Development and Psychopathology (2024), **36**, 1669–1684
doi:10.1017/S0954579423000950

CAMBRIDGE UNIVERSITY PRESS

Regular Article

Seeking contexts that promote neurodiverse social success: Patterns of behavior during minimally-structured interaction settings in autistic and non-autistic youth

Morgan L. McNair[1], Elliot Gavin Keenan[1,2], Abigail P. Houck[1] and Matthew D. Lerner[1]

[1]Department of Psychology, Stony Brook University, Stony Brook, NY, USA and [2]Department of Human Development & Psychology, University of California, Los Angeles, CA, USA

Abstract

While peer interaction differences are considered a central feature of autism, little is known regarding the nature of these interactions via directly-observed measurement of naturalistic (i.e., minimally-structured) groups of autistic and non-autistic adolescent peers. 148 autistic and non-autistic adolescents (111 male, $M_{age} = 14.22$, $SD_{age} = 1.90$; $M_{IQ} = 103.22$, $SD_{IQ} = 15.80$) participated in a 50-minute, minimally-structured, naturalistic peer interaction paradigm with activities of varying social demands: an incidental social demand (eating in a room with peers), a physical social demand (playing a physically-interactive game), and a verbal social demand (playing a verbal game). While autistic youth exhibited fewer overall interaction behaviors than non-autistic youth, the two groups did not differ in amount of positive, negative, and low-level interaction behaviors. Within activities, autistic and non-autistic youth only differed in positive interaction behaviors during the context of a verbal social demand. Youth who displayed more positive interaction behaviors during this same activity had less autism spectrum disorder symptomatology, controlling for nested group effects and relevant covariates. These results point toward subtle differences in social demands across naturalistic settings that can either support or impede prosocial interaction for autistic youth, providing a guidepost for identifying settings that best promote social success for neurodiverse populations.

Keywords: autism; social behavior; naturalistic interaction; social demands

(Received 22 December 2022; revised 29 June 2023; accepted 1 July 2023; First Published online 18 August 2023)

Introduction

A central feature of autism spectrum disorder (ASD) is social interaction difficulties. Autistic[1] youth are diagnostically characterized by a variety of social communication challenges (Association, 2013) as well as social-cognitive (e.g., Kimhi, 2014) and peer relationship difficulties (Mendelson et al., 2016). A crucial outcome domain of these challenges is actual, observed interactions with peers. While observed peer interaction has been well-studied in neurotypical populations (e.g., Gest et al., 2003; Ladd et al., 1988; Roberts et al., 2013), such research in the autism literature is more limited. Prior research has often focused on dyadic interactions (e.g., Bauminger-Zviely et al., 2017; Hauck et al., 1995; Morrison et al., 2020; Usher et al., 2015), younger children (Bauminger-Zviely et al., 2014; Bauminger-Zviely & Shefer, 2021; Williams et al., 2010), highly structured settings (Begeer et al., 2010; Kok et al., 2002), and diagnostically homogenous peer groups (Heasman & Gillespie, 2019b). Thus, the current literature has failed to represent the domain in which most youth (autistic or not) experience most of their formative peer interactions: minimally-structured settings with neurodiverse (i.e., autistic and non-autistic) groups of peers. Such settings are *prima facie* not uniform – some settings provide incidental (e.g., lunchrooms) opportunities for peer interaction, others provide physically-loaded (e.g., playing on a playground) opportunities, while others provide verbally-loaded (e.g., playing creative games) opportunities for peer interaction. Just as such settings provide differential opportunities for successful social interaction in non-autistic peers (e.g., for more athletic vs. more verbal youth), it may be that these settings yield differential affordances for promoting, or impeding, successful, naturalistic interactions for autistic youth. If so, leveraging such settings may provide opportunities to promote the aims of interventions for core challenges autistic youth experience (see Gates et al., 2017) without the need for direct intervention at all. However, no study has sought to observe peer interactions in neurodiverse groups of teens across naturalistic settings that systematically vary in social demands.

Peer interactions and social-emotional well-being

Peer interactions enable youth to experience acceptance and rejection of different types of social behaviors (Hartup, 2005; Rubin et al., 2008) as well as learn social sensitivity (van Hoorn et al., 2016), social norms (Blaževic, 2016; Chen, 2012), and regulatory

[1]Throughout the paper, identity-first language – "autistic; on the autism spectrum" – will be used. In consultation with autistic self-advocates, there has been a shift in autism research toward identity-first language (Bottema-Beutel et al., 2021).

Corresponding author: M. D. Lerner; Email: matthew.lerner@stonybrook.edu

Cite this article: McNair, M. L., Keenan, E. G., Houck, A. P., & Lerner, M. D. (2024). Seeking contexts that promote neurodiverse social success: Patterns of behavior during minimally-structured interaction settings in autistic and non-autistic youth. *Development and Psychopathology* **36**: 1669–1684, https://doi.org/10.1017/S0954579423000950

skills (Bulotsky-Shearer et al., 2012; von Salisch & Saarni, 2001). Peer interactions among non-autistic youth have also been shown to be associated with greater social competence and cooperative play (Howes et al., 1988), and in adolescence, the relationship between peer interactions and social-emotional well-being is highly salient. Adolescents spend more time with (Hartup, 1992) and establish new and more mature relationships (Denham et al., 2009) with same-aged peers as well as larger social networks (Hill, 1980), develop greater emotional independence from their parents (Collins, 1988; Denham et al., 2009), and are at increased susceptibility to both positive (e.g., prosocial behaviors, such as helping others) and negative (e.g., internalizing and externalizing difficulties) peer contagion (i.e., peer influence that occurs in naturalistic settings; Dishion & Tipsord, 2011). Appropriate and effective functioning within-group social situations also increases in importance during adolescence and has been associated with social competence (Englund et al., 2000).

Autistic youth experience a range of cognitive, language, and social-cognitive difficulties (Kang et al., 2020; Velikonja et al., 2019) that can affect their peer interactions. While social difficulties exist among autistic youth regardless of cognitive abilities (Shattuck et al., 2007), lower cognitive abilities have been associated with poorer social skills in both autistic (Bölte & Poustka, 2002; Fombonne, 2003) and non-autistic youth (Itskovich et al., 2021), suggesting the need to consider cognitive abilities when analyzing interaction behaviors. Additionally, autistic youth with language difficulties in childhood present with fewer socialization skills (Szatmari et al., 2009) and poorer social and communication functioning during adolescence (Baghdadli et al., 2012), demonstrating a downstream effect of language skills on social interactions with others (Birtwell et al., 2016). Further, there is strong theoretical and empirical evidence (e.g., Barendse et al., 2018; Baron-Cohen et al., 1985; Boraston et al., 2007; Happé & Frith, 1995; Peterson et al., 2009) to support social-cognitive abilities as a crucial factor that can affect social interactions in autistic youth. Thus, it is important to account for these within-person factors when analyzing peer interaction behaviors in autistic and non-autistic youth. While the universal impact of peer interactions on autistic and non-autistic youths' social development is well-established (and several key factors that can broadly affect these interactions have been identified), more work evaluating the granular aspects (i.e., types) of peer behaviors that comprise such interactions is needed and vital to better identify what kinds of interactions are most impactful, and for whom.

Peer interaction behaviors

Decades of research have involved observation of peer interaction behaviors in non-autistic youth (e.g., Coplan & Arbeau, 2009; Fabes et al., 2011; Howes et al., 1988), and many studies have utilized observation of children in classrooms settings (e.g., Gest et al., 2003; Hertz-Lazarowitz, 1989; King, 1990; Pellegrini et al., 1995; Richter & Tjosvold, 1980) or during unstructured play times (e.g., recess, indoor snack times or breaks; Dougherty et al., 1985; Leff & Lakin, 2005; Veiga et al., 2017) to capture naturalistic interaction behaviors between peers. While examination of in vivo peer interactions has been a part of clinical research for some clinical populations (e.g., social anxiety; Beidel et al., 2000, 2010; Cannon et al., 2020), much less research has sought to observe in vivo peer interaction of autistic individuals. Due to social behavior differences of autistic individuals, peer interaction behaviors are *not* self-evidently the same as those seen in non-autistic youth. Work by Bauminger (2002) and Hauck et al. (1995) have distinguished three broad domains – positive, negative, and low-level behaviors – by which autistic and non-autistic youth vary in their peer interaction behaviors in naturalistic social settings. Positive interaction behaviors are verbal or nonverbal social behaviors that serve to start or maintain a social interaction with a peer. Behaviors that would be considered positive interaction behaviors include making eye contact with a peer, using social communication, and sharing objects and experiences with peers. For example, a positive interaction behavior observed in the current study was a participant offering a slice of pizza to a peer. Negative social interaction behaviors, such as physical and verbal aggressions toward another peer or avoiding a peer, are behaviors that serve to end or prevent a social interaction with a peer. An example of a negative interaction behavior observed in the current study was a participant turning away from a peer who was trying to talk to them during a game. Low-level interaction behaviors are also verbal or nonverbal behaviors that *may* hold social intention but are more passive than positive interaction behaviors (e.g., being in close proximity to a peer without initiating an interaction, or looking at another child without making eye contact with them). A low-level interaction behavior observed in the current study was when a child engaged in arm flapping next to a peer but did not talk to or make eye contact with them. Unlike positive or negative interaction behaviors, the social intent of low-level interaction behaviors is less clear. Low-level behaviors, which include behaviors characteristic of autistic individuals such as idiosyncratic language use and repetitive behaviors (Association, 2013), are often viewed as socially inappropriate by non-autistic individuals (Crompton et al., 2021; DeBrabander et al., 2019).

The majority of peer interaction behaviors exhibited by autistic and non-autistic youth are prosocial and positive (e.g., Bauminger et al., 2003; Bauminger, 2002; Hauck et al., 1995; Rum et al., 2021), though the *quantity* of positive peer interactions exhibited by autistic youth, compared to non-autistic peers, is often fewer. When autistic and non-autistic elementary-aged children interact in minimally-structured interaction settings, such as recess or free play in a schoolyard, autistic youth have demonstrated less overall social interaction (Macintosh & Dissanayake, 2006). Fewer social interactions, as well as less positive interaction behaviors, in autistic compared to non-autistic youth during recess and snack time have also been found in pre-adolescent and adolescent youth (Bauminger et al., 2003). Another study evaluated peer interaction behaviors in dyads of unfamiliar autistic and non-autistic children and adolescents during structured and unstructured tasks, finding that autistic youth displayed less social reciprocity, including behaviors such as eye contact, conversational skills, and asking information about their conversation partner, but more overall talking and sharing than non-autistic youth (Usher et al., 2015). Limited conversational reciprocity of young autistic children during dyadic social interactions has been replicated (e.g., Bauminger-Zviely et al., 2014). In sum, while prior research has shown autistic youth exhibit less overall social interaction and positive interaction behaviors than non-autistic youth in structured and minimally-structured settings, there has been no work to date systematically comparing the amount of social interaction and positive interaction behaviors expressed by autistic and non-autistic youth during interaction contexts that vary in social demand.

Low-level interaction behaviors have also been studied in autistic and non-autistic youth. Hauck et al. (1995) found that in mixed (i.e., ASD-TD pairs) and non-mixed dyads, autistic children

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

exhibited more functional communication, which is a low-level interaction behavior, than non-autistic youth. An earlier study comparing the spontaneous communication initiations in autistic youth during everyday school activities found autistic youth with IQ < 50 used more low-level social interaction behaviors than autistic youth with IQ > 50 (Stone & Caro-Martinez, 1990). Bauminger (2007b) observed more low-level interaction behaviors in autistic youth interacting with unfamiliar peers in a minimally-structured setting (i.e., recess) prior to participation in a social-emotional intervention. After intervention participation, however, low-level and positive interaction behaviors were observed at similar levels (Bauminger, 2007b). Greater use of low-level interaction behaviors in autistic youth has also been recently replicated in work analyzing social interaction behaviors between elementary-school-aged dyads of autistic youth and their non-autistic siblings during a semi-structured activity (i.e., a game of choice; Rum et al., 2021). However, there has been limited research investigating how interaction contexts with varying social demands impact low-level interaction behaviors in mixed groups of autistic and non-autistic youth, particularly adolescent-aged groups.

Some autistic children and adolescents experience negative social behaviors like physical aggression and tantrums (Matson & Nebel-Schwalm, 2007); however, within the literature evaluating peer interactions of autistic and non-autistic youth during naturalistic social settings, negative interaction behaviors are rarely observed in either diagnostic group (2007b, Bauminger, 2002; Hauck et al., 1995). Given that research has shown negative behaviors to be a common problem within ASD (Matson & Adams, 2014), but such behaviors have rarely been directly examined in mixed autistic and non-autistic adolescents during naturalistic group interactions, it is important to examine such settings to address this discrepancy.

Invaluable work has sought to measure and characterize the qualitative features with peer interactions of autistic individuals. However, these studies have important limitations in terms of age of participants, size and neurodiversity of the peer group, and how naturalistic the interactions have been. Much of the literature assessing social interaction behaviors in autistic and non-autistic youth has relied on dyadic interactions (e.g., Bauminger-Zviely et al., 2017; Hauck et al., 1995; Morrison et al., 2020; Usher et al., 2015), younger children (Bauminger-Zviely et al., 2014; Bauminger-Zviely & Shefer, 2021; Williams et al., 2010) or adults (Ponnet et al., 2005; Ponnet et al., 2005), and settings involving only autistic (Heasman & Gillespie, 2019a) or non-autistic youth (Lerner & Mikami, 2012; Lerner et al., 2011). Additionally, some studies have employed contrived social paradigms, including the use of a confederate peer (e.g., Ratto et al., 2011; Simmons et al., 2021). Such paradigms have the benefit of pressing various dimensions of interactional ability within a participant; however, they do not approximate the ebb, flow, and pull of interactional dynamics inherent in the naturalistic peer interactions in which youth are enmeshed in their daily lives. While prior research has provided a strong foundation for understanding peer interaction behaviors in autistic youth, many of the developmentally rich interactions autistic youth experience are in mixed groups (i.e., include a range of neurodiverse youth), rather than dyads, and during adolescence, a development period vital and salient for social and self-development (Denham et al., 2009).

Importantly, recent work has sought to examine differences in quality of interactions among autistic, non-autistic, and mixed dyads (DeBrabander et al., 2019; Milton, 2012; Morrison et al., 2020), finding that the quality of interaction between autistic and non-autistic individuals often suffers due to the double empathy problem. The double empathy theory posits that differential expectations autistic and non-autistic people have about social experiences lead to difficulties in communication with and understanding of each other, which may in turn impact behaviors during social interactions (Crompton et al., 2021; Milton et al., 2018). However, recent observational studies have involved fairly structured, contrived settings, which could potentially limit the naturalistic feel of the interaction. An interaction paradigm that mimics common naturalistic peer interaction settings (i.e., minimally-structured contexts) is needed to provide the sort of ecologically-valid context that can adequately test the double empathy theory and possible differential interaction behaviors between autistic individuals, non-autistic individuals, and mixed groups. To date, few studies have examined the degree to which social interaction behavioral differences can be effectively evaluated in settings including mixed *groups* of autistic and non-autistic adolescents. Further, prior research assessing peer interaction behaviors in autistic youth often fails to account for the inevitably intercorrelated nature of behaviors among peers in groups (e.g., Attar-Schwartz, 2009; Huefner & Ringle, 2012; Lee, 2000). Thus, in addition to understanding patterns of peer interaction behaviors in mixed groups of autistic and non-autistic adolescents, it is important to account for the behaviors of other youth within a group.

Interaction settings

While youth interact in many kinds of settings, the most developmentally rich and impactful settings for social development are naturalistic peer interaction settings (Bohnert et al., 2013). Such settings are characterized by the availability of peer interaction opportunities, with a lack of formal structure or adult guidance dictating how time is spent, what materials are used, and where an individual must be located within a setting. While some naturalistic peer interactions are truly unstructured (e.g., bumping into a peer on the street), most naturalistic peer interactions where peer relationships develop are minimally structured (e.g., recess, after school programs, recreational activities, sports, going out to eat; Barber et al., 2005; Bohnert et al., 2013) – that is, they provide the opportunity for self-directed, free-form interaction, but the setting provides informal guidelines, which may drive the interactions that occur. Such *minimally-structured, naturalistic interaction settings* (MSNISs) vary by type and degree of social demands. For example, some minimally-structured settings have incidental social demands (ISD), such as eating with peers (e.g., in a lunchroom or restaurant; Humphrey & Symes, 2011) – that is, by virtue of being in a given space, youth *may* interact with one another but could also sit quietly by themselves without this seeming unusual. While adolescents often elect to engage in unstructured, group interactions (Mahoney et al., 2009; Smetana et al., 2015), little is known about the specific peer interaction behavior patterns of adolescents in minimally-structured social settings. Insight into the impact that environmental scaffolding of social dynamics has on social interaction behaviors in adolescents is needed to better understand the types of settings that promote positive peer interactions for teens more broadly. Autistic youth have been shown to exhibit less social engagement, less positive, and more low-level interaction behaviors than autistic youth in an ISD setting (Humphrey & Symes, 2011). Other MSNIS have either physical social demands (PSD; e.g., a playground; Locke et al.,

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

2016; Roberts et al., 1990), whereby the setting provides affordances and pulls for playing with peers in a physical way, or verbal social demands (VSD; e.g., conversations, verbal games; Ratto et al., 2011; Simmons et al., 2021), whereby the setting provides affordances and pulls for talking with peers. In PSD settings, autistic youth exhibit both positive and low-level interaction behaviors; however, the amount of positive interaction behaviors expressed is less than non-autistic youth (Locke et al., 2016). In VSD settings, autistic youth also exhibit positive interaction behaviors that look similar in amount to non-autistic youth but are not as robust (Ratto et al., 2011). While prior literature has provided insight into social interaction behaviors of autistic youth during various types of MSNISs, no work to date has directly compared peer interaction behaviors in autistic youth *by* MSNIS.

Research investigating MSNIS in which autistic individuals commonly participate finds that, similar to non-autistic youth, autistic adolescents are most often involved in sports (PSD) or academic (VSD) activities (Bohnert et al., 2019). It has been found that autistic adults participate more in weekly recreational activities, such as organized group or independent leisure activities (PSD and VSD), than casual social activities (ISD), such as hanging out with friends (Bishop-Fitzpatrick et al., 2017). While the literature has demonstrated autistic youth may elect to participate in some MSNIS (PSD and VSD) more than others (ISD), no study to date has examined differences in actual observed social behavior in these settings nor how this pattern of effects differs from non-autistic youth in the same settings. In other words, little is known about what autistic youth actually *do* socially when they are in each of these MSNIS with neurodiverse peers – the social settings in which they are most likely to find themselves in daily life.

Aims and hypotheses

The present study investigated patterns of peer interaction behaviors of autistic and non-autistic youth occurring in small group MSNIS that vary in social demands. Aim 1 was to examine differences in peer interaction behavior types between autistic and non-autistic youth across MSNIS with differing social demands. Across all MSNIS, it was hypothesized that (1a) autistic youth would interact with peers less than non-autistic youth as well as (1b) exhibit less positive interaction behaviors and (1c) more low-level interaction behaviors than their non-autistic peers. Given the low frequency with which negative interaction behaviors have been observed in prior research, no directional hypotheses were specified regarding negative behaviors. Additionally, as there was no past literature to guide a hypothesized comparison *between* autistic and non-autistic groups *within* each MSNIS, we sought to explore such differences across interaction types.

Aim 2 was to assess the pattern of peer interaction behavior types exhibited by autistic youth across MSNIS that qualitatively differ by social demand. It was hypothesized that (2a) autistic youth would exhibit more positive interaction behaviors during the PSD and VSD MSNIS as compared to the ISD MSNIS. Conversely, it was hypothesized that (2b) autistic youth would exhibit more low-level interaction during the ISD MSNIS as compared to the PSD and VSD MSNIS. No directional hypotheses were specified regarding negative interaction behaviors and minimally-structured interaction setting task demands.

Crucially, there are several within-person (i.e., cognitive, social-cognitive, and language ability) and between-person (i.e., the behaviors of others within a given group) factors that can influence an individual's observed peer interaction behavior. Additionally, autism symptoms are continuously distributed across populations, so examining autism only categorically may obscure important and meaningful variation across youth in social settings (see e.g., Kim et al., 2019). Thus, aim 3 sought to examine associations between peer interaction behaviors within each MSNIS and autism symptoms according to these factors. It was hypothesized that (3a) fewer positive peer interaction behaviors and (3b) more low-level interaction behaviors would predict greater ASD symptomatology in MSNIS requiring more social demands (i.e., during PSD and VSD).

Method

Participants

Study participants (Table 1) included 148 youth (111 male, $M_{age} = 14.22$, $SD_{age} = 1.90$; $M_{IQ} = 103.22$, $SD_{IQ} = 15.80$) drawn from a larger study of social competence. Group placement (i.e., autistic or non-autistic) was determined using the Social Communication Questionnaire (SCQ; Rutter et al., 2003), the Autism Diagnostic Observation Schedule, 2nd Edition (ADOS-2; Lord et al., 2012; administered by a research-reliable clinician), and prior diagnosis, such that autistic youth with a prior diagnosis had SCQ scores ≥ 11 and met the diagnostic cutoff for ASD on the ADOS-2. If the participant had no prior diagnosis and met diagnostic criteria for ASD on the SCQ and ADOS-2, the Autism Diagnostic Interview - Revised (ADI-R; Rutter et al., 2003) was administered by a research-reliable clinician.

Eligibility criteria included IQ ≥ 70 on the Kaufman Brief Intelligence Test, 2nd Edition (KBIT-2; Kaufman & Kaufman, 2004), no medical impairment that prevents normal play, and English as the child's and caregiver's primary language. Participants were recruited via a commercial mailing list from the community surrounding the university, flyers shared with local community clinical and family organizations, and follow-up with participants who gave permission to be recontacted for future studies. Prospective participants' parents were administered a phone screen to determine initial eligibility, and if all phone screen criteria were met, then participants were invited for an Initial Screening Visit at the laboratory on the university's campus. The Initial Screening Visit consisted of diagnostic (i.e., SCQ; ADOS-2; ADI-R, if applicable) and cognitive evaluation (i.e., KBIT-2; Expressive Vocabulary Test, 2nd Edition, (Williams & Williams, 2007), and participants deemed eligible after this visit were invited to participate in two additional visits: a second visit, including social cognition (e.g., Theory of Mind Inventory, Hutchins et al., 2012) and other assessments, and a third visit, including a peer interaction assessment.

Participant's parents and participants consented and assented, respectively, by trained study staff upon their arrival at the initial study visit. During the assent process, participants were informed that the purpose of the study was to learn how children understand and connect to the world around them as well as how children interact with each other. Participants were also informed that the peer interaction assessment would be videotaped. Families were offered $75.00 to $100.00, depending on study condition, for participation in the larger study.

Procedure

Peer Interaction Assessment: Pizza Party Paradigm. Each peer interaction assessment group, of which there were 27, included

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

Table 1. Demographics

	Autistic Youth				Non-Autistic Youth				
	Total	Mean	*SD*	Range	Total	Mean	*SD*	Range	*p*-value
	77				71				
Gender (male/female)	62/15				50/22				.106
Age (years)		14.35	*2.02*	11.14–17.9		14.08	*1.77*	11.3–17.9	.179
IQ[1]		99.92	*16.60*	70–134		106.80	*14.14*	72–131	< .01
ADOS-2 CSS[2]		7.79	*2.03*			3.38	*2.66*		< .001
EVT[3]		102.87	*15.90*			109.38	*14.05*		< .01
ToMI[4]		14.37	*3.24*			17.30	*3.18*		< .001
Peer Interaction Behaviors									
Positive Interaction Behaviors		15.83	*8.22*			18.05	*8.29*		.103
ISD[5]		14.76	*11.36*			14.33	*11.84*		.822
PSD[6]		15.10	*8.89*			17.77	*8.31*		.062
VSD[7]		17.62	*9.20*			22.06	*8.81*		< .005
Negative Interaction Behaviors		0.15	*0.59*			0.06	*0.32*		.254
ISD		0.11	*0.45*			0.02	*0.18*		.120
PSD		0.23	*1.02*			0.10	*0.56*		.326
VSD		0.11	*0.43*			0.06	*0.34*		.461
Low-Level Interaction Behaviors		11.65	*5.62*			11.90	*5.34*		.785
ISD		17.17	*8.98*			19.94	*8.53*		.056
PSD		10.06	*6.35*			9.35	*6.14*		.493
VSD		7.72	*4.82*			6.40	*4.81*		.096
Total Interaction Behaviors		15.27	*2.56*			16.21	*0.73*		< .005
ISD		18.07	*4.17*			19.53	*1.86*		< .01
PSD		13.90	*2.37*			14.58	*1.08*		< .05
VSD		13.86	*2.82*			14.52	*1.34*		.073
Race									
White/ Caucasian	65 (84.4%)				66 (93%)				.103
Black/African American	3 (3.9%)				1 (1.4%)				.351
Asian/Asian American	3 (3.9%)				1 (1.4%)				.351
Native American/ American Indian or Alaskan Native	3 (3.9%)				0 (0%)				.093
Native Hawaiian/ Pacific Islander	1 (1.3%)				0 (0%)				.335
Other	3 (3.9%)				0 (0%)				.093
Unknown/ Declined to answer	1 (1.3%)				1 (1.4%)				.954
Ethnicity									
Non-Hispanic/ Latino	73 (94.8%)				61 (85.9%)				.065
Hispanic/ Latino	4 (5.1%)				10 (14.1%)				

1. Full-scale IQ measured via the Kaufman Brief Intelligence Test, 2nd Edition (Kaufman & Kaufman, 2004); 2. Comparison Severity Score (Gotham et al., 2009) from the Autism Diagnostic Observation Scale, 2nd Edition (Lord et al., 2012); 3. Expressive Vocabulary Test, 2nd Edition (Williams & Williams, 2007) standard score; 4. Theory of Mind Inventory (Hutchins et al., 2012) standard score; 5. Incidental Social Demand MSNIS; 6. Physical Social Demand MSNIS; 7. Verbal Social Demand MSNIS. *P*-values are derived from *t*-tests (continuous) and χ^2 tests (categorical) comparing the autistic and non-autistic groups.

four to eight age-, sex-, and IQ-matched participants, with at least two autistic and two non-autistic participants. Participants were not informed that groups would consist of both autistic and non-autistic children. Peer interaction assessment group placement was determined by study staff based on age and gender matching procedures as well as parent response to scheduling polls. Otherwise, peer interaction group placement was random. The modal group size was 6 participants (mean = 5.48 participants; median = 5 participants; minimum = 4, maximum = 8). The peer interaction assessment (called the Pizza Party Paradigm) consisted of a 50-minute interaction that took place in a large meeting room within the laboratory space at the university. All Pizza Party Paradigm sessions were recorded on video using four Noldus (Axis IP PTZ Dome) cameras installed in the ceiling of each corner of the room. While inconspicuously placed, cameras were not hidden out of participants' sight.

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

Each Pizza Party Paradigm was separated into three MSNISs of varying social demand. During the first MSNIS, which had ISD and lasted 20 minutes, participants were provided with pizza and snacks. The study staff welcomed participants and indicated the food was for the participants to enjoy but gave no explicit instructions to interact with one another. During the second MSNIS, which had PSD and lasted 15 minutes, participants were provided with game materials for Giant Jenga (a tower-building game with large wooden blocks) and instructions on *how* to play the game; study staff did *not* provide any other instruction to the participants, did not tell them *to* play the game, and offered no incentives for doing so. During the third MSNIS, which had VSD and also lasted 15 minutes, participants were provided with game materials for Apples-to-Apples® (a card game where players choose a card from their hand that goes "best" with a theme card for each round) and instructions on *how* to play the game; study staff did *not* provide any other instruction to the participants, did not tell them *to* play the game, and offered no incentives for doing so. No adults were present during the interaction components of the Pizza Party Paradigm. Between each MSNIS, study staff would enter the room to provide or remove materials, as previously detailed.

During the peer interaction assessment, participants were placed in groups comprised of autistic and non-autistic peers. After the peer interaction assessment, participants were asked, "Did you know anyone from today's pizza party before today?" with response options as "Yes," "No," and "I don't know." Participants were also asked, "If so, how many other kids here did you know before the pizza party?" as well as "Who did you know?" For the purposes of subsequent analyses, responses "No" and "I don't know" to the question "Did you know anyone from today's pizza party before today?" were collapsed into one variable. Of all participants, 120 participants (81.1%) reported that they did not know anyone from their interaction assessment group (i.e., responded "No" to the question "Did you know anyone from today's pizza party before today?"). Of the 24 (16.2%) participants who reported that they knew another participant in their interaction assessment group (i.e., responded "Yes" to "Did you know anyone from today's pizza party before today?"), the percentage of participants in their group that they previously knew ranged from 12.5% to 50%. Four participants (2.7%) stated that they did not know if they knew anyone in the group previously.

Measures

Kaufman brief intelligence test, 2nd edition (KBIT-2)

The KBIT-2 (Kaufman & Kaufman, 2004) is an assessment of verbal and nonverbal intelligence in children (at least four years of age) and adults. The KBIT consists of three sections, including verbal knowledge, matrices, and riddles, and has been commonly used to assess cognitive abilities in autistic youth (e.g., Granieri et al., 2020; Russo-Ponsaran et al., 2019). In the present study, trained study staff and research assistants administered the KBIT-2.

Autism diagnostic observation schedule, 2nd edition (ADOS-2)

The ADOS-2 (Lord et al., 2012), considered the gold standard for autism diagnosis, is a semi-structured, clinician-administered interview consisting of social presses to evaluate autism symptomatology. In the present study, the ADOS-2 was administered and scored by research-reliable examiners and used to determine participant group placement. Additionally, ADOS-2 Comparison Severity Score (CSS; Gotham et al., 2009) was used as an outcome variable of ASD symptomatology.

Expressive vocabulary test, 2nd edition (EVT-2)

The EVT-2 (Williams & Williams, 2007) is a measure of expressive language and word retrieval in children (at least 2.5 years of age) and adults. Participants are presented with pictures and asked to either identify the picture or find a synonym. The EVT-2 standard scores are co-normed (Williams & Williams, 2007), and the measure has been commonly used to assess acquired language in autistic individuals (e.g., Dominick et al., 2007; Parsons et al., 2019). In the present study, the EVT-2 was administered by trained study staff and research assistants.

Theory of mind inventory (ToMI)

The ToMI (Hutchins et al., 2012) is a parent-report questionnaire measuring a parent's idea about their child's theory of mind abilities, such as perspective-taking. Participants' parents are presented with 48 statements of theory of mind knowledge and asked to indicate on a continuum sliding scale how true or not true the statement is with respect to their child. The measure has been commonly used to assess theory of mind abilities in samples of autistic youth (e.g., Lecheler et al., 2021; Lerner et al., 2011), and in the present study, the ToMI composite score was included as a covariate within the hierarchical linear models (HLMs).

Social interaction observation scale (SIOS)

The SIOS (Bauminger, 2002, 2007a, 2007b; Bauminger et al., 2003) is a measure of peer interaction behaviors, often used in studies of autistic youth. Peer interaction behaviors are categorized as positive, negative, and low-level. Positive peer interaction behaviors are defined as verbal and nonverbal social behaviors that lead to an effective social process with peers. These include behaviors that serve to start or maintain social interaction, such as eye contact, greeting, affection, sharing objects or experiences, social communication, and giving help. Negative peer interaction behaviors are defined as verbal and nonverbal unpleasant social behaviors that operate to stop or decrease the likelihood of the development of an adequate social interaction, including physical or verbal aggressiveness as well as avoiding others and actively looking away. Low-level peer interaction behaviors are defined as verbal and nonverbal behaviors that indicate social intention but with minimal social enactment. These include behaviors such as being in close proximity to another child without initiating an interaction, looking at another child without establishing eye contact, using functional communication (e.g., "It is my turn.") or idiosyncratic language, and exhibiting repetitive behaviors without a clear social or communication intent. If the participant interacted with a peer using positive, negative, or low-level interaction behaviors, the behavior would be coded as engaging in peer interaction.

Coder training and procedure

Coders. The coding team was comprised of three undergraduate psychology students. All coders were naive to participant diagnosis as well as specific study hypotheses.

Coder Training. The coding team trained over a 4-month period. Training consisted of reading the SIOS scoring manual, attending weekly team meetings, reviewing specific training video segments, and practicing coding (Margolin et al., 1998). Prior to coding the data for the present study, coders trained and met adequate reliability (Intraclass correlations (ICCs) > .59; Shrout & Fleiss, 1979) on a sample of similar videos of social interactions between autistic youth from a prior study. Because all coders coded

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

the same videos during training, reliabilities were calculated using ICC(2,1) (Shrout & Fleiss, 1979). During coding of videos used for the present study, reliabilities were calculated using ICC(1,3) (Shrout & Fleiss, 1979).

Coding of Minimally-Structured Interaction Assessments. For each interaction assessment, each participant was double-coded by independent coders. Video recordings of each interaction assessment were separated into three videos corresponding to each MSNISs – the ISD section, the PSD section, and the VSD section. Thus, with 148 participants and three videos per interaction assessment, 444 videos were double-coded. Coder assignments were both randomized and counter-balanced to ensure an equal number of coder pairings. The SIOS was used to rate video recordings of each participant's positive, negative, or low-level behaviors during the peer interaction assessment. Coders were instructed to code participant behaviors in 1-minute segments, such that for each segment, coders identified up to three of the most salient behaviors that occurred in the given window. Then, totals were summed across each behavior, such that they represented the total number of segments where the behavior was deemed most salient. ICC (1,3) was calculated for reliability (see Table 2), and the average of each pair of codes for each peer interaction behavior was used in subsequent analyses.

Data analytic plan

Interrater reliability for each coding item was assessed using ICC(1,3). To test Hypotheses 1a-1c (as well as to explore these patterns in negative peer interaction behaviors), four 3 (MSNIS, within person) x 2 (diagnostic group, between person) repeated-measures ANOVAs were conducted, predicting total peer interaction, positive peer interaction behaviors, low-level peer interaction behaviors, and negative peer interaction behaviors. Post hoc 2-way comparisons were conducted only if the overall ANOVA was significant. With regard to the exploratory analyses comparing peer interaction behaviors *between* autistic and non-autistic groups *within* each MSNIS, the multivariate test for MSNIS by diagnostic group was first examined; if significant, parameter estimates representing pairwise comparisons between diagnostic group within each MSNIS were examined. To test Hypothesis 2a and 2b (as well as to explore these patterns in negative peer interaction behaviors), three repeated-measures ANOVAs comparing the three MSNIS within positive, low-level, and negative interaction behaviors were conducted, including only autistic youth in the analyses.

Hypothesis 3, that fewer positive peer interaction behaviors, as well as more low-level interaction behaviors, would predict greater ASD symptomatology in PSD and VSD MSNIS, was assessed using HLMs. First, 2-level, unconditional HLMs were conducted to account for the fact that participants (level 1) were nested in groups (level 2); Intraclass correlations (ICCs) were then examined to determine whether there was sufficient Level 2 variance (i.e., >10%; Guo, 2005) to necessitate a random effect term for each given variable in the full predictive model. It was determined that IQ, total peer interaction, and each SIOS peer interaction behavior by setting exhibited enough Level 2 variance to necessitate a random effect term (see Table 3). Following this, nine 2-level HLMs were specified as follows to test the indicated hypotheses:

Table 2. ICCs of SIOS items

Peer Interaction Behavior	SIOS Item	ICC(1,3)
Positive		**0.95**
	Eye contact	**0.90**
	Eye contact combined with smile	0.11
	Smile without eye contact	0.53
	Affection	0
	Sharing objects	**0.95**
	Sharing experience	**0.71**
	Social communication	**0.96**
	Talk that reflects an interest in another child	0.26
	Greeting	0
	Giving help	0
Negative		**0.67**
	Physical or verbal aggressiveness	0.55
	Temper tantrums	**0.92**
	Teasing	0.30
	Controlling	0
	Avoidance	0
	Looking away	0
Low-level		**0.92**
	Looking	**0.85**
	Close proximity	**0.97**
	"Yes" and "No"	0
	Imitation	0
	Idiosyncratic language	0
	Repetitive behavior	**0.70**
	Functional communication	0.25
Total peer interaction		**0.97**

Bolded items indicate coded peer interaction behaviors, as well as the behaviors captured within each over-arching peer interaction behavior category, that met reliability (ICC > .59). For the purpose of this study, only aggregate peer interaction behavior categories (i.e., Positive, Negative, and Low-Level Peer Interaction Behavior as well as Total Peer Interaction) were used in analyses.

Level 1:

$$Y_{gg} = \pi_{0g} + \pi_{1g}(ToMI) + \pi_{2g}(KBIT) + \pi_{3g}(EVT) + \pi_{4g}(SIOS) + \pi_{5g}(Peer\ Interation) + e_{gg}$$

Level 2:

$$\pi_{0g} = \beta_{00}$$
$$\pi_{1g} = \beta_{10}$$
$$\pi_{2g} = \beta_{20} + r_2$$
$$\pi_{3g} = \beta_{30}$$
$$\pi_{4g} = \beta_{40} + r_4$$
$$\pi_{5g} = \beta_{50} + r_5$$

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

Table 3. ICCs of 2-level, unconditional hierarchical multiple linear models

	Variable	ICC		*p*-value
		Level 1[a]	Level 2[b]	
ISD[1]	Positive Peer Interaction	0.568	0.432	<0.001
	Negative Peer Interaction	0.580	0.420	<0.001
	Low-level Peer Interaction	0.807	0.193	<0.001
	Total Peer Interaction	0.905	0.095	<0.05
PSD[2]	Positive Peer Interaction	0.641	0.359	<0.001
	Negative Peer Interaction	0.622	0.378	<0.001
	Low-level Peer Interaction	0.698	0.302	<0.001
	Total Peer Interaction	0.864	0.136	<0.005
VSD[3]	Positive Peer Interaction	0.805	0.195	<0.001
	Negative Peer Interaction	0.808	0.192	<0.001
	Low-level Peer Interaction	0.947	0.053	<0.001
	Total Peer Interaction	0.964	0.036	0.184
	KBIT-2[4]	0.919	0.081	<0.05
	EVT-2[5]	0.979	0.021	0.358
	ToMI[6]	0.998	0.002	>0.500
	ADOS-2 CSS[7]	0.999	0.001	>0.500

MSNIS = minimally-structured, naturalistic interaction settings. 1. ISD = MSNIS with incidental social demand; 2. PSD = MSNIS with physical social demand; 3. VSD = MSNIS with verbal social demand; 4. Full-scale IQ measured via the Kaufman Brief Intelligence Test, 2nd Edition (Kaufman & Kaufman, 2004); 5. Expressive Vocabulary Test, 2nd Edition (Williams & Williams, 2007) standard score; 6. Theory of Mind Inventory (Hutchins et al., 2012) standard score; 7. Comparison Severity Score (Gotham et al., 2009) from the Autism Diagnostic Observation Scale, 2nd Edition (Lord et al., 2012); 2-level, unconditional hierarchical multiple linear models were conducted to account for the fact that participants were nested in groups. a) Level 1 is the proportion of variance at the within-group between-person level (i.e., intra-group variance); b) Level 2 is the proportion of variance at the between-group level (i.e., inter-group variance). In other words, if an individual's score on a given variable was highly correlated with that of everyone else in their Pizza Party Paradigm (PPP) group and minimally-correlated with the scores of those in other groups, there would be high Level 2 ICC (max = 1). If the scores of those in a PPP group were not more highly correlated than their scores were with participants in any other group, there would be high Level 1 ICC (max = 1). The sum of Level 1 and Level 2 ICC for any given variable should usually equal 1 in a 2-level model.

Y_{gg} is the ADOS-2 CSS for a given participant; SIOS is the peer interaction behavior indicated in each model (i.e., positive, negative, and low-level); ToMI, KBIT-2, EVT-2 represents the covariates of social cognitive, cognitive, and language ability; total peer interaction represents the covariate of time spent interacting with peers in the given MSNIS; π_{0g} is the model intercept; π_{1g}, π_{2g}, π_{3g}, π_{4g}, and π_{5g} are the linear slopes for each variable; β_{00}, β_{10}, β_{20}, β_{30}, β_{40}, and β_{50} are the Level 2 effects associated with each specified parameter requiring such an effect; e_{gg} is the residual Level 1 error, while r_2, r_4, and r_5 represent the Level 2 random effect associated with each specified parameter.

Results

After all Pizza Party Paradigm videos were coded, the interrater reliability of each SIOS item was assessed (Table 2). Positive, negative, low-level, and overall interaction behavior scales reached adequate reliability (i.e., ICC > .59; Shrout & Fleiss, 1979).

Peer interaction behaviors in autistic and non-autistic youth across MSNIS

Across all MSNIS, autistic and non-autistic youth did not differ in amount of positive (Fig. 1a), low-level (Fig. 1b), or negative (Fig. 1c) interaction behaviors (p's > .05). They did differ in the overall amount of peer interaction, such that autistic youth displayed less peer interaction across all settings than their non-autistic peers ($F_{1,146} = 8.80$, $p < .005$; Fig. 1d).

There was an activity by diagnostic group interaction for positive interaction behaviors ($F_{1,146} = 6.97$, $p < .01$). Post hoc comparisons revealed that, in the VSD MSNIS only, fewer positive interactions were observed in autistic than non-autistic youth ($p < .005$; Fig. 1a); autistic and non-autistic youth did not differ in amount of positive peer interaction behaviors during the ISD and PSD MSNIS (p's > .05). There was also an activity by diagnostic group interaction for low-level interaction behaviors ($F_{1,146} = 9.82$, $p < .005$). Post hoc comparisons revealed that during the ISD MSNIS, autistic youth exhibited fewer low-level behaviors than non-autistic youth, though this comparison was marginally significant ($p = .056$; Fig. 1b); autistic and non-autistic youth did not differ in amount of low-level peer interaction behaviors during the PSD and VSD MSNIS (p's > .05).

Peer interaction behaviors in autistic youth by MSNIS

For positive peer interaction behaviors in autistic youth, there was a main effect of MSNIS ($F_{1,76} = 285.55$, $p < .001$). Post hoc comparisons revealed that autistic youth exhibited more positive interaction behaviors during the VSD MSNIS than the ISD ($p < .05$) and PSD ($p < .005$) MSNIS (Fig. 1a).

For low-level peer interaction behaviors in autistic youth, there was a main effect of MSNIS ($F_{1,76} = 330.32$, $p < .001$). Post hoc comparisons revealed that autistic youth exhibited fewer low-level interaction behaviors during the VSD MSNIS compared to the ISD ($p < .001$) and PSD ($p < .001$) MSNIS. Additionally, autistic youth exhibited fewer low-level interaction behaviors during the PSD than during the ISD MSNIS ($p < .001$; Fig. 1b).

There was no overall main effect of MSNIS on negative peer interaction behaviors in autistic youth ($p > .05$; Fig. 1c).

Peer interaction behaviors and ASD symptomatology by MSNIS – controlling for relevant covariates and accounting for nesting in group

During the PSD MSNIS, greater theory of mind skills predicted less ASD symptomatology ($\beta_1 = -.0201$, $p < .05$) and more positive interaction behaviors marginally predicted less ASD symptomatology ($\beta_4 = -0.091$, $p = .061$). During the VSD MSNIS, greater theory of mind skills ($\beta_1 = -0.198$, $p < .05$) and more positive interaction behaviors ($\beta_4 = -0.074$, $p < .05$) predicted less ASD symptomatology. During the ISD MSNIS, no effects were found predicting ASD symptomatology ($p > .05$).

With respect to negative peer interaction behaviors, during the ISD and PSD MSNIS, no effects were found predicting ASD symptomatology ($p > .05$). During the VSD MSNIS, only more overall peer interaction predicted less ASD symptomatology ($\beta_1 = -0.193$, $p < .05$).

With respect to low-level peer interaction behaviors, during the ISD MSNIS, no effects were found predicting ASD symptomatology ($p > .05$). During the PSD MSNIS, only greater theory of mind skills predicted less ASD symptomatology ($\beta_1 = -0.207$, $p < .05$). During the VSD MSNIS, greater theory of mind skills ($\beta_1 = -0.194$, $p = .05$) marginally predicted less, while more low-level interaction marginally predicted more ($\beta_4 = .105$, $p = .05$) ASD symptomatology, and more overall peer interaction predicted less ASD symptomatology ($\beta_5 = -0.236$, $p < .01$).

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

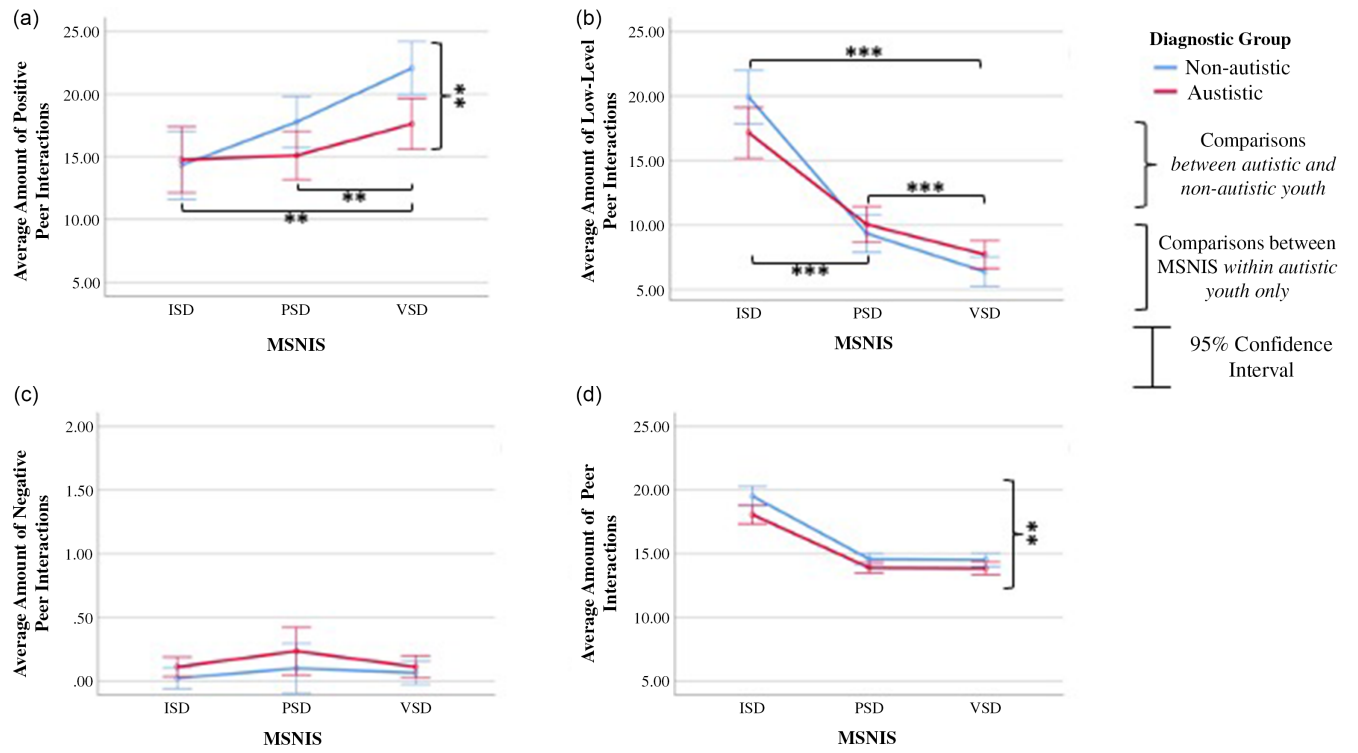

Figure 1. *$p < .05$, **$p < .005$, ***$p < .001$. Peer interaction behaviors during minimally-structured, naturalistic interaction settings (MSNIS) with varying social demands. ISD = incidental social demand; PSD = physical social demand; VSD = verbal social demand. ***a***) Autistic youth displayed more positive peer interaction in the VSD as compared to the PSD or the ISD; autistic youth displayed less positive peer interaction than non-autistic peers in the VSD. ***b***) Autistic youth displayed fewer low-level peer interactions in the PSD and VSD as compared to the ISD as well as fewer low-level peer interactions in the VSD than in the PSD. ***c***) There were no significant effects found for negative peer interaction behaviors. ***d***) Non-autistic youth exhibited more peer interaction behaviors than autistic youth across all MSNISs.

Discussion

The present study investigated patterns of peer interaction behaviors of autistic and non-autistic youth occurring in group MSNISs that vary in social demands. Peer interaction behavior types were reliably identified across three MSNIS with differing social demands, allowing for the differences in peer interaction behavior types between autistic and non-autistic youth, as well as within only autistic youth, across MSNIS to be assessed. While autistic youth exhibited fewer interaction behaviors compared to non-autistic youth overall, the two diagnostic groups did not differ in overall amount of positive, negative, and low-level interaction behaviors. When comparisons were made at the MSNIS level, autistic and non-autistic youth only differed in positive interaction behaviors during the VSD MSNIS. Further, youth who displayed more positive interaction behaviors during this same MSNIS had less ASD symptomatology, even after accounting for within-person (i.e., cognitive, social-cognitive, and language abilities) as well as between-person (i.e., the correlated nature of social behavior within a group) factors.

Can peer interaction behaviors be reliably observed in neurodiverse groups?

It was found that positive, negative, and low-level interaction behaviors as well as total peer interactions in autistic and non-autistic youth were reliably identified in each MSNIS, highlighting that peer interaction behaviors in mixed groups of autistic and non-autistic youth can be assessed and reliably observed in MSNIS varying by social demand. Almost all past literature quantitatively analyzing qualitative interaction behaviors in autistic and non-autistic youth have analyzed interaction behaviors in dyads or groups smaller than those used in the present study (e.g., Simmons et al., 2021; Williams et al., 2010). A concern of the past literature regarding analyzing interaction behaviors in groups of larger sizes was that the behaviors would be too obscured by the complexities of a larger social group (e.g., Bauminger-Zviely et al., 2014; Rum et al., 2021). However, we were able to reliably identify peer interaction behaviors in groups of both autistic and non-autistic youth across MSNIS with differing social demands, providing an important foundation for future research seeking to model real-world social interactions using either human coding or automated techniques.

Peer interaction behaviors in autistic and non-autistic youth across MSNIS

Autistic youth displayed less peer interaction across all settings than their non-autistic peers. However, when comparing peer interaction behavior types across all activities, autistic and non-autistic youth did not differ in amount of positive, negative, or low-level interaction behaviors. These findings were contrary to our hypotheses regarding positive and low-level interaction behaviors as well as past research suggesting autistic youth exhibit fewer positive and complex social interaction behaviors (e.g., social reciprocity or making eye contact with a smile; Bauminger et al., 2003, 2008; Usher et al., 2015). Indeed, often most interaction behaviors observed in both autistic and non-autistic youth *are* prosocial or positive behaviors (Bauminger et al., 2003; Bauminger, 2002); thus, it may be that MSNISs allow for more opportunities for autistic youth to engage with peers in positive ways.

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

In prior observational studies of autistic youth, low-level behaviors arise variably, with some studies reporting many of the interaction behaviors autistic youth exhibit being low-level (Bauminger, 2007b) and others reporting low-level behaviors as the second-most observed interaction behavior (following positive interaction behaviors; Hauck et al., 1995). Contrary to our results, Bauminger et al. (2003) found autistic youth display more low-level behaviors, such as functional communication and close proximity, than non-autistic youth. Additionally, past research has found autistic youth with lower cognitive abilities exhibit more low-level interaction behaviors (Stone & Caro-Martinez, 1990). An inclusion criterion for the present study was a full-scale IQ > 70, and the cognitive abilities of the autistic participants in our sample were in the average cognitive abilities range, on average. Therefore, the higher cognitive range of the autistic youth in the present study may have contributed to the similar amounts of low-level behaviors observed between the autistic and non-autistic youth. Importantly, however, this suggests that such behaviors, rather than being characteristic of autism more generally (as they are often called — Bauminger et al., 2003), may be useful in identifying autistic youth specifically based on interaction setting.

Further, while the Pizza Party Paradigm was designed to assess peer interaction behaviors in a minimally-structured setting, providing food as well as materials of two different games may have surpassed an unknown minimum threshold of structure to elicit similar interaction behaviors from both autistic and non-autistic youth. For instance, just having the opportunity to engage with a task (e.g., eating or playing a game) could have potentially decreased any feelings of social anxiety participants may have experienced while interacting with novel peers. Future research should explore peer interaction behavior patterns using fully unstructured interaction settings as a comparator to better understand how even the introduction of *minimal* structure may have contributed to the modest differences in interaction behaviors that emerged between autistic and non-autistic youth.

Consistent with previous research on peer interaction behaviors in autistic and non-autistic youth (e.g., Bauminger, 2002, 2007a, 2007b; Bauminger et al., 2003; Hauck et al., 1995), negative peer interaction behaviors occurred at a very low frequency in our sample, and autistic and non-autistic youth did not differ in amount of negative interaction behaviors observed. It is notable that even in a fairly lengthy interaction period with a group of unfamiliar peers, minimal supervision, three changes in social demand of interaction setting, and the absence of structured activities, a minimal number of negative interaction behaviors were observed in any of the youth. This finding cuts against models (e.g., classroom-based) that suggest that autistic youth are at high risk for engaging in negative behaviors in absence of a high degree of structure in social interactions (Crosland & Dunlap, 2012; Strain et al., 2011). That is, those behaviors, when observed, are more likely to be occurring for reasons other than the fact that autistic youth are given opportunities to move about their social world just as their peers do.

More broadly, the findings of the present study suggest that adolescents, when given minimal structure, tend to engage in a preponderance of positive social interaction behaviors – with a similar level of low-level interaction behaviors – and very few negative interaction behaviors. In an era dominated by digital interactions, and where in-person interactions are often mediated by the presence of phones and screens, it is notable that, in the absence of such tools, adolescents maintain a tendency toward positive interaction behaviors with each other.

Peer interaction behaviors between groups within each MSNIS

In only the VSD MSNIS, fewer positive interactions were observed in autistic youth compared to non-autistic youth. What aspects of the VSD MSNIS may contribute to this? Social communication difficulties are a characteristic feature of ASD (Association, 2013), and research has demonstrated autistic youth often experience a range of problems in language processing (Bavin et al., 2014; Lartseva et al., 2014); thus, more verbally demanding social environments may pose unique challenges for autistic youth, consequently lowering positive interaction behaviors. Alternatively, the difference in positive interaction behaviors between autistic and non-autistic youth during the VSD MSNIS could be due to a "slow-to-warm-up" profile (Thomas et al., 1970). Specifically, slow-to-warm children need more time to adjust to new, unfamiliar situations, and prior literature on peer-mediated social intervention studies highlight the importance of peer familiarity (i.e., getting to know new peers and settings) for social interactions, particularly for autistic youth (Corbett et al., 2014). Thus, the attenuated positive interaction behaviors may be a factor of time, such that if Pizza Party Paradigm was longer in duration and allowed for more time to get to know the new peers and interaction setting, autistic adolescents may reach similar levels of positive interaction behaviors as non-autistic youth. Nonetheless, these same youth did *not* show such an effect in their overall amount of peer interaction, and this VSD effect was maintained even after controlling for amount of interaction, suggesting that if the 'slow-to-warm-up' phenomenon is responsible, it is specific to positive interactions. Future replications of this work should counterbalance the MSNIS order such that the MSNIS with VSD, which may be more challenging for autistic youth, is not always preceded by a period of prior social demand.

The results of the present study highlight subtle environmental contingencies of minimally-structured settings that may drive social dynamics in adolescence. Specifically, positive peer interaction behaviors appeared to increase in frequency during the PSD and VSD, while low-level peer interaction behaviors decreased in frequency during these interaction settings. Literature on out-of-school activities adolescents partake in has shown that activity-based peer interactions are less likely to involve peer rejection than extracurriculars without an activity (Mahoney et al., 2009). Further, the introduction of game materials to the interaction contexts, even without any instruction to play the games, may have served as "setting events" (Kantor, 1959), enriching the environment just enough to catalyze positive social behaviors (e.g., Brown et al., 1986, 1987; Horner, 1980). Thus, the more activity-based peer interactions, such as the interaction settings with physical or verbal social demands in this study, may have provided more opportunities for positive peer interactions than the context with an ISD.

There was also an activity by diagnostic group interaction for low-level interaction behaviors. While there were no specific differences in a given MSNIS that clearly drove this interaction effect, it is clear that there was a difference in pattern of low-level interaction behaviors across the three MSNIS by diagnostic status. Specifically, autistic and non-autistic youth calibrated their low-level interaction behaviors from the incidental (ISD) to the PSD and VSD MSNIS; however, autistic youth appeared to calibrate their behavior to a lesser extent. These findings suggest that autistic youth use low-level behaviors in normative ways to adjust to the

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

social demands of the interaction setting, but the modulation of their low-level behaviors across MSNIS may be not as stark given that several behaviors captured within this interaction domain (e.g., idiosyncratic language and repetitive behaviors) are more commonly seen in autistic individuals and may serve a non-social purpose.

Peer interaction behaviors in autistic youth by MSNIS

In line with our hypothesis, autistic youth displayed more positive peer interaction behaviors during the VSD MSNIS than the ISD and the PSD MSNIS. In other words, autistic youth showed more positive interaction behaviors during MSNIS with VSDs as compared to MSNIS with PSDs or ISDs. The social motivation hypothesis posits that the decreased social interaction and social difficulties experienced by autistic individuals stem from attenuated social motivation (Chevallier et al., 2012; Clements et al., 2018), suggesting decreases or drop-offs in sustained social behavior over a long MSNIS period may occur. However, autistic youth in our sample not only continued to engage socially throughout the Pizza Party Paradigm but also demonstrated *more* positive interaction behaviors from ISD MSNIS to VSD MSNIS. Thus, it may be that VSD MSNIS are especially helpful for autistic youth to engage in successful prosocial interactions – and, indeed, why such activities are especially commonly selected among autistic youth for recreation (Bohnert et al., 2019).

Autistic youth exhibited fewer low-level interaction behaviors during the VSD MSNIS compared to the ISD as well as the PSD MSNIS as well as fewer low-level interaction behaviors during the PSD than during the ISD MSNIS. Thus, autistic youth decreased in their low-level interaction behaviors as the MSNIS social demands shifted from incidental to physical to verbal. This pattern of low-level interaction behaviors mimics the appropriate interaction behaviors that would be expected for the setting. For example, during the ISD MSNIS, participants were provided pizza and told to help themselves to the food. During this portion of the peer interaction assessment, youth may sit quietly in close proximity to other peers (more low-level interaction) while eating, but not talk (less positive interaction), because they were eating. Then, as autistic youth shift to MSNIS with physical and verbal demands, interaction behaviors such as talking with peers or sharing objects and experiences with peers (more positive interaction) may take the place of low-level interaction behaviors. Rather than exhibiting contextual rigidity sometimes attributed to autistic youth (D'Cruz et al., 2013; Poljac et al., 2017), these results suggest that these adolescents *did* calibrate their behaviors by context in a way that followed the demands of the environment. Such shifting has been shown to be valuable for eliciting positive outcomes for this population (Lerner et al., 2017). It may be valuable, then, to further examine what person-level factors may promote such adaptive shifting strategies in autistic youth.

Peer interaction behaviors and ASD symptomatology by MSNIS

Crucially, it was found that even after controlling for within-person factors (i.e., cognitive, social-cognitive, and language abilities) as well as between-person (i.e., the correlated nature of social behavior within a group) factors, more positive interaction behaviors predicted less ASD symptomatology during the PSD MSNIS as well as the VSD MSNIS, though the former relationship was only marginal. In other words, youth who exhibited more positive interaction behaviors during MSNIS that involved PSDs or VSDs also exhibited less ASD symptomatology. Additionally, during the VSD MSNIS, more low-level interaction behaviors marginally predicted more ASD symptomatology. Overall, these findings suggest that the autism-like differences in behavior across the three MSNIS were not only robust to important confounds but also track with continuous distributions of autism symptoms across the population. Thus, these findings may help to identify settings that may challenge – or support – youth with subclinical autism symptoms who, nonetheless, are seeking the optimal environments for promoting their own social success. In other words, finding a group of youth with shared interests may not be enough – obtaining a social setting that does not make it harder to engage with that group may be equally valuable for supporting peer relations in these groups.

Limitations and future directions

There are several limitations of the present study that bear note. First, only one set of MSNIS was evaluated. Future research should not only attempt to replicate the present study but also evaluate peer interaction behaviors across a variety of MSNIS in which mixed groups of autistic and non-autistic youth may find themselves. Second, despite efforts to recruit participants from a wide geographic area, not all groups consisted of completely novel peers. While 16.2% of the sample reported they *did* know at least one other peer from their group, there were no participants who endorsed they knew all other participants in their group, suggesting participants still had some social interactions that were with novel peers. Importantly, *how well* participants knew the other peers they reported "knowing" was not directly assessed – only the binary choice of whether they previously knew anyone in the session *at all* was considered; thus, there may be a potential confound introduced by individual differences in previous relationships or experiences among participants. It is currently unknown how the pattern of peer interaction behaviors changes as a function of variation in familiarity with peers (i.e., ranging from a group of strangers to regular classmates). Previous literature has found that social play with friends, compared to non-friends, has been shown to elicit more social interactions (Guralnick et al., 2007) and less solitary play (Bauminger-Zviely & Agam-Ben-Artzi, 2014), though the latter effect was only found in mixed dyads (i.e., ASD-TD). Future iterations of this work would benefit from assessing the level of familiarity among participants who report "knowing" another child in their peer interaction group to better understand how this potential confound impacts peer interaction behaviors in groups of adolescents.

A third limitation of the present study was the length of the Pizza Party Paradigm, which lasted 50 minutes and was separated into three, shorter length segments of varying social demand. While a 50-minute interaction period, such as this paradigm, mimics the length of other common activities (e.g., sports, club meetings, rehearsals), shorter interactions, such as recess or impromptu conversations with peers, may elicit a different pattern of behavior. Additionally, longer interactions may be needed to detect more subtle natural patterns of behavior. Future work should evaluate the effect that duration of peer interaction has on observed interaction behaviors. Fourth, the SIOS coding system (Bauminger, 2002, 2007a, 2007b; Bauminger et al., 2003) only captures the three most salient behaviors in each one-minute segment, and the coding system is not exhaustive in its list of possible interactions. These

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

restrictions could exclude important components of peer interactions that are less salient, low frequency/high importance, or not on the list of behaviors. To capture a possibly larger array of behaviors, the SIOS coding system could be improved by increasing the number of most salient behaviors coded within a one-minute segment. Future work should utilize multiple behavioral coding systems, including the SIOS, to provide a more comprehensive picture of peer interaction behavior types (i.e., both aggregate and item-level) that occur during mixed group interactions of adolescents in MSNIS with varying social demands.

Fifth, future replications of the study would benefit from a more racially and gender-diverse sample, as this sample consists primarily of white, male youth. This would allow for better generalizability of the current findings and further our understanding of autism in populations that have been historically underrepresented within autism research (e.g., Black autistic youth; female and gender-minority youth; Jones & Mandell, 2020; Shaia et al., 2020; Strang et al., 2020). Additionally, the wide age range of the sample included both pre-adolescent and adolescent youth, which may have influenced interaction behavior types and group dynamics despite peer interaction assessment groups being matched by age, sex, and IQ. Investigating both age and gender effects on types of peer interaction behaviors would be a fruitful area of future research, particularly given that autistic females have reported masking/passing as non-autistic more than autistic males (Hull et al., 2020; Lai et al., 2019). Further, in considering the extension of this peer interaction assessment tool, the distribution of behaviors observed may be influenced by the cognitive and clinical presentations of the group, such that those with lower cognitive ability and/or more autistic characteristics may demonstrate a different distribution of positive, negative, and low-level behaviors. Future research should be conducted to examine the distribution of peer interaction behaviors as a function of the profile of autistic children.

Lastly, coders were blind to each participant's diagnostic status; thus, diagnostic status of the peer(s) a participant interacted with was not recorded. Prior literature has shown that autistic youth differentially interact with other autistic youth than their non-autistic peers (Crompton et al., 2020; Davis & Crompton, 2021; Morrison et al., 2020). For example, both Bauminger et al. (2003) and Hauck et al. (1995) found that autistic youth exhibit more positive and low-level interaction behaviors toward non-autistic youth than fellow autistic peers. Additionally, autistic youth have been shown to socially engage less during large, group-based social activities (Macintosh & Dissanayake, 2006), and prior research has demonstrated youth with developmental delays exhibit more prosocial behaviors in dyad settings than in groups (Guralnick et al., 2007). Collecting information on the peers participants interacted with could provide further insight into the social preferences of autistic youth in mixed group settings. Further, we can observe if types and frequencies of peer interaction behaviors are related to the number of peers participants interacted with, the diagnostic status of these peers, and the interaction between these variables.

Clinical and theoretical implications

The present study has important clinical and theoretical implications. The activities available to participants during the MSNIS served as proxies for the most common types of MSNIS in which youth find themselves. Specifically, the ISD MSNIS most similarly mimics being in a cafeteria or lunchroom, the PSD MSNIS as recess or a playground setting, and the VSD MSNIS as chat with peers. It was found that MSNIS with VSD differentially impacted the display of positive interaction behaviors by diagnostic group, such that autistic youth exhibited fewer positive interaction behaviors than non-autistic youth only during this MSNIS (even after controlling for relevant covariates and accounting for nesting in group) – but also the *most* positive interactions they exhibited across the entire paradigm. These results provide not only a better understanding of the differential expectations of interaction behaviors in autistic and non-autistic youth by settings that differ in social demand but also greater insight into which social interaction environments pose more challenges, or promote more positive interactions, for autistic youth. It may be that MSNIS with VSD still promote positive interactions for autistic youth but to a lesser extent than for non-autistic youth. Qualitative research addressing what aspects of this particular setting autistic youth enjoyed, disliked, and found easy or challenging could provide critical lived-experience information to help clarify the gap between diagnostic groups.

Further, findings from the current study have implications for assessments of autistic children. Many clinicians complete naturalistic peer interaction observations, often at school, as a part of a comprehensive clinical evaluation with the expectations that all MSNIS settings are equally representative. However, the present study highlights that the MSNIS type may considerably impact the presentation of the child they observe (e.g., interaction behaviors observed during lunch, as compared to recess, may yield results that are not indicative of the specific profile and needs of a given child).

The present study also replicated prior research on the rare occurrence of negative interaction behaviors (e.g., Bauminger et al., 2003; Bauminger, 2002, 2007b; Hauck et al., 1995). Even in a group of unfamiliar peers and changing social demands, negative interaction behaviors were not commonly observed in either autistic or non-autistic youth (Table 1). These findings beg the question of what function negative interaction behaviors serve when they occur. Research has shown autistic youth are more likely to respond to peer victimization experiences in reactive ways, such as aggression, than non-autistic youth (Humphrey & Symes, 2011); thus, negative interaction behaviors with *novel* peers may suggest a possible past experience with peer victimization as well as the need for assessment of this experience and social-emotional support. Further, the rare occurrence of negative peer interaction behaviors, in combination with the finding that autistic youth and non-autistic youth did not exhibit differences in overall positive and low-level interaction behaviors, challenges existing literature surrounding the social motivation hypothesis (i.e., that autistic youth should display high levels of low-level interactions because they are not motivated to do more) and complicates recent critiques of this hypothesis. Recent literature has emphasized how social outcomes for autistic individuals may be due to a conflict of 'fit' between the autistic person and their social environment (Morrison et al., 2020) due to uniquely autistic expressions of social interest (Jaswal & Akhtar, 2019). These findings suggest autistic youth may express social interest in uniquely autistic *and* neuro-normative ways, suggesting contextual factors such as the social demand of an interaction setting may additionally play a role in how autistic youth engage and express social interest in others.

https://doi.org/10.1017/S0954579423000950 Published online by Cambridge University Press

Conclusion

In sum, while autistic youth showed fewer interaction behaviors compared to non-autistic youth overall, the two diagnostic groups exhibited similar peer interaction behavior patterns when interacting in mixed groups across MSNIS with varying social demands; however, MSNIS with VSDs served as the only social context in which autistic and non-autistic adolescents differed in social interaction behavior – specifically positive interaction behavior. Further, youth who displayed more positive interaction behaviors during this same MSNIS had less ASD symptomatology, even after accounting for within-person and between-person factors, suggesting that MSNIS with VSDs may pose unique challenges for positive interactions in autistic adolescents. This work highlights the value of the Pizza Party Paradigm as a useful tool for examining naturalistic interactions in this population and the importance of assessing peer interaction behaviors of autistic and non-autistic youth within specific contexts, as interaction patterns, and thus behavioral expectations, appear to differ by the social demands imposed on the individual.

Acknowledgments. This work was supported by the National Institute of Mental Health (NIMH #1R01MH110585).

Competing interