

Reciprocity in autistic and typically developing children and adolescents with and without mild intellectual disabilities

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Abstract

The assessment of autism in individuals with mild intellectual disabilities (MID) is complicated because of the overlap between autistic traits and intellectual limitations. Impaired social emotional reciprocity is a core diagnostic criterion for autism. However, it is unknown whether reciprocal behaviour differs between MID individuals with or without an autism spectrum disorder (ASD). This study explored differences in reciprocal behaviour of 35 children and adolescents with MID (intelligence quotient 50–85): 15 with ASD (ASD-MID) and 20 with typical development (TD-MID) using the Interactive Drawing Test (IDT). ASD-MID participants showed a lower quality of reciprocal behaviour compared with TD-MID participants. The difference in quality of reciprocal behaviour between ASD-MID and TD-MID participants was not significantly related with Peabody Picture Vocabulary Test scores and thus not attributable to verbal capacity. The IDT is likely to reflect the child's inclination to display reciprocal behaviour in everyday situations, as its scale scores were meaningfully associated with the level of social cognition assessed with the Social Responsiveness Scale.

Thus, the IDT seems well suited for measuring impairments in reciprocal behaviour in children and adolescents with MID.

Keywords assessment, autism, intellectual disabilities, real life, reciprocity, social skills

Introduction

Diagnosing autism spectrum disorder (ASD) in children and adolescents with intellectual disabilities (ID) is perceived as complicated because both autistic traits and intellectual limitations affect a child's social development (American Psychiatric Association 2013; Eisenmajer *et al.* 2005; Smith & Williams 2005). In the diagnostic process, it may be difficult to decide whether limitations in social behaviour of children with ID are due to a co-occurring ASD and are often unduly attributed to the ID, a phenomenon also known as diagnostic overshadowing (Lovell & Reiss 1993). In the DSM-5, IDs are characterised by deficits in intellectual and adaptive functioning, i.e. impairments in conceptual skills (e.g. understanding language), social skills (e.g. interacting skills as turn-taking in games, understanding others and problems with social cues) and practical skills of daily living. ASD is characterised by deficits in social communication and social interaction (especially impaired social

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reciprocity) and restricted, repetitive patterns of behaviour, interests or activities (American Psychiatric Association 2013). If impaired reciprocity is also a defining feature of ASD in those with a combined ASD-ID diagnosis, reciprocity in this group should be more impaired than in those diagnosed only with ID.

It is evident that in both ASD and ID individuals, impairments in social interactions are to be found (DSM-5). Within this domain, recent studies have indicated that limitations in reciprocity can be measured reliably and are clearly linked to ASD in normally intelligent children (Backer van Ommeren *et al.* 2012; Backer van Ommeren *et al.* 2015, in press). It is currently unknown whether these limitations may also be indicative for ASD in children with ID. Improving our understanding of the nature of deficits in reciprocity of a group of children and adolescents with ID additionally diagnosed with and without ASD may disentangle the effect of autistic traits vs. ID on social interactive competences. Such understanding could contribute to finding more specific cues for treatment or training for children with ASD and ID. In this study, we used a new, standardised test for measuring the quality of reciprocal behaviour, the Interactive Drawing Test (IDT; Backer van Ommeren *et al.* 2012, Backer van Ommeren *et al.* 2015, in press) to compare reciprocity in ASD and typical development (TD) individuals with mild ID (MID, denoted as ASD-MID and TD-MID, respectively).

The IDT test is based on the objective and detailed observation of a real-life spontaneous interaction between a participant and an experimenter. The experimenter collaborates with the participating child or adolescent, while drawing together on a shared piece of paper. Various aspects of reciprocal interaction are measured. These vary from a very basic level, with a child only showing similar activity (scribbling on the paper) and turn-taking behaviour, to a more advanced level, where a child recognises the intentions of the other person and contributes to the drawing object (e.g. a house) that the experimenter has initiated (e.g. by adding windows to the house). Previous studies showed that the ability to reciprocate and contribute to the experimenter-initiated drawing was the most sensitive aspect of reciprocal behaviour to distinguish between normally intelligent participants with or without ASD (Backer van

Ommeren *et al.* 2012; Backer van Ommeren *et al.* 2015, in press). Administration of the IDT is largely non-verbal, making the test particularly suitable for testing MID groups. Participation requires no specific drawing skills, and the test only targets reciprocal behaviour expected of children with a developmental age of 6 years.

