Developmental Psychobiology, 64*(6), Article e22287. https://doi.org/10.1002/dev.22287

Bryson, S. E. (1996). Brief report: Epidemiology of autism. *Journal of Autism and Developmental Disorders, 26*(2), 165–167. https://doi.org/10.1007/BF02172005

Burns, J., & Tierney, S. (2023). Beyond the mask: The role of camouflaging in managing an autistic identity for girls and women. In *Principles of Gender-Specific Medicine* (pp. 805–819). Elsevier. https://doi.org/10.1016/B978-0-323-88534-8.00046-8

Camarata, S. (2014). Early identification and early intervention in autism spectrum disorders: Accurate and effective? *International Journal of Speech-Language Pathology*, *16*(1), 1–10. https://doi.org/10.3109/17549507.2013.858773

Carpenter, M., Nagell, K., Tomasello, M., Butterworth, G., & Moore, C. (1998). Social cognition, joint attention, and communicative competence from 9 to 15 months of age. *Monographs of the Society for Research in Child Development, 63*(4), i–174. https://doi.org/10.2307/1166214

Charman, T., & Stone, W. (2006). *Social and Communication Development in Autism Spectrum Disorders: Early Identification, Diagnosis, and Intervention*. The Guilford Press.

Chawarska, K., Klin, A., & Volkmar, F. (2003). Automatic attention cueing through eye movement in 2-year-old children with autism. *Child Development, 74*(4), 1108–1122.

Chawarska, K., Macari, S., Powell, K., DiNicola, L., & Shic, F. (2016). Enhanced social attention in female infant siblings at risk for

autism. *Journal of the American Academy of Child & Adolescent Psychiatry, 55*(3), 188-195.e1. https://doi.org/10.1016/j.jaac.2015.11.016

Chien, Y.-L., Gau, S.S.-F., Shang, C.-Y., Chiu, Y.-N., Tsai, W.-C., & Wu, Y.-Y. (2015). Visual memory and sustained attention impairment in youths with autism spectrum disorders. *Psychological Medicine, 45*(11), 2263–2273. https://doi.org/10.1017/S0033291714003201

Cola, M. L., Plate, S., Yankowitz, L., Petrulla, V., Bateman, L., Zampella, C. J., De Marchena, A., Pandey, J., Schultz, R. T., & Parish-Morris, J. (2020). Sex differences in the first impressions made by girls and boys with autism. *Molecular Autism, 11*(1), Article 49. https://doi.org/10.1186/s13229-020-00336-3

Cola, M., Yankowitz, L. D., Tena, K., Russell, A., Bateman, L., Knox, A., Plate, S., Cubit, L. S., Zampella, C. J., Pandey, J., Schultz, R. T., & Parish-Morris, J. (2022). Friend matters: Sex differences in social language during autism diagnostic interviews. *Molecular Autism, 13*(1), Article 5. https://doi.org/10.1186/s13229-021-00483-1

Corbett, B. A., Schupp, C. W., Simon, D., Ryan, N., & Mendoza, S. (2010). Elevated cortisol during play is associated with age and social engagement in children with autism. *Molecular Autism, 1*(1), Article 13. https://doi.org/10.1186/2040-2392-1-13

David, L. W., Stenberg, N., Diseth, T. H., Helverschou, S. B., Nyquist, C. B., Øien, R. A., & Waehre, A. (2023). Autistic Characteristics in a Nationally Representative Clinical Sample of Adolescents Seeking Medical Gender-Affirming Treatment in Norway. *Journal of Autism and Developmental Disorders*. https://doi.org/10.1007/s10803-023-06181-6

De Haan, D., van Vriens- Hoogdalem, A.-G., Zeijlmans, K., & Boom, J. (2021). Metacommunication in social pretend play: Two dimensions. *International Journal of Early Years Education, 29*(4), 405–419. https://doi.org/10.1080/09669760.2020.1778451

De Vries, A. L. C., Noens, I. L. J., Cohen-Kettenis, P. T., Van Berckelaer-Onnes, I. A., & Doreleijers, T. A. (2010). Autism Spectrum Disorders in Gender dysphoric children and adolescents. *Journal of Autism and Developmental Disorders, 40*(8), 930–936. https://doi.org/10.1007/s10803-010-0935-9

Deák, G. O., Flom, R. A., & Pick, A. D. (2000). Effects of gesture and target on 12- and 18-month-olds' joint visual attention to objects in front of or behind them. *Developmental Psychology, 36*(4), 511–523.

Dean, M., Harwood, R., & Kasari, C. (2017). The art of camouflage: Gender differences in the social behaviors of girls and boys with autism spectrum disorder. *Autism: The International Journal of Research and Practice, 21*(6), 678–689. https://doi.org/10.1177/1362361316671845

Dean, M., Chang, Y.-C., Shih, W., Orlich, F., & Kasari, C. (2023). Social engagement and loneliness in school-age autistic girls and boys. *Women's Health, 19*, Article 17455057231170973. https://doi.org/10.1177/17455057231170973

Evans, S. C., Boan, A. D., Bradley, C., & Carpenter, L. A. (2019). Sex/Gender Differences in Screening for Autism Spectrum Disorder: Implications for Evidence-Based Assessment. *Journal of Clinical Child & Adolescent Psychology, 48*(6), 840–854. https://doi.org/10.1080/15374416.2018.1437734

Fantasia, V., Moncalli, F., & Bello, A. (2024). Shared construction of social pretend play sequences at the kindergarten. *Europe's Journal of Psychology, 20*(2), 116–128. https://doi.org/10.5964/ejop.12443

Farhan, H. (2025). *Play behavior and cognitive flexibility in autistic and non-autistic children* [Abstract Poster Presentation]. 2025 Student Research Symposium., Montclair State University. https://digitalcommons.montclair.edu/student-research-symposium/2025/poster01/18/

Fedewa, M., Watkins, L., Barber, A., & Baggett, J. (2024). Supporting social play of preschoolers with and without autism: A collaborative approach for special educators and speech language pathologists. *Early Childhood Education Journal, 52*(6), 1023–1033. https://doi.org/10.1007/s10643-023-01488-6

Fenson, L., Marchman, V. A., Thal, D. J., Dale, P. S., Reznick, J. S., & Bates, E. (2007). *MacArthur-Bates communicative development inventories* (2nd ed.). Paul H. Brookes.

Fombonne, E. (2018). Editorial: The rising prevalence of autism. *Journal of Child Psychology and Psychiatry*, *59*(7), 717–720. https://doi.org/10.1111/jcpp.12941

Frost, K. M., Pomales-Ramos, A., & Ingersoll, B. (2022). Brief report: Response to joint attention and object imitation as predictors of expressive and receptive Language growth rate in young children on the autism Spectrum—PubMed. *Journal of Autism and Developmental Disorders, 54*(3), 1213–1220. https://pubmed.ncbi.nlm.nih.gov/35657445/

Gialamas, A., Mittinty, M. N., Sawyer, M. G., Zubrick, S. R., Lynch, J. (2014). Child care quality and children's cognitive and socio-emotional development: An Australian longitudinal study. *Early Child Development and Care, 184*(7), 977–997.

Goodall, C. (2018). I felt closed in and like i couldn't breathe': A qualitative study exploring the mainstream educational experiences of autistic young people. *Autism & Developmental Language Impairments, 3*, Article 239694151880440. https://doi.org/10.1177/2396941518804407

Guo, Z., Tang, X., Xiao, S., Yan, H., Sun, S., Yang, Z., Huang, L., Chen, Z., & Wang, Y. (2024). Systematic review and meta-analysis: Multimodal functional and anatomical neural alterations in autism spectrum disorder. *Molecular Autism, 15*(1), Article 16. https://doi.org/10.1186/s13229-024-00593-6

Halsall, J., Clarke, C., & Crane, L. (2021). Camouflaging by adolescent autistic girls who attend both mainstream and specialist resource classes: Perspectives of girls, their mothers and their educators. *Autism*, *25*(7), 2074–2086. https://doi.org/10.1177/13623613211012819

Hamilton, P., & Roberts, K. (2025). It's not as clear cut as autistic boys versus autistic girls." Exploring autistic girls' experiences of mainstream secondary education. *Journal of Research in Special Educational Needs*(4). https://doi.org/10.1111/1471-3802.70011

Harrop, C., Shire, S., Gulsrud, A., Chang, Y. C., Ishijima, E., Lawton, K., & Kasari, C. (2015). Does gender influence core deficits in ASD? An investigation into Social-Communication and play of girls and boys with ASD. *Journal of Autism and Developmental Disorders*, *45*(3), 766–777. https://doi.org/10.1007/s10803-014-2234-3

Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Brookes.

Hiller, R. M., Young, R. L., & Weber, N. (2014). Sex differences in autism spectrum disorder based on DSM-5 criteria: Evidence from clinician and teacher reporting. *Journal of Abnormal Child Psychology, 42*(8), 1381–1393. https://doi.org/10.1007/s10802-014-9881-x

Howlin, P., & Asgharian, A. (1999). The diagnosis of autism and asperger syndrome: Findings from a survey of 770 families. *Developmental Medicine & Child Neurology*, *41*(12), 834–839. https://doi.org/10.1017/S0012162299001656. Cambridge Core.

Hudry, K., Leadbitter, K., Temple, K., Slonims, V., McConachie, H., Aldred, C., Howlin, P., & Charman, T. (2010). Preschoolers with autism show greater impairment in receptive compared with expressive language abilities. *International Journal of Language & Communication Disorders, 45*(6), 681–690. https://doi.org/10.3109/13682820903461493

Hughes, C., Foley, S., Devine, R. T., Ribner, A., Kyriakou, L., Boddington, L., & Holmes, E. A. (2020). Worrying in the wings? Negative emotional birth memories in mothers and fathers show similar associations with perinatal mood disturbance and delivery mode. *Archives of Women's Mental Health*, *23*(3), 371–377. Gale Academic OneFile.

Hull, L., Petrides, K. V., Allison, C., Smith, P., Baron-Cohen, S., Lai, M. C., & Mandy, W. (2017). Putting on my best normal: Social camouflaging in adults with autism spectrum conditions. *Journal of Autism and Developmental Disorders*, *47*(8), 2519–2534. https://doi.org/10.1007/s10803-017-3166-5

Hull, L., Petrides, K. V., & Mandy, W. (2020). The female autism phenotype and camouflaging: A narrative review. *Review Journal of Autism and Developmental Disorders, 7*(4), 306–317.

Humphrey, N., & Symes, W. (2011). Peer interaction patterns among adolescents with autistic spectrum disorders (ASDs) in mainstream school settings. *Autism*, *15*(4), 397–419. https://doi.org/10.1177/1362361310387804

Jaggy, A. K., Kalkusch, I., Bossi, C. B., Weiss, B., Sticca, F., & Perren, S. (2023). The impact of social pretend play on preschoolers' social development: Results of an experimental study. *Early Childhood Research Quarterly*, *64*, 13–25. https://doi.org/10.1016/j.ecresq.2023.01.012

Jones, W., & Klin, A. (2013). Attention to eyes is present but in decline in 2–6-month-old infants later diagnosed with autism. *Nature*, *504*(7480), 427–431. https://doi.org/10.1038/nature12715

Kenny, L., Hattersley, C., Molins, B., Buckley, C., Povey, C., & Pellicano, E. (2016). Which terms should be used to describe autism? Perspectives from the UK autism community. *Autism*, *20*(4), 442–462. https://doi.org/10.1177/1362361315588200

Kim, T. K., & Park, J. H. (2019). More about the basic assumptions of t-test: Normality and sample size. *Korean Journal of Anesthesiology, 72*(4), 331–335. https://doi.org/10.4097/kja.d.18.00292

Kissine, M., Saint-Denis, A., & Mottron, L. (2023). Language acquisition can be truly atypical in autism: Beyond joint attention. *Neuroscience and Biobehavioral Reviews, 153*, 105384. https://doi.org/10.1016/j.neubiorev.2023.105384

Kwok, E. Y. L., Brown, H. M., Smyth, R. E., & Oram Cardy, J. (2015). Meta-analysis of receptive and expressive language skills in autism spectrum disorder. *Research in Autism Spectrum Disorders, 9*, 202–222. https://doi.org/10.1016/j.rasd.2014.10.008

Lai, M.-C., & Baron-Cohen, S. (2015). Identifying the lost generation of adults with autism spectrum conditions. *The Lancet Psychiatry, 2*(11), 1013–1027. https://doi.org/10.1016/S2215-0366(15)00277-1

Lai, M.-C., Lombardo, M. V., Auyeung, B., Chakrabarti, B., & Baron-Cohen, S. (2015). Sex/Gender differences and autism: Setting the scene for future research. *Journal of the American Academy of Child & Adolescent Psychiatry, 54*(1), 11–24. https://doi.org/10.1016/j.jaac.2014.10.003

Lord, C., & Paul, R. (1997). Language and communication in autism. In D. J. Cohen & F. R. Volkmar (Eds.), *Handbook of autism and pervasive developmental disorders* (2nd ed., pp. 195–225). Wiley. https://idiscover.lib.cam.ac.uk/permalink/f/16u99e0/44CAM_ALMA21524599560003606

Loutzenhiser, L., Mcauslan, P., & Sharpe, D. P. (2015). The trajectory of maternal and paternal fatigue and factors associated with fatigue across the transition to parenthood. *Clinical Psychologist, 19*(1), 15–27. https://doi.org/10.1111/cp.12048

Luo, Z., Lahat, A., Perlman, M., Howe, N., Recchia, H. E., Bukowski, W. M., & Ross, H. (2022). Changes in social pretend play as toddlers form relationships with peers. *Merrill-Palmer Quarterly*, *68*(4), 401–436. https://doi.org/10.1353/mpq.2022.a905091

McCrossin, R. (2022). Finding the true number of females with Autistic Spectrum Disorder by estimating the biases in initial recognition and clinical diagnosis. *Children, 9*(2), Article 272. https://doi.org/10.3390/children9020272

McKern, N., Dargue, N., & Sweller, N. (2023). Comparing gesture frequency between autistic and neurotypical individuals: A systematic review and meta-analysis. *Psychological Bulletin*, *149*(11–12), 724–745. https://doi.org/10.1037/bul0000408

Mehling, M. H., & Tassé, M. J. (2016). Severity of Autism Spectrum Disorders: Current conceptualization, and transition to DSM-5. *Journal of Autism and Developmental Disorders, 46*(6), 2000–2016. https://doi.org/10.1007/s10803-016-2731-7

Montagut-Asunción, M., Crespo-Martín, S., Pastor-Cerezuela, G., & D'Ocon-Giménez, A. (2022). Joint attention and its relationship with autism risk markers at 18 months of age. *Children, 9*(4), Article 556. https://doi.org/10.3390/children9040556

Morales, M., Mundy, P., & Rojas, J. (1998). Following the direction of gaze and language development in 6-month-olds. *Infant Behavior and Development, 21*(2), 373–377. https://doi.org/10.1016/S0163-6383(98)90014-5

Mundy, P., Sigman, M., & Kasari, C. (1994). Joint attention, developmental level, and symptom presentation in autism. *Development and Psychopathology*, *6*(3), 389–401. https://doi.org/10.1017/S0954579400006003. Cambridge Core.

Munroe, A., & Dunleavy, M. (2023). Recognising autism in girls within the education context: Reflecting on the internal presentation and the diagnostic criteria. *Irish Educational Studies*, *42*(4), 561–581. https://doi.org/10.1080/03323315.2023.2260371

van Smits- Der Nat, M., Van Der Wilt, F., Meeter, M., & Van Der Veen, C. (2024). The value of pretend play for social competence in early childhood: A meta-analysis. *Educational Psychology Review, 36*(2), Article 46. https://doi.org/10.1007/s10648-024-09884-z

Nowell, K. P., Bernardin, C. J., Brown, C., & Kanne, S. (2021). Characterization of special interests in autism spectrum disorder: A brief review and pilot study using the special interests survey. *Journal of Autism and Developmental Disorders, 51*(8), 2711–2724.

Nyström, K., & Öhrling, K. (2004). Parenthood experiences during the child's first year: Literature review. *Journal of Advanced Nursing, 46*(3), 319–330. https://doi.org/10.1111/j.1365-2648.2004.02991.x

Osterling, J., & Dawson, G. (1994). Early recognition of children with autism: A study of first birthday home videotapes. *Journal of Autism and Developmental Disorders*, *24*(3), 247–257. https://doi.org/10.1007/BF02172225

Putri, A. R., Pamungkasari, E. P., & Prasetya, H. (2020). Factors affecting early detection and stimulation by mothers and their impact on receptive language skills of children age 4 to 6 years. *Journal of Maternal and Child Health, 5*(3), 235–242.

Roman-Urrestarazu, A., Yang, J. C., van Kessel, R., Warrier, V., Dumas, G., Jongsma, H., Gatica-Bahamonde, G., Allison, C., Matthews, F. E., Baron-Cohen, S., & Brayne, C. (2022). *Autism incidence and spatial analysis in more than 7 million pupils in English schools: A retrospective, longitudinal, school registry study*. https://doi.org/10.17863/CAM.92798

Romeo, R. R., Leonard, J. A., Robinson, S. T., West, M. R., Mackey, A. P., Rowe, M. L., & Gabrieli, J. D. E. (2018). Beyond the 30-Million-Word gap: Children's conversational exposure is associated with Language-Related brain function. *Psychological Science*, *29*(5), 700–710. https://doi.org/10.1177/0956797617742725

Rutter, M. (1978). Diagnosis and definition. In M. Rutter, & E. Schopler (Eds.), *Autism: A reappraisal of concepts and treatment* (pp. 1–25). Plenum.

Rynkiewicz, A., Schuller, B., Marchi, E., Piana, S., Camurri, A., Lassalle, A., & Baron-Cohen, S. (2016). An investigation of the 'female camouflage effect' in autism using a computerized ADOS-2 and a test of sex/gender differences. *Molecular Autism*, *7*(1), 10. https://doi.org/10.1186/s13229-016-0073-0

Salo, V. C., Rowe, M. L., & Reeb-Sutherland, B. C. (2018). Exploring infant gesture and joint attention as related constructs and as predictors of later Language. *Infancy*, *23*(3), 432–452. https://doi.org/10.1111/infa.12229

Schupp, C. W., Simon, D., & Corbett, B. A. (2013). Cortisol responsivity differences in children with autism spectrum disorders during free and cooperative play. *Journal of Autism and Developmental Disorders*, *43*(10), 2405–2417. https://doi.org/10.1007/s10803-013-1790-2

Sedgewick, F., Hill, V., Yates, R., Pickering, L., & Pellicano, E. (2016). Gender differences in the social motivation and friendship experiences of autistic and Non-autistic adolescents. *Journal of Autism and Developmental Disorders*, *46*(4), 1297–1306. https://doi.org/10.1007/s10803-015-2669-1

Sigman, M., Ruskin, E., Arbelle, S., Corona, R., Dissanayake, C., Espinosa, M., Kim, N., López, A., Zierhut, C., Mervis, C. B., & Robinson, B. F. (1999). Continuity and change in the social competence of children with Autism, down Syndrome, and developmental delays. *Monographs of the Society for Research in Child Development*, *64*(1), JSTOR. http://www.jstor.org/stable/3181510

Smith, T., Groen, A. D., & Wynn, J. W. (2000). Randomized trial of intensive early intervention for children with pervasive developmental disorder. *American Journal on Mental Retardation*, *105*(4), 269–285. https://doi.org/10.1352/0895-8017(2000)105%3C0269:RTOIEI%3E2.0.CO;2

Stata. (2023). *Mvtest- multivariate tests of means*. Stata. https://www.stata.com/manuals/mvmvtestmeans.pdf

Tager-Flusberg, H., Rogers, S., Cooper, J., Landa, R., Lord, C., Paul, R., Rice, M., Stoel-Gammon, C., Wetherby, A., & Yoder, P. (2009). Defining spoken Language benchmarks and selecting measures of expressive Language development for young children with autism spectrum disorders. *Journal of Speech Language and Hearing Research*, *52*(3), 643–652. Gale Academic OneFile.

The Australian Institute of Family Studies (2020). The Longitudinal Study of Australian Children: An Australian Government Initiative: Data user guide. https://growingupinaustralia.gov.au/data-and-documentation/data-user-guide

Totsika, V., Hastings, R. P., Dutton, Y., Worsley, A., Melvin, G., Gray, K., Tonge, B., & Heyne, D. (2020). Types and correlates of school non-attendance in students with autism spectrum disorders. *Autism*, *24*(7), 1639–1649. https://doi.org/10.1177/1362361320916967

Wass, S. V., Jones, E. J. H., Gliga, T., Smith, T. J., Charman, T., Johnson, M. H., Baron-Cohen, S., Bedford, R., Bolton, P., Chandler, S., Davies, K., Fernandes, J., Garwood, H., Hudry, K., Maris, H., Pasco, G., Pickles, A., Ribiero, H., Tucker, L., BASIS team. (2015). Shorter spontaneous fixation durations in infants with later emerging autism. *Scientific Reports, 5*(1), Article 8284.

Westby, C. (2022). Playing to pretend or pretending to play: Play in children with autism spectrum disorder. *Seminars in Speech and Language*, *43*(04), 331–346. https://doi.org/10.1055/s-0042-1750348

Wetherby, A. M., & Prizant, B. M. (2001). *Communication & Symbolic Behaviour Scale Developmental Profile–Infant/Toddler Checklist [CBS-DP]*. Paul H. Brookes.

White, R. E., Thibodeau-Nielsen, R. B., Palermo, F., & Mikulski, A. M. (2021). Engagement in social pretend play predicts preschoolers' executive function gains across the school year. *Early Childhood Research Quarterly, 56*, 103–113. https://doi.org/10.1016/j.ecresq.2021.03.005

Whyte, E. M., & Scherf, K. S. (2018). Gaze following is related to the broader autism phenotype in a sex-specific way: Building the case for distinct male and female autism phenotypes. *Clinical Psychological Science, 6*(2), 280–287.

Wolfberg, P., DeWitt, M., Young, G. S., & Nguyen, T. (2015). Integrated play groups: Promoting symbolic play and social engagement with typical peers in children with ASD across settings. *Journal of Autism and Developmental Disorders*, *45*(3), 830–845. https://doi.org/10.1007/s10803-014-2245-0

Wood-Downie, H., Wong, B., Kovshoff, H., Mandy, W., Hull, L., & Hadwin, J. A. (2021). Sex/Gender differences in camouflaging in children and adolescents with autism. *Journal of Autism and Developmental Disorders*, *51*(4), 1353–1364. https://doi.org/10.1007/s10803-020-04615-z

World Health Organisation (2019). F84.5 Asperger Syndrome. In *International statistical classification of diseases and related health problems* (11th ed.). https://icd.who.int/browse10/2019/en#/F84.0

Yurkovic-Harding, J., Lisandrelli, G., Shaffer, R. C., Dominick, K. C., Pedapati, E. V., Erickson, C. A., Yu, C., & Kennedy, D. P. (2022). Children with ASD establish joint attention during free-flowing toy play without face looks. *Current Biology, 32*(12), 2739-2746.e4. https://doi.org/10.1016/j.cub.2022.04.044

Zhao, Y. V., & Gibson, J. L. (2022). Solitary symbolic play, object substitution and peer role play skills at age 3 predict different aspects of age 7 structural language abilities in a matched sample of autistic and non-autistic children. *Autism & Developmental Language Impairments, 7*, Article 23969415211063822. https://doi.org/10.1177/23969415211063822