

Observation of Socially Appropriate and Inappropriate Behaviours Among Children with Autism Spectrum Disorder During an Early Behavioural Intervention Program

Abstract

This observational study described behaviours (13 target behaviours) among 13 children with autism spectrum disorder during their interactions with their therapist at the onset of early behavioural intervention (EBI). It also examined the interrelations between the different types of behaviours and with standardized assessments of intellectual quotient (IQ) and autism severity. Finally, it assessed behavioural changes after 8 months of intervention. Socially appropriate behaviours were more frequent than inappropriate or non-social behaviours. Although participants rarely initiated interactions, other socially appropriate behaviours, such as maintaining interactions, were frequently observed. These were positively associated with IQ and negatively associated with autism severity; the opposite relationships were found for inappropriate and non-social behaviours, those behaviours were negatively associated with IQ and autism severity. Approximately half of participants demonstrated a proportional increase in socially appropriate behaviours after 8 months of intervention, while the other half tended not to change. These changes were associated with children's IQ and autistic symptoms at the beginning of EBI. These data emphasize the need for systematic interventions on some socially appropriate behaviours, like social initiations, and on increasing social behaviours in general at the beginning and within EBI programs, particularly for children with a lower level of functioning.

Although social impairments are among the core symptoms of autism spectrum disorder (ASD; American Psychiatric Association, 2000, 2013; Fostad, Matson, Hess, & Neal, 2009), the severity of these deficits varies substantially across children with this condition (Jones & Klin, 2009). Additionally, many children with ASD engage in a range of socially inappropriate behaviours such as aggression, self-injurious behaviour, stereotypical behaviour, and the destruction of property. These co-occurring problems add to the complexity of children's social profiles and may influence their responses to intervention (Jang, Dixon, Tarbox, & Granpeesheh, 2011; Machalicek, O'Reilly, Beretvas, Sigafoos, & Lancioni, 2007; Mahan & Matson, 2011; Matson, 2009; Matson & Minshawi, 2007; Matson, Wilkins, & Macken, 2009; Symes, Remington, Brown, & Hasting, 2006). Although it is well known that children with ASD vary in their social skills, there is limited direct observational data regarding their social behaviour during naturally occurring interactions, prior to the implementation of an intervention program (Boyd, Conroy, Asmus, & McKenney, 2011).

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Furthermore, few studies have examined interactions between children with ASD and their therapists during behavioural intervention programs. For many children with ASD, these programs are critical environments for interaction because of the considerable time spent in intervention. For example, early intensive behavioural intervention (EIBI) programs typically range from 20 to 40 hours per week. A child's relationship with their behavioural therapist can be one of their first outside of the family environment. Interactions between child and therapist, though structured by an intervention model, are part of a child's daily life and afford them an opportunity to learn social skills that they might otherwise acquire more slowly, or not at all. Studying children's behaviour in interactions with their therapist would therefore add to our understanding of social impairments in ASD and can inform the promotion of socially appropriate behaviours within intervention programs. Socially appropriate behaviours include a wide range of behaviours that individuals emit in social contexts to ensure their integration with others. This class of behaviours includes social behaviours broadly defined, such as social initiations and shared attention or sharing, but are not limited to these. Rather, this class of behaviours includes conduct that more generally promotes their engagement in a social or learning situation, such as responding to a request, complying with another person's request in order to complete a task, or refusing a request in an appropriate manner. In contrast, socially inappropriate behaviours refer to a class of behaviours that interfere with an individual's social integration and learning, such as pushing or screaming instead of saying "no" in response to a therapist's request in an intervention context.

Socially Appropriate and Inappropriate Behaviours During Early Behavioural Intervention

The outcomes of EIBI on several standardized tests (e.g., measures of intellectual quotient and adaptive behaviour) are now relatively well documented (Eldevik et al., 2009; Eldevik, Jahr, Eikeseth, Hastings, & Hugues, 2010; Makrygianni & Reed, 2010; Perry et al., 2011; Reichow, Barton, Boyd, & Hume, 2012; Reichow & Wolery, 2009; Virués-Ortega, 2010). Studies have shown that several individual factors impact EIBI outcomes, including age at intake (Harris & Handleman, 2000; Makrygianni &

Reed, 2010; Perry et al., 2011), intellectual functioning (Harris & Handleman, 2000; Lovaas, 1987; Sheinkopf & Siegel, 1998, Perry et al., 2011), adaptive behaviour (Makrygianni & Reed, 2010; Perry et al., 2011), autism severity (Perry et al., 2011), verbal imitation (Sallows & Graupner, 2005), and language skills (Sheinkopf & Siegel, 1998). Therapists who conduct EIBI have also reported that the presence of socially inappropriate behaviour reduces children's responsiveness to interventions (Rivard, Morin, Dionne, Mello, & Gagnon, 2015; Symes et al., 2006). However, few studies have used direct observation to examine the topography and frequency of children's behaviours within the context of these interventions. In fact, little information of any kind is available on the patterns of behaviours displayed by children with ASD with their therapists. Such data could facilitate the observation of social skills by professionals in the context of intervention programs. As noted by some authors, studies on early intervention programs would benefit from assessing children's social and communication behaviours because these, along with adaptive behaviours, are the most resistant to intervention (Kelley, Naigles, & Fein, 2010; Rivard & Forget, 2012).

Direct Observation of Socially Appropriate and Inappropriate Behaviours

The direct and systematic observation, and subsequent quantitative analysis, of children's behaviour in real-life settings provides superior ecological validity relative to standardized assessments. This method is also more sensitive to, and representative of, real behavioural patterns (Bijou, Peterson, & Ault, 1968; Bloom, Fisher, & Orme, 2003; Cooper, Heron, & Heward, 2007). Direct behavioural observation provides a fine-grained portrait of what children do in specific contexts (Granpeesheh, Dixon, Tarbox, Kaplan, & Wilke, 2009; Rivard & Forget, 2012).