The main goal of this study was to assess the quality of reciprocal behaviour in children and adolescents with MID [intelligence quotient (IQ) 50–85] with or without ASD. We expected ASD-MID participants to score lower on more advanced reciprocal behaviour and particularly on the ability to respond adequately to the initiative of the experimenter compared with TD-MID participants (the most sensitive measurement for ASD deficits) in line with findings in our studies with high functioning samples. To ascertain that the scores of both groups were not dependent on verbal competency and were reflecting everyday reciprocity, we explored the associations of verbal abilities and autistic traits measured with the Social Responsiveness Scale (SRS, Bölte *et al.* 2008) with reciprocal behaviour measures with the IDT in both groups.

Method

Participants

The MID participants were recruited from special primary and secondary schools for children with cognitive impairments in the Amsterdam and Arnhem region (the Netherlands). The sample included 35 children with mild ID [Wechsler Intelligence Scale (WISC) IQs 50–85]: 15 ASD-MID participants (11 boys, 4 girls) and 20 TD-MID participants (8 boys, 12 girls; see Table 1 for more details of descriptives). The intellectual impairments of participants were established prior to and independently from the current study with the Dutch version of the WISC (Kort *et al.* 2002) as part of the diagnostic procedure to enroll in these special schools (only children with a WISC IQ < 86 are admitted). All ASD-MID participants had a clinical diagnosis established prior to recruitment according to DSM-IV-TR criteria (American Psychiatric Association 2000) by psychiatrists and/or psychologists who were not involved in the current research project. This diagnostic process of establishing ID and comorbid disorders as ASD

Table 1 Descriptives for ASD and TD participants with MID

Child variables	ASD (<i>n</i> = 15)		TD (<i>n</i> = 20)		Group differences
	M (SD)	Range	M (SD)	Range	
Age (in years)	11.6 (2.3)	8.0–16.0	10.3 (1.7)	6.3–12.9	ns
PPVT	83.6 (10.9)	67–113	83.8 (9.3)	68–101	ns
Boys; girls (<i>n</i>)	11; 4		8; 12		ASD girls < TD girls
SRS <i>t</i> _score	71.9 (11.8)	52–97	61.7 (11.5)	42–86	ASD > TD

ASD, autism spectrum disorder; TD, typical development; MID, mild intellectual disabilities; SD, standard deviation; PPVT, Peabody Picture Vocabulary Test; SRS, Social Responsiveness Scale.

included parent interviews, psychiatric examinations of the child, school observations and neuropsychological testing. The experimenters of our study had written parental consent for full access to all (neuro) psychological, psychiatric reports as well as updated measurements of intellectual abilities (assessed less than 2 years ago) of all participants.

The ASD-MID and TD-MID participants did not differ in age, $F_{1,33} = 1.39$, $P = 0.07$, or receptive vocabulary abilities measured with the Peabody Picture Vocabulary Test (PPVT) (Dunn & Dunn 2004), $F_{1,32} = .06$, $P = 0.80$. The SRS confirmed the ASD diagnosis by showing elevated scores in the ASD-MID group compared with the TD-MID group, $F_{1,32} = 6.3$, $P < 0.05$, $\eta_p^2 = 0.16$ (Roeyers *et al.* 2011). ASD participants scored above the SRS cut-off of 61 for total score (71.9, range 52–97), and TD participants scored on the cut-off (61.7, range 42–86). Gender distribution in the ASD-MID group (73% boys, 27% girls) was different ($P < 0.05$) compared with the TD-MID group (40% boys, 60% girls).

Procedure

After receiving informed consent from the parents and the participants themselves (if 12 years or older), children and adolescents were asked to participate. Psychologists that administered and scored the IDT were blind to the ASD diagnosis of participants and were specially trained to manage (i.e. videotape and score) the IDT. The assessments with the IDT and PPVT took place at the participants' schools. The SRS questionnaires were completed by the participants' parents.

Measures

The Interactive Drawing Test

The IDT is suited for children and adolescents within the age range of 6–18 years. It measures important aspects of reciprocal behaviour by analysing interactions between the child/adolescent and the experimenter while drawing together. Materials include a sheet of drawing paper (A3), coloured markers and a camera to videotape the drawing process. The test lasts approximately 10 min. The experimenter has explicit instructions to elicit reciprocal interactions. The only verbal instruction is 'We are going to draw together'. No additional explanations are offered. If the child requests more information, the experimenter repeats the instruction. The experimenter prompts the child non-verbally to contribute meaningful elements to the drawing. The experimenter and the child take turns in drawing, using their own coloured marker (see for more details Backer van Ommeren *et al.* 2012, 2015, in press). For each turn of the child, four scales of reciprocal behaviour are rated: Turn-taking (one point is awarded if the child copies the experimenter's turn-taking behaviour), Reciprocal interaction (one point is awarded if the child adds meaningful elements to a shared drawing object), Reciprocal interaction in the other's initiative (one point is awarded if the child contributes to objects initiated by the experimenter) and Reciprocal flexibility (one point is awarded if the child accepts a specific interfering input of the experimenter in his or her own drawing object). The points for each scale are divided by the total number of turns, providing proportion scores for each scale. By

adding them up over the four scales, a total proportion score is obtained.

Excellent inter-rater reliability and moderate to good retest reliability for the test have been demonstrated even though the test is designed to elicit spontaneous reciprocal behaviour (Backer van Ommeren *et al.* 2015). Criterion-related validity was good, with medium to large effect sizes between children and adolescents with and without ASD. Modest correlations were found between the IDT scores and the scores on the Autism Diagnostic Observation Schedule (Lord *et al.* 2008) and significant correlations between the IDT scores and the scores on the SRS (Bölte & Poustka 2002; Bölte *et al.* 2008) that assesses the level of specific social behaviours important for reciprocity, by interviewing parents.

The Peabody Picture Vocabulary Test (PPVT)

The PPVT is designed as a test of receptive vocabulary achievement and verbal ability. The test consists of a series of pictures, and the participant has to match an orally given word to a picture. The number of correct answers, in combinations of eight items, comprises the raw score. Errors are subtracted from the raw score, which are then standardised on a representative sample, and are converted to a standard deviation IQ score. The reliability of the PPVT tested with split-split half and test-retest administration is excellent, and the construct and content validity is good (Bucik & Bucik 2003). The PPVT is suited for a wide age range (2–90 years).

The Social Responsiveness Scale

The SRS is a 65-item questionnaire completed by parent or teacher. This test provides a quantitative measure of social responsiveness, i.e. the severity of ASD, by assessing social awareness, social cognition, social communication, social motivation and autistic preoccupations observed in real-life situations. The test-retest reliability, inter-rater reliability, construct validity, convergent validity and internal consistency of the SRS is good (Bölte *et al.* 2008; Wigham *et al.* 2012). The SRS is suited for rating individuals within a wide age range (4–18 years).

Results

Interactive Drawing Test

Using univariate analyses of variance, ASD-MID participants showed less reciprocal behaviour than TD-MID participants based on their IDT total scores, $F_{1,31} = 5.3$, $P < 0.05$, $\eta_p^2 = 0.15$. We found no differences in Turn-taking, $F_{1,31} = 3.62$, $P = 0.07$ ns, or Reciprocal interactions, $F_{1,31} = 0.09$, $P = 0.77$ ns between the groups. However, as expected, ASD-MID participants showed less Reciprocal interaction in the other's initiative compared with TD-MID participants: $F_{1,31} = 13.57$, $P = 0.001$, $\eta_p^2 = 0.30$. ASD-MID and TD-MID participants did not differ in Reciprocal flexibility scores (Scale 4): $F_{1,31} = 1.82$, $P = 0.19$ (see Table 2 for more details). We found no interactions between gender and group on any of the IDT scales (P s ranging from 0.07 to 0.93). Applying Bonferroni correction to control for multiple tests of the four IDT sub-scales indicated that despite the

Table 2 IDT scores of ASD and TD participants with MID

Child variables	ASD ($n = 15$)		TD ($n = 20$)		Group differences
	M (SD)	Range	M (SD)	Range	
Turn-taking	0.74 (0.67)	0.0–1.9	1.30 (7.6)	0–2	$P = 0.07$, $\eta_p^2 = 0.11$
Reciprocal interaction	0.77 (0.22)	0.11–1.0	0.75 (0.24)	0.10–0.95	ns
Interaction in other	0.25 (19)	0.0–.60	0.46 (0.19)	0.10–0.68	$P = 0.001$, $\eta_p^2 = 0.30$
Reciprocal flexibility	0.56 (0.35)	0–1.0	0.78 (0.25)	0.33–1.00	ns
Total score	2.3 (0.74)	0.56–3.46	3.4 (1.05)	0.53–4.4	$P < 0.05$, $\eta_p^2 = 0.15$

ASD, autism spectrum disorder; TD, typical development; MID, mild intellectual disabilities; IDT, Interactive Drawing Test.

relatively small sample size, the lower scores of the ASD-MID compared with the TD-MID on the scale Reciprocal interaction in the other's initiative remained significant ($P < 0.01$) (see Figs 1 and 2 for examples of ASD-MID and TD-MID participants).

Peabody Picture Vocabulary Test scores were not significantly related to the IDT scores in the total group (r s ranging from -0.01 to 0.13). SRS total scores were unrelated to the IDT scores in the total group (r s ranging from 0.09 to 0.28). The SRS subscale social cognition, correlated significantly with the total IDT score (-0.36^* , $P < 0.05$) and with the IDT scales 'Reciprocal interaction in the other's initiative' ($r -0.41$, $P < 0.05$) and 'Reciprocal flexibility' ($r -0.35$, $P < 0.05$; Table 3).

Discussion

The findings with the IDT demonstrate that among children and adolescents with MID, those with ASD were more limited in reciprocal behaviour than TD-MID participants. As expected and in line with previous findings (Backer van Ommeren *et al.* 2012, 2015, in press), ASD-MID participants had a lower

IDT total score than TD-MID participants.

However, the ASD-TD differences in some aspects of reciprocal behaviour were not as obvious in the MID compared with the normally intelligent participants. This indicates that, as expected, ID likely influences children's performance on these aspects of reciprocal behaviour. The critical question is whether this occurs to the extent that reciprocal performance of those with ASD-MID and those with TD-MID cannot be distinguished. We found no difference between the two groups in the ability to reciprocate in general. This indicates that the ability for reciprocal interaction, irrespective of who initiates the interaction, does not differ between ASD-MID and TD-MID participants. However, ASD-MID participants were clearly less able to reciprocate another person's initiative (in 25% of the turns) than TD-MID participants (in 46% of the turns; see Table 2). This finding indicates that the ability for participating in a reciprocal process is clearly negatively influenced by the autistic trait of being more focused on themselves (Klin & Saulnier 2007; Travis *et al.* 2001; Wimpory *et al.* 2007). So the level of reciprocity, where positive contribution to the

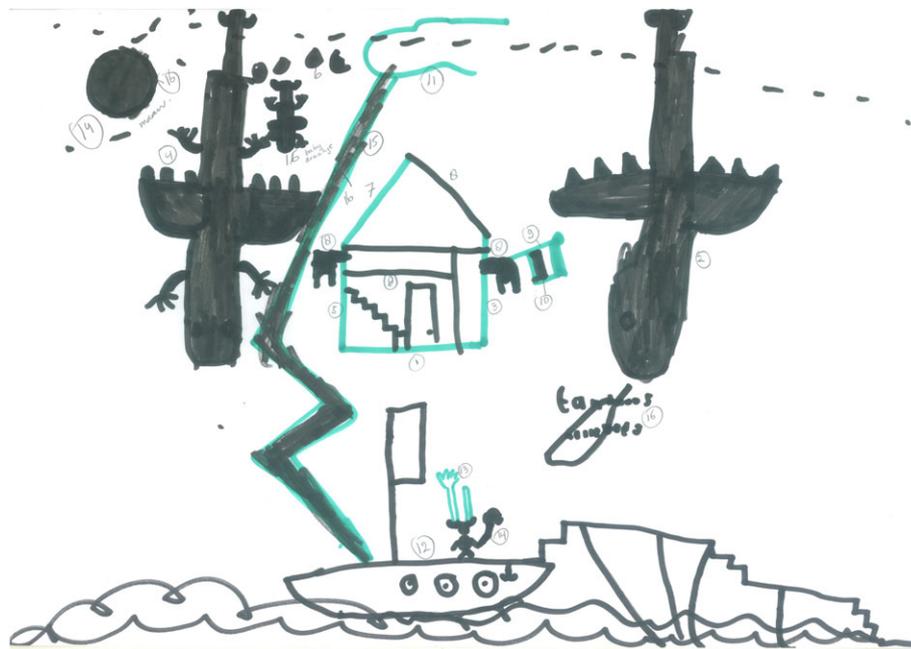


Figure 1 Example of a drawing by a 9-year-old autistic boy with ID (black marker). From the start, this boy (his drawing has even numbers and starts with turn 2) is preoccupied with drawing his own objects (dragons, boat) and hardly contributes to the researcher's objects (odd numbers, starts with turn 1, green marker). [Colour figure can be viewed at wileyonlinelibrary.com]



Figure 2 Example of a drawing of a 9-year-old typically developing boy with ID (black marker). From the start, this boy (even numbers, starts with turn 2) alternately draws in the researcher's objects (odd numbers starts with turn 1, green marker) or in his own objects. [Colour figure can be viewed at wileyonlinelibrary.com]

Table 3 Correlations between IDT scores ($N = 35$) and SRS total score, sub module social cognition and PPVT

	Total IDT score	Turn-taking behaviour	Reciprocal interactions	Reciprocal interactions in other's initiative	Reciprocal flexibility
SRS total score	-0.25	-0.17	-0.09	-0.28	-0.24
SRS social cognition	-0.36*	-0.23	-0.16	-0.41*	-0.35*
PPVT	-0.01	-0.10	0.02	0.11	0.13

IDT, Interactive Drawing Test; SRS, Social Responsiveness Scale; PPVT, Peabody Picture Vocabulary Test.

* $p < .05$

initiatives of the interaction partner is needed, seems to constitute the distinguishing feature between ASD-MID and TD-MID children and adolescents. Importantly, these differences are not attributable to verbal capacity, as associations between this particular IDT reciprocal behaviour were not significantly related with PPVT scores. Moreover, the IDT is likely to reflect the child's likelihood to display reciprocal behaviour that is seen by parents in everyday

situations, as its scale scores were meaningfully associated with the level of social cognition (important for reciprocal behaviour) assessed with the SRS (Table 3). Admittedly, these latter correlations were only moderate, but strong correlations between scores based on a 10-min test of reciprocity (IDT) and a parent-reported instrument reflecting a summary of long periods of observation and not focusing on reciprocity per se (SRS) are not expected.

An important finding is that the largest difference between the ASD-MID and TD-MID groups in this study was found on the Reciprocal interaction in the other's initiative scale. This scale was also found to make the strongest difference when comparing ASD and TD groups without ID where the proportional difference in this behaviour was very similar as found in the current study (0.23 vs. 0.21 in this study; Backer van Ommeren *et al.* 2015). Thus, the strongest difference in limitations in reciprocity between children/adolescents with ASD vs. those without ASD, independent of the co-occurrence of MID, is to be found when the researcher controls the drawing topic and the child/adolescent has to adjust his/her drawing behaviour to that of the experimenter. So independent of the sheer intellectual capabilities of the child/adolescent, the degree to which the child succeeds in decentering and letting go of control of what happens in the situation seems to be important to distinguish those with likely ASD from those without. This suggestion is corroborated by the finding that the ASD-MID group also differed almost significantly from the TD-MID group in their tendency to copy the experimenter's turn-taking behaviour (which was also found in the comparison of ASD-TD groups without MID; cf. Backer van Ommeren *et al.* 2015). So it is not the presence vs. absence of reciprocal behaviour *per se* that distinguishes ASD from TD children – independent of the presence of additional intellectual disability – but the degree to which they are truly able to adjust their behaviour to that of their interaction partner. And this is exactly what was expected, based on the diagnostic characteristics of ASD.

The findings from this study should be considered in the context of several limitations. First, the samples in this study were small, and future studies with larger samples are needed to confirm and further elaborate our findings. Furthermore, a larger and more balanced selection of female participants is needed for a valid assessment of gender differences in both groups. Further, although the test was developed to mimic a real-life situation, it actually constitutes a rather ideal real-life situation with an absence of failure or rejection: all inputs of the child are accepted by the experimenter. In addition, the IDT assesses only reciprocity skills of the child with an adult and not with one or more peers. Reciprocal behaviour in real life could be more challenging, especially if the

ID are complicated by the presence of ASD (Bölte & Poustka 2002).

Despite these limitations, the IDT is sensitive enough to detect differences in the quality of reciprocal behaviour of ASD-MID and TD-MID children and adolescents and showed as strongly as in high functioning ASD and TD individuals that the negative effect of the defining autistic trait of being too focused on themselves on reciprocal behaviour can be identified in those with ASD and MID, thus contributing to the diagnostic process of identifying an ASD in MID individuals. Additional studies may add to this finding by using larger groups with sufficient male and female participants possibly also in other, even more challenging real-life situations.

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Accepted 14 June 2017