Some studies have analyzed the social behaviour in children with ASD through direct observation in various natural settings, such as the family environment (Donais, 1996; Duval & Forget, 2005; Jones & Schwartz, 2009), interactions or play with peers (Boyd et al., 2011; Boyd, Conroy, Mancil, Nakao, & Alter, 2007; Jones & Schwartz, 2009), and classroom settings with their peers or their teacher (Boyd, Conroy, Asmus, McKenney, & Mancil, 2008; Chamberlain, Kasari, & Rotheram-

Fuller, 2007; Poirier & Forget, 1997). Some of these studies have examined the initiation of social interactions, social responses, and social interactions (Boyd et al., 2008; 2007; 2011), while others also included other socially appropriate behaviours such as maintaining an interaction and socially inappropriate behaviours such as aggression toward property (Donais, 1996; Duval & Forget, 2005; Poirier & Forget, 1997). For instance, the observation system developed by Donais (1996) and subsequently used by Poirier and Forget (1997) and Duval and Forget (2005) included six categories of socially appropriate behaviour (e.g., responding to a request, initiating social interaction, maintaining social interaction), six categories of socially inappropriate behaviours (e.g., stereotypical behaviours, self-injurious behaviours, physical aggression toward others, aggression toward property) and one category of non-social behaviour. The latter was used to classify instances in which participants did not interact with the adult and displayed neutral behaviour in the absence of a request by the adult. The authors applied this system to the observation of behaviour among children with ASD at home with their family (Donais, 1996; Duval et Forget, 2005) and at school with their teachers (Poirier et Forget, 1997). In general, these studies have shown that interactions initiated by children with ASD are lacking both in quantity and quality, which means on the one hand that they have the tendency to emit fewer (i.e., less frequent) social behaviours in general than their peers and, on the other hand, that they have difficulties to interact with other in a natural, fluid, and efficient ways in comparison to their peers (Boyd et al., 2011; Chamberlain et al., 2007). For example, an observational study by Hauck, Fein, Waterhouse, & Fein (1995) revealed that children with ASD present fewer social initiation behaviours than their typically developing peers or their peers with intellectual disability and that when they emitted social initiations, their behaviours were more ritualistic and less spontaneous. Boyd et al. (2011) reported similar results and showed that, in comparison to their peers, children with ASD displayed lower rates of prosocial behaviours such as initiations and responses to interactions.

To our knowledge, no direct and systematic observation studies have examined socially appropriate and inappropriate behaviours of children with ASD during early intervention with their therapist at the onset of an EIBI program, and analyzed the progression of these

behaviours as the intervention progresses. In fact, Donais (1996) specifically suggested that her system could be used to study socially appropriate behaviours among children with ASD as they interact with their therapist during EIBI. The presence of distinct behavioural patterns, especially if these can be tied to instruments used in screening for ASD and devising intervention plans, would help to identify more precisely the challenges present in interactions between children and their therapist at the beginning of an intervention program. This knowledge could then help guide some aspects of the curricula in early intervention programs, like how to prioritize the behaviours targeted by an intervention plan.

Objectives

The first objective of the present study was to describe the type and frequency of 13 socially appropriate, inappropriate, and non-social behaviours among 13 preschool-age children with ASD with their therapists in the context of an early behavioural intervention (EBI) program. The second objective was to examine the interrelations between the various types of behaviours and their associations with standardized measures of intellectual functioning and autism severity. The third objective was to measure changes in participants' behaviour after 8 months of intervention.

Materials and Methods

The research protocol was primarily evaluated and approved by the Ethics board of University of Quebec in Montreal and approved by the Joint Research Ethics Board for the public developmental service agencies in Quebec.

Participants

All participants were recruited from a provincially funded rehabilitation centre in the province of Québec (Canada) that provides services for children and adults with ASD and intellectual disabilities. These centres are tasked with providing 20 hours per week of behavioural intervention to children with ASD between 2 and 6 years old. The families of 16 children with ASD who were about to begin the intervention program were contacted for this study. Fourteen children were initially enrolled but one boy's health prevented him from participating in the

second portion of data collection; his data were therefore dropped from analyses. The final sample consisted of two girls and 11 boys aged between 37 and 59 months ($M = 48.4$ months, $SD = 7.6$). The primary language spoken by all participants was French, which was the language spoken during intervention sessions.

In order to be included in the intervention program and in the study, children were required to: (1) have received a diagnosis of ASD from an independent multidisciplinary team; (2) be younger than 5 years, 11 months at the beginning of the program; (3) not have previously received social skills intervention or any other intervention service; and (4) reside within the territory of the rehabilitation centre. The independent multidisciplinary teams included either a psychologist or pediatrician and followed the provincial guidelines for diagnosing ASD, which at the time of the study were based on the criteria in the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision* (DSM-IV-TR; American Psychiatric Association, 2000). The guidelines at the time of study and at present involve a comprehensive assessment using the Autism Diagnostic Interview-Revised (ADI-R; Le Couteur, Lord, & Rutter, 2003) and the Autism Diagnostic Observation Schedule (ADOS-G; Lord, Rutter, DiLavore, & Risi, 2002). Children with diagnoses of autistic disorder, Asperger's disorder, and pervasive developmental disorder/not otherwise specified, as defined by the DSM-IV-TR, were eligible for the study, whereas children with Rett's disorder or childhood disintegrative disorder were not.

Setting

The children who participated in this study received, on average, 14.5 hours per week of intervention. Thus, we use the term early behavioural intervention (EBI) to describe the program offered by the rehabilitation centre, rather than early intensive behavioural intervention (EIBI), which typically refers to 25 to 40 hours/week.

The EBI program was based on the curriculum developed by Maurice, Green, and Luce (1999) and mainly used discrete trial teaching (DTT). At the onset of the program, the child's parents, therapist, and psychoeducator (i.e., a professional who has received a master's degree in psychoeducational studies) determined the goals and priorities of intervention. These goals were indi-

vidualized to each child's needs within the context of their family, and mainly focused on adaptive behaviours and communicative, cognitive, and social abilities. The therapist and psychoeducator assessed the child's level of functioning related to the goals, and outlined the steps required to teach missing skills through DTT. In DTT, therapists divide intervention objectives or target behaviours into small units according to the child's functioning. Each response that the child produces is preceded by a discriminative stimulus (e.g., a model, an instruction, a prompt, or a pictogram) and followed by a consequence defined according to a pre-determined reinforcement schedule. In the EBI program, the positive reinforcers used as consequences for correct responses were continually assessed for effectiveness. Food and other physical reinforcers were always paired with social reinforcers such as praise or attention.

EBI programs run by provincial centres typically take place in children's mainstream daycare setting, where they receive a 1:1 ratio with their therapists during EBI sessions and are integrated with their peers outside of these sessions with an adult to child ratio of 1:6. They generally are among typically developing peers when integrated; however these specifics are not available to the rehabilitation centre. If it becomes appropriate and relevant for a child's goals to involve interactions with peers or generalization of skills to their daycare setting, their EBI therapist will work with the child in the daycare group setting as part of their EBI program time.

All observation sessions took place during these 1:1 EBI sessions. The activities implemented during observation sessions did not differ from children's regular (i.e., non-observed) sessions. Therapists were not informed of the specific purpose of the study or the types of behaviours being observed. Rather, they were simply instructed to lead the sessions as they would on any other day. The amount and type of social demands placed on the child during observation sessions were therefore those set out by each child's individual program goals.

All therapists were special education technicians who had received training in early intervention for children with ASD. This training consisted of 35 hours of training when they began working at the agency, 45 hours of continued education and training each year, and supervision by a psychoeducator or a psychologist for 3 hours

every 2 weeks. None of the participants received any other kind of intervention either before or during the implementation of the EBI program.

Participants' regular EBI sessions and, therefore, this study's observation sessions took place in a separate room at the child's mainstream day care. The room contained a child-sized table and chair, and few stimuli other than the materials used in EBI activities. The observer assigned to each participant stood in a corner of the room and recorded the session with a hand-held camera without interacting with the therapist or the child.

Procedures and Measures

Measures of Autism Severity and Intellectual Functioning

Standardized assessments of autism severity and intellectual functioning were conducted in August and September 2007, before or at the beginning of the child's intervention program, as he or she was being evaluated by the centre before beginning the intervention proper. These measures were used to explore whether correlations existed between social behaviours and severity of ASD or level of intellectual functioning, not for diagnostic purposes.

The Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Rochen-Renner, 1988) was used to establish the degree of severity of autism for each participant. The CARS consists of 15 items that address functional domains. Each item is rated on a 4-point scale, from 1 (normal for child's age) to 4 (severely abnormal for child's age), yielding a score ranging from 15 to 60. A cut-off score of 30 is used to determine a diagnosis of ASD, with scores between 30 and 36.5 indicating mild to moderate symptoms, and scores between 37 and 60 corresponding to the highest severity of symptoms (Schopler et al., 1988). The high reliability of the CARS has been demonstrated through internal consistency (Cronbach's $\alpha = .94$), test-retest reliability ($r = .88$) and inter-rater reliability ($r = .71$) analyses (Schopler et al., 1988). Validity was assessed through comparisons between each participant's CARS scores and an independent diagnostic evaluation made by a psychologist and a child psychiatrist ($r = .84$ and $.80$, respectively), as well as their psycho-educational profiles ($r = .75$ and $.82$; Schopler et al., 1988).

The Gilliam Autism Rating Scale (GARS; Gilliam, 1995) was also used as a measure of autism severity. The GARS yields an Autism Quotient (AQ) based on ratings on 4 subscales; stereotyped behaviours, communication, social interaction and developmental disturbances; with scores ranging from 69 to 131. The GARS was tested on a sample of 1092 children with ASD and shown to have a high internal consistency for the general scale (Cronbach's alpha of 0.96) and for the other evaluated areas (Cronbach's alpha of 0.88 to 0.93). On a sample of 57 respondents, it has shown a good inter-rater reliability for the general scale (correlation 0.88) and for the evaluated areas (correlation from 0.73 to 0.82). On a sample of 11 respondents, it has shown high test-retest reliability for the general scale (correlation 0.88) and for the evaluated areas (correlation 0.81 to 0.86). To the extent that CARS scores correlated highly with the GARS scores, only the former were employed in subsequent analyses. These tests were administered and scored by three research assistants possessing a 3-year undergraduate degree in psychology and currently enrolled in a graduate program specializing in behavioural intervention for people with ASD. The research assistants received theoretical and practical training and were supervised by the principal investigator, who is a registered psychologist. Prior to administering the tests, assistants observed each participant interacting with his or her therapist as well as with typically developing children during seven 1-hour sessions as part of the centre's evaluation process.

One of the research assistants also measured participants' intellectual functioning with the Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III; Weschler, 2002) intended for use with children between 2 years, 6 months and 7 years, 3 months. For children between 2 years, 6 months and 4 years, the test consists of 4 core subtests (receptive vocabulary, information, block design and object assembly), while for children 4 years to 7 years, 3 months, there are 7 core subtests (information, vocabulary, word reasoning, block design, matrix reasoning, picture concepts, and coding). Five scores can then be calculated: Verbal IQ (VIQ), Performance IQ (PIQ), Full-Scale IQ (FSIQ), General Language Composite (GLC), and Processing Speed Quotient (PSQ). For the purposes of this study, only the FSIQ was employed as a general measure of intellectual quotient. The parents of three children did not

consent to the use of this test with their child, such that assessments of intellectual functioning were only conducted among 10 participants. The assistant who conducted the WPPSI-III evaluations received thorough training and was supervised extensively by the principal investigator. According to Wechsler (2002), the WPPSI-III has excellent internal consistency (Cronbach's $\alpha = .86$ to $.97$), test-retest reliability ($r = .84$ to $.92$), and validity for children with and without developmental disabilities.

Behavioural Observation Measures

We attempted to describe a comprehensive set of behaviours in order to cover a representative sample of socially appropriate and inappropriate behaviours that the participants engaged in during the EBI sessions. We developed an observation system based on those used by Donais (1996), Duval and Forget (1997), and Poirier and Forget (1997). The behaviours of interest and their operational definitions are included in the Appendix. Research assistants viewed videotaped observation sessions and coded participants' behaviours based on predefined categories. Socially appropriate behaviours were coded according to six categories: responding to a prompt or request (R), continuing a response (Cr; continuing to respond to a request after a 10-second interval has elapsed, in the absence of a new request from the therapist), initiating social interaction (I), maintaining social interaction (M), appropriately refusing to comply with a request (Xa), and other socially appropriate behaviours (Oa) that did not fit in any of the first five categories. The operational definition we used for socially inappropriate behaviour is the definition used by all provincially run rehabilitation centres in Québec to describe problem behaviours (PB) in individuals with intellectual disability and ASD. It is described by Tassé, Sabourin, Garcin, and Lecavalier (2010):

[an] action or set of actions deemed problematic because it deviates from social, cultural or developmental norms and is prejudicial to the person or the person's social or physical environment. [It] is deemed severe if it actually or potentially jeopardizes the physical or psychological integrity of the person, another person, or the environment, or jeopardizes the person's freedom, social integration, or social ties. (p. 68)

Participants' socially inappropriate behaviours were coded into six categories: stereotypical behaviours (St), self-injurious behaviours (Si), physical aggression toward others (Ao), aggression toward property (Ap), inappropriate refusal to comply with a request (Xi), and other inappropriate behaviours (Oi) that did not fit into any other category. Another category, non-social (N) behaviours, was used to code situations in which participants did not interact with their therapist and displayed neutral behaviour. These behaviours were not mutually exclusive, such that virtually any combination of behaviours could be recorded within the same interval. Coders were provided with an observation guide that included comprehensive operational definitions, as well as examples and counterexamples for each type of behaviour.

Procedure

Two sets of observation sessions were carried out. The first set took place over the first 7 weeks of the EBI program and is known as Time 1 (T1). During this period, staff from the centre perform a series of assessments and observe the child with the goal of collecting data to devise an individualized intervention plan. This period also serves to facilitate bonding between the child and therapist prior to implementing the intervention plan. The second set of observations, labelled as Time 2 (T2), began 8 months after the last observation of T1 and also lasted 7 weeks. Observation sessions at T1 and T2 took place once a week, at the same time of day and on the same day of the week for each participant. Each week, participants were observed and filmed over the course of a 60-minute session. Although participants were to be observed for a total of 840 minutes, six children were only filmed for 780 minutes because they were absent or ill on the day of the last session of T1 (Participants 12 and 13) or T2 (Participants 5, 6, 7, and 9).

Participants' behaviours were documented during fixed time intervals consisting of 5 s of observation followed by 5 s of data collection. This system replicated the method used by Donais (1996), Poirier and Forget (1997), and Duval and Forget (2005), with the exception that we shortened data collection intervals to 5 s to reduce the potential loss of important data. Up to 2520 observation intervals were recorded for

each participant (2160 intervals for the five participants who missed a session).

The frequency and type of participants' social behaviours and the therapists' actions (i.e., the type of antecedent and consequence stimuli delivered for each of the child's responses) were recorded. Therapists' actions were also recorded, and were the subject of a previous study by the authors (Rivard, Forget, Kerr, & Bégin, 2014). Using the generalized matching law, we assessed whether participants' displays of socially appropriate behaviour varied as a function of changes in their therapists' attention.

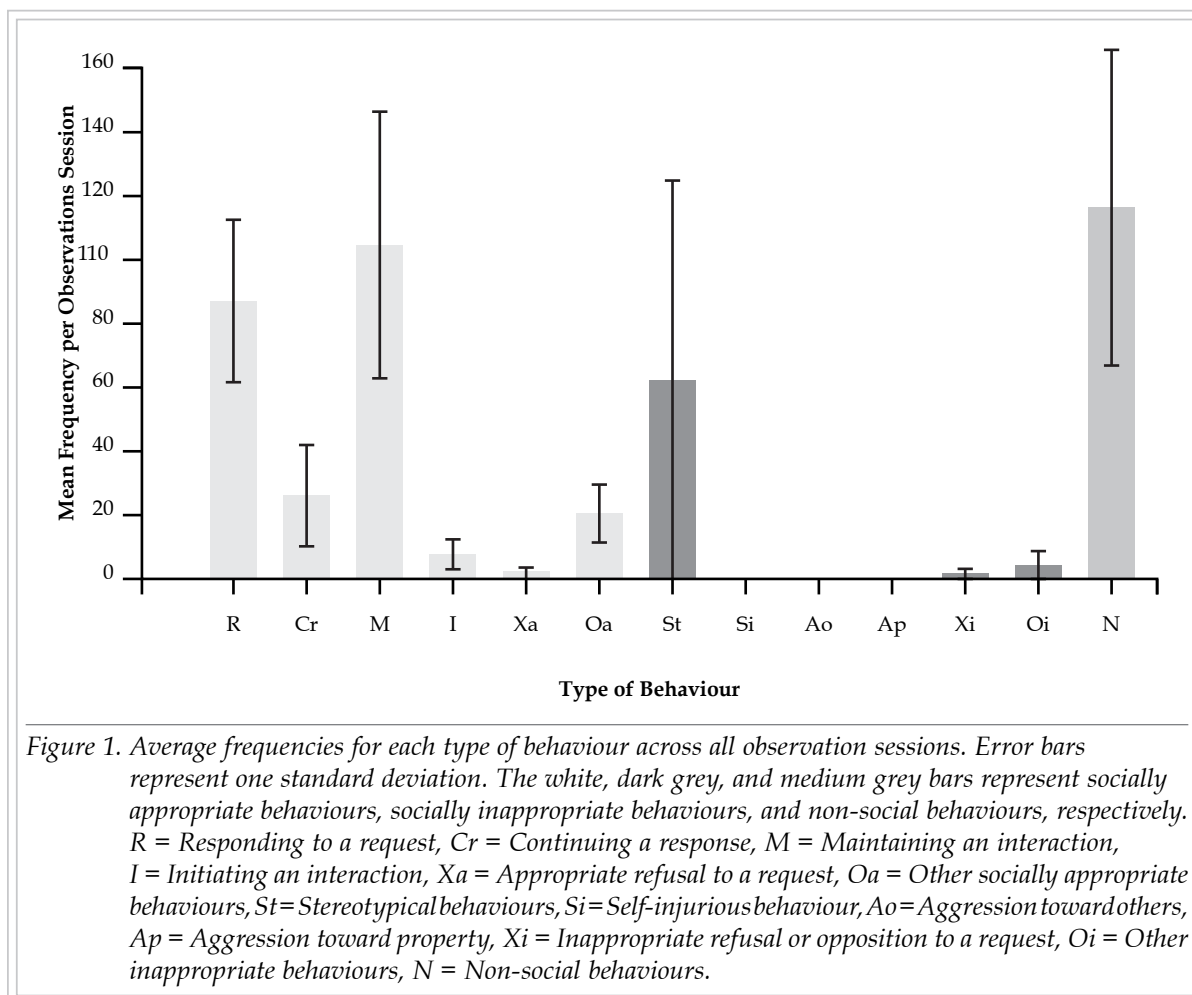
The research assistants who coded the videotaped observation sessions were 8 undergraduate psychology students who were blind to the purpose of the study. They received 60 hours of training on systematic observation, which included written materials, oral exams, video training, and frequent supervision.

Interobserver agreement (IOA) was calculated as the total number of agreements divided by the number of agreements plus disagreements. The research assistants attained 85% IOA on practice videos before they began coding actual observations sessions. For the actual sessions, a second independent observer observed 29% of the total videotaped observation sessions for each participant, which was two 60-minute observation sessions per participant for each time period. Final IOA rates ranged between 81% and 96% (k values between .69 and .96).

Results

Objective 1

As a first step, the analysis of overall behaviour patterns was conducted. Figure 1 presents the frequencies for each behaviour, averaged across all observation sessions. Descriptive within-par-



participant analyses were conducted on the 13 types of behaviours. Overall, participants displayed high frequencies of non-social behaviour (N) and several forms of socially appropriate behaviour, primarily responding to requests (R), maintaining interactions (M), and, to a lesser extent, continuing a response (Cr). They displayed low frequencies of socially inappropriate behaviours, with the exception of stereotypical behaviour (St). However, these behaviours were also those for which the most variability between participants was observed. Indeed, although some participants (e.g., 2, 3, and 5) frequently engaged in stereotypical behaviours, a few others (e.g., 4, 11, and 12) displayed this behaviour very infrequently or not at all during any given session. These general patterns were fairly stable across sessions at both T1 and T2, with no discernable trends over the seven consecutive sessions of each observation period. Thus, the frequencies of behaviours across all seven sessions at T1 and T2 were pooled for subsequent analyses.

Objective 2

Correlations were computed to examine potential relationships between different types of behaviours and between these and participants' levels of intellectual functioning and autism severity. For the sake of brevity, we focus on associations approximating Cohen's (1988) conventions for large effect sizes ($r > .50$). Overall, as shown in Table 1, the three behaviour categories (socially appropriate, socially inappropriate, and non-social) showed significant interrelationships and associations with the two standardized measures (IQ and CARS). Specifically, socially appropriate behaviours were negatively correlated with non-social behaviours, $r(11) = -.955$,

$p < .001$, and with socially inappropriate behaviours, $r(11) = -.488$, $p = .045$. The latter were positively correlated with non-social behaviours, $r(11) = .578$, $p = .019$. Having a higher IQ was associated a higher frequency of socially appropriate behaviour, $r(8) = .699$, $p = .012$, and lower frequencies of both socially inappropriate and non-social behaviours, $r(8) = -.701$, $p = .012$ and $r(8) = -.763$, $p = .005$, respectively. Consistent with these results, a lower CARS score (indicating less severe autism) was associated with more socially appropriate behaviours, $r(11) = -.615$, $p = .013$, and fewer socially inappropriate and non-social behaviours, $r(11) = .505$, $p = .039$ and $r(11) = .662$, $p = .007$, respectively. Of the subcategories of socially appropriate or inappropriate behaviours, maintaining interactions $r(8) = .720$, $p = .010$ and $r(11) = -.525$, $p = .030$ and stereotypical behaviours $r(8) = -.666$, $p = .018$ and $r(11) = .490$, $p = .045$, correlated with IQ and CARS scores, respectively. Additionally, low CARS scores (but not high IQ scores) were associated with higher rates of initiation behaviours, $r(11) = -.573$, $p = .021$.

Objective 3

Two repeated measures MANOVAs were carried out to examine whether the frequencies of socially appropriate and socially inappropriate behaviours, respectively, changed over the course of 8 months of EBI, that is, between T1 and T2. There was a significant multivariate effect of time for socially appropriate behaviours, $F(6,7) = 4.555$, Wilkes' $\Lambda = .204$, $p = .034$, $\eta^2_p = .796$. Follow-up univariate analyses were performed as one-tailed, paired-samples t-tests. The only differences to attain statistical significance were for appropriate responses to requests (R), $t(12) = 3.009$, $p = .005$, $d = .834$, and the initiation of interactions (I), $t(12) = 1.967$, $p = .036$,

Table 1. Correlations Between Observed Behaviours, Intellectual functioning, and Autism Severity

	Socially appropriate	Socially inappropriate	Non-social behaviour	IQ	CARS
Socially appropriate	-	-.488*	-.955**	.699*	-.615*
Socially inappropriate	-.488*	-	.578*	-.701*	.505*
Non-social behaviour	-.955**	.578*	-	-.763**	.662**
IQ	.699*	-.701*	-.763**	-	-.814**
CARS	-.615*	.505*	.662**	-.814**	-

Note: IQ: intellectual quotient (full scale); CARS: Childhood Autism Severity Scale; * $p < .05$, ** $p < .01$, all one-tailed.

$d = .546$; these large and moderate effects, respectively, indicated that these behaviours were more frequently observed at T2 than T1. No change was noted for continuing a response (Cr), $t(12) = 0.169, p = .434, d = .047$, or for appropriately denying a request, $t(12) = 0.375, p = .357, d = .104$. Nonsignificant decreases were noted for maintaining interactions (M), $t(12) = -0.811, p = 0.784, d = -0.225$, and other appropriate behaviours (Oa), $t(12) = -1.752, p = .947, d = -0.489$. These small and moderate effects, respectively, were in the opposite direction than what had been predicted (i.e., that socially appropriate behaviours would increase over time).

For socially inappropriate behaviours, the multivariate effect of time did not attain significance, $F(6,7) = 0.485$, Wilkes' $\Lambda = .706, p = .802, \eta^2_p = .294$. For descriptive purposes, we nevertheless report univariate analyses on each type of behaviour as one-tailed, paired-sample t-tests. Stereotypical behaviours (St) and aggression towards others (Ao) displayed small but nonsignificant decreases over time, $t(12) = -0.827, p = .212, d = -0.229$ and $t(12) = -1.177, p = .131, d = -0.327$, respectively. No change was discernable for aggression towards

property (Ap), $t(12) = -0.572, p = .289, d = -0.159$, or opposition to a request (Xi), $t(12) = -0.361, p = .362, d = -0.100$. Nonsignificant increases were noted for other socially inappropriate behaviours (Oi), $t(12) = 0.585, p = .796, d = 0.238$, and self-injurious behaviours (Si), $t(12) = 1.000, p = .831, d = .277$; these small effects of time were in the opposite direction to what was predicted (i.e., that socially inappropriate behaviours would become less frequent over time).

A descriptive analysis showed that the progression of participants' behaviour over the 8-month period was heterogeneous. Although non-social behaviours were initially operationalized as neutral, they were positively associated with socially inappropriate behaviours and autism severity and negatively associated with socially appropriate behaviours and IQ (see Objective 2). It was therefore deemed appropriate to treat these on an equal footing with the range of inappropriate behaviours, such that behaviours could be summarized as a single ratio (i.e., the frequency of appropriate behaviours over the total number of behaviours observed). Table 2 depicts the average absolute frequencies for three categories of behaviours T1 and T2, as well as the propor-

Table 2. Participants' Standardized Test Scores and Average Frequencies of Socially Appropriate, Socially Inappropriate and Non-Social Behaviours During the Two Observation Periods

Participant	IQ	CARS	T1-A	T1-I	T1-N	T1-P	T2-A	T2-I	T2-N	T2-P
1	57	37.5	172	27	184	0.45	103	73	103	0.28
2	51	38.0	238	152	156	0.44	208	210	208	0.35
3	44	44.5	150	132	214	0.30	185	118	185	0.39
5	45	44.0	267	153	106	0.51	162	244	162	0.27
7	-	48.5	244	39	136	0.58	238	24	238	0.59
8	44	31.0	259	68	104	0.60	256	97	256	0.57
10	60	36.0	277	84	91	0.61	238	82	238	0.52
4	67	34.0	228	34	134	0.58	270	19	270	0.68
6	79	31.0	261	23	102	0.68	233	37	233	0.60
9	-	36.5	256	37	111	0.63	285	11	285	0.80
11	117	22.5	336	2	55	0.86	350	1	350	0.95
12	68	30.0	285	10	102	0.72	313	26	313	0.77
13	-	36.5	288	78	57	0.68	343	16	343	0.92

Note. IQ: Intellectual quotient, CARS: The Childhood Autism Rating Scale score; T1: first observation period, T2: second observation period; A: socially appropriate behaviours, I: socially inappropriate behaviours, N: non-social behaviours, P: Proportion of total behaviours classified as appropriate. Boldface characters indicate participants for whom progress was observed between T1 and T2. Participants listed in the top and bottom of the table were classified as Low and High Functioning, respectively, on the basis of a composite indicator derived from z-scores for IQ and CARS total scores.

tion of observed behaviours that were classified as socially appropriate. Participants 3, 4, 9, 11, 12, and 13 showed an overall improvement in behaviour, exhibiting more socially appropriate behaviour relative to inappropriate or non-social behaviours. Participants 1, 2, 5, 6, 10, and, to a lesser extent, 8 tended to exhibit a decrease in their rate of appropriate social behaviours. With the exception of Participant 8, the magnitude of these changes ranged between approximately 5% and 24%. Participant 7 did not show any discernable change.

Post hoc group analyses examined whether autism severity and intellectual functioning could differentiate between children whose behaviour improved or did not improve over the course of 8 months of intervention. To this end, a composite measure was created by averaging participants' z-scores on the IQ and CARS; prior to averaging, the sign of z-scores for the CARS was inverted such that a high composite score would be consistent with a high IQ and a low autism index. Two groups (High and Low Functioning) were then created by means of a median split on this composite variable. A 2 (T1, T2) \times 2 (Low, High Functioning) mixed-design ANOVA examined the frequency of socially appropriate behaviours as a proportion of all observed behaviours, over time and as a function of these two subgroups. These results are depicted in Figure 2. Similar analyses were also conducted on the absolute mean frequencies of each type of behaviour (appropriate, inappropriate, and non-social) taken individually. Each of these resulted in consistent and virtually identical patterns of results, with one exception: the interaction between time and group that did not attain significance in the case of socially inappropriate behaviour, but would nevertheless be considered a large effect ($p = .068$, $\eta_p^2 = .271$). The decision to combine two indicators (IQ and CARS scores) to form a single grouping variable was informed by the correlation between these two measures, $r(8) = -.814$, $p = .002$.

There was no significant main effect of time, $F(1,11) = 0.181$, $p = .678$, $\eta_p^2 = .016$. There was a large and significant main effect of group, with the High Functioning group displaying higher frequencies of appropriate behaviours compared to the Low Functioning group, $F(1,11) = 21.702$, $p = .001$, $\eta_p^2 = .664$. However, time and group also interacted significantly, $F(1,11) = 8.303$, $p = .015$,

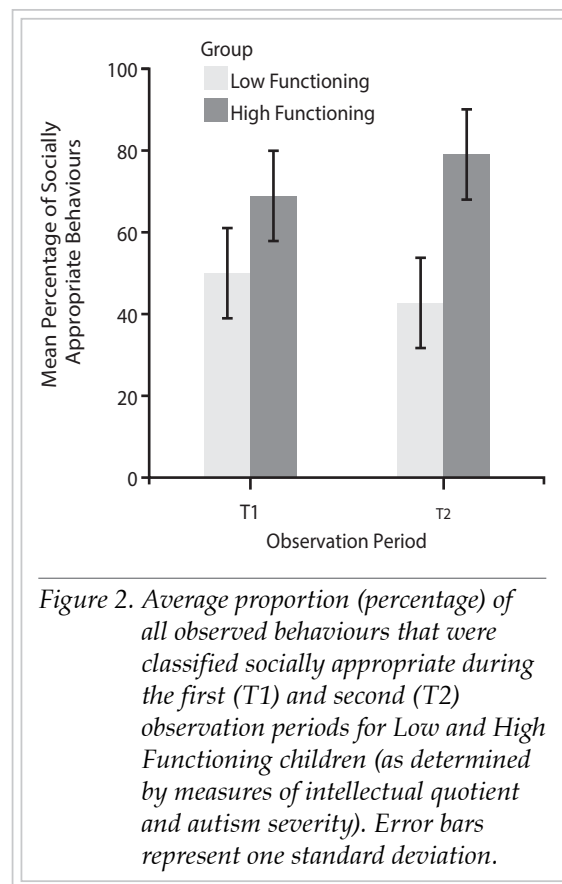


Figure 2. Average proportion (percentage) of all observed behaviours that were classified socially appropriate during the first (T1) and second (T2) observation periods for Low and High Functioning children (as determined by measures of intellectual quotient and autism severity). Error bars represent one standard deviation.

$\eta_p^2 = .430$, also a large effect. Decomposition into simple effects revealed a significant increase in socially appropriate behaviours for the High Functioning group $F(1,11) = 5.079$, $p = .046$, $d = 0.315$, but nonsignificant (albeit large) decrease for the Low Functioning group, $F(1,11) = 3.266$, $p = .098$, $\eta_p^2 = .229$.

Discussion

This observational study enabled a quantitative analysis of the socially appropriate and inappropriate behaviours displayed by young children with ASD during interactions with their therapist in the context of an EBI program. As noted in the literature, there is at present a lack of systematic assessments of the pattern of behaviours prior to intervention and as a measure of response to ongoing interventions such as EBI (Boyd et al., 2011; Kelley et al., 2010).

Across all participants, responding to requests and maintaining interactions were the two most frequently displayed socially appropri-

ate behaviours at the onset of the program. However, these behaviours also exhibited large individual variability. These data suggest that various types of socially appropriate behaviours may be differentially present among children with ASD who are situated at various points on a social skills continuum. In contrast, rates of initiating interactions and appropriately denying therapists' requests were extremely low or altogether absent across participants. Thus, participants were inclined to respond appropriately to, and to comply with, social demands. Their difficulties were in spontaneously, voluntarily, and appropriately initiating social exchanges with their therapists, although initiation behaviours did increase over time. The consistency of these observations leads us to infer that, as documented in previous studies, these types of socially appropriate behaviours may belong to the core social communication deficit present in children with ASD. This finding supports a hypothesis proposed by Hauck et al. (1995). These authors suggested that the absence or scarcity of social initiation is indicative of a central social deficit in ASD. The fact that children in the present study rarely initiated interactions with their therapist is consistent with observations made by Boyd and his colleagues (2007, 2008, 2011), who noted similar deficits in children with ASD within their family and school environments and in their interactions with peers. These data also lead us to conclude that it would be beneficial to combine the contributions of DTT and strategies based on incidental teaching (IT) in this EBI program to promote the quality of some targeted behaviours, like social initiations, emitted by the children in therapy. That is, DTT strategies are more focused on teaching receptive skills and compliance, whereas IT strategies tend to promote more spontaneous behaviours, expressive skills, and social initiation behaviours. Because these behaviours are a central challenge in ASD, they should be a therapeutic priority.

Participants also showed heterogeneous rates of stereotypical behaviours, the only form of socially inappropriate behaviour that was frequently observed in this study. Other types of socially inappropriate behaviours (self-injury, physical aggression toward the therapist, aggression toward property, oppositional behaviours, and other inappropriate activities) were rare overall and did not appear to be dis-

tributed on a continuum. Only one participant manifested self-injurious behaviours; three presented aggression toward others (i.e., the therapist) or their physical environment. These low rates of inappropriate social behaviours are surprising in light of the high prevalence of problem behaviours documented in other studies conducted among children with ASD (e.g., Matson et al., 2009). Our findings suggest that the structure of the DTT environment may prevent children from engaging in socially inappropriate behaviours, even at the onset of an intervention program, and possibly without directly targeting these behaviours.

The low rates of socially inappropriate behaviours must be interpreted within the context of a high prevalence of non-social behaviour as well as a lack of initiation behaviours among participants. The most frequently observed target behaviours were non-social behaviours, which were negatively correlated with all socially appropriate behaviours combined. This indicates that participants were not inclined to interact with their therapist unless he or she invited them to do so. As was the case with all types of socially inappropriate behaviours combined, non-social behaviours were negatively associated with IQ and positively associated with autism severity. Thus, although the environment in which this intervention program was implemented may to some extent inhibit inappropriate behaviours, children with more pronounced deficits may instead display non-social behaviours rather than more actively engaging with the therapist. These results underscore the importance of systematically teaching socially appropriate behaviours in early intervention programs. We also suggest that more comprehensive interventions, which would incorporate DTT and other behavioural strategies to promote initiation, may be necessary.

The third objective of this study was to track the progression of socially appropriate and inappropriate behaviours after 8 months of EBI. One of this study's salient findings was that the evolution in children's targeted behaviours varied substantially, and that at least some of this variability relates to individual differences in intellectual functioning or autism severity. Within-participant analyses indicated that approximately half of participants showed improve-

ment, that is, a proportional increase in socially appropriate behaviours within the context of DTT. Compared to their peers with higher IQs and lower autism severity scores, however, children with a more severe profile tended to exhibit fewer socially appropriate behaviours and relatively more frequent inappropriate and non-social behaviours, at the onset of the EBI program. As the intervention progressed, these group differences were amplified: appropriate behaviours increased in the High Functioning group, but appeared to remain stable (or possibly decrease) in the Low Functioning group. Thus, it may be necessary to directly target behaviours related to engagement in therapy sessions with children who exhibit a lower level of functioning at the onset of EBI and prioritize social behaviors over some other usual targeted behaviors that are more related to academics. That is, socially appropriate behaviours have less chance to be learned spontaneously during more cognitive tasks for those children, but are very important for their social and school integration.

Taken individually, only two subtypes of behaviour showed statistically significant change over time: responding to the therapist's requests and initiating interactions. Responding to the therapist's prompts is at the core of DTT and directly reinforced by the therapist, such that an increase in the frequency of these responses is not surprising, but nevertheless encouraging. As discussed previously, initiation behaviours were rarely observed in participants' interactions with their therapist. This is one of the main indicators of ASD and is often considered a priority for interventions. However, as discussed by Rivard and Forget (2012), this behaviour is also among the most resistant to interventions and must be taught systematically. In the present study, an increase in initiation behaviours was observed after 8 months of EBI. This datum is encouraging in that DTT directly promotes responses to another person's prompts and requests, rather than spontaneous initiation on the part of the child (Rivard & Forget, 2012). As previously discussed, we posit that the combined contributions of DTT and other intervention strategies in applied behaviour analysis, such as IT, may enable further gains in social initiation for young children with ASD. Other, more subtle shifts in various types of behaviours may have been obscured by participants' heterogeneous profiles.

Limitations of the Study

The methodological limitations of this study must be noted. First, it examined socially appropriate and inappropriate behaviours within a very specific context (i.e., DTT) and among a small sample. Participants also belonged to a narrow demographic, namely young children with ASD who are enrolled in a one-on-one early intervention program. Therefore, our results may not be representative of behaviours displayed by older individuals with ASD, or by children with ASD in other social settings, thereby limiting the external validity of this investigation. The present study also lacks ecological validity in that it only focused on the evolution of socially appropriate and inappropriate behaviours in EBI therapy sessions, rather than specifically on social behaviours that may occur in unstructured social or play contexts with peers. While in itself a meaningful addition to our understanding of the outcomes of EBI, this information would benefit from being correlated with observed changes in standardized test scores or with the attainment of goals outlined within the child's individualized EBI plan. Additionally, IQ scores were missing for three participants due to time constraints and their parents' refusal to participate in this portion of the study. Finally, given the exploratory nature of this project and the difficulty of recruiting participants, it was not possible to adjust the statistical significance level to account for multiple hypothesis testing (e.g., using Bonferroni's correction) because the adoption of more conservative significance levels would have prevented us from observing potentially meaningful effects.

Future Directions and Implications

Future studies may consider the use the present coding system in naturalistic observations of semi-structured interactions with peers. Such investigations would add valuable data to a body of research that used the same coding scheme on interactions in school settings (Poirier & Forget, 1997), within the family environment (Donais, 1996; Duval & Forget, 2005), and in the context of EBI (the present study).

We conclude by restating the significance of our findings regarding the differential progression of socially appropriate behaviours among

children with varying levels of functioning and social profile at the onset of EBI. There is evidence for the relationship between factors such as IQ and program effectiveness as assessed by standardized tests. EBI research may benefit from observed behavioural patterns as an additional follow-up measure. In addition to this potential empirical contribution, this added source of information may assist the planning of intervention strategies to promote social behaviours, namely the initiation of interactions, within EBI programs.

Key Messages From This Article

People with disabilities: Children with ASD can have different kinds of difficulty socializing with other people, including their EBI therapist. Understanding these differences may help us adapt therapy to their individual needs.

Professionals: Children with ASD's interpersonal behaviour profiles evolve differently over the course of EBI. Intervention strategies that directly target social skills may be particularly helpful for children with lower IQ or more severe autistic symptoms.

Policymakers: Some children with ASD may require additional support to derive social skills benefits from EBI. Behavioural observation and standardized assessments may be useful in identifying potential recipients of additional assistance.

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Appendix

<i>Socially Appropriate Behaviour</i>	<i>Operational Definition and Example</i>
Responding to a request (R)	Gives a verbal or non-verbal response to a request or executes a requested behaviour. For instance, the participant gives an high five to his therapist after a request by the therapist to do so.
Continuing a response (Cr)	Continues an already coded response (R), without an explicit prompt to do so. For instance, the participant remains in a game arms more for than 5 seconds after it was requested.
Initiating interaction (I)	Initiates a social interaction with another person in an adequate manner. For instance, the participant asks to play a dyadic game with his therapist.
Maintaining an interaction (M)	Maintains a social interaction that was initiated by another person. For instance, (1) the participant takes his turn in a dyadic game when his therapist's turn has finished or (2) the participant makes eye contact when his therapist praises him for doing something well.
Denying a request (Xa)	Adequately refuses to comply with a request. For instance, the therapist asks if the child wants to play a game and the participant says "No."
Other appropriate behaviours (Oa)	Performs appropriate social behaviours not included in any of the previous categories.
Stereotypical behaviours (St)	Displays stereotypical behaviours during a social interaction. For instance, following a request by his therapist, the participant starts flapping his fingers.
Self-injury (Si)	Displays behaviours that may result in self-injury during a social interaction. For instance, when the therapist puts his hands on the shoulders of the participant, the participant starts biting himself.
Physical aggression toward others (Ao)	Engages in physical display of aggression toward another person. For instance, when the therapist asks the participant to give him an high five, the participant pushes the therapist.
Aggression toward property (Ap)	Displays behaviours with the intention of destroying objects in the environment. For instance, the participant breaks a toy after his therapist asked to see it.
Opposition to a request (Xi)	Actively and repeatedly refuses to comply with a request. For instance, after the therapist's demand the participant screams "No!" loudly and repeatedly.
Other inappropriate behaviours (Oi)	Engages in inappropriate behaviours not included in any of the previous categories following a request by the therapist. For instance, when instructed to sit, the participant instead paces about the room.
Non-social (N)	Displays neutral behaviour in the absence of a request by the therapist; no interaction between therapist and participant. For instance, the participant looks at the wall in the corner of the room while the therapist is writing something down and not looking at the participant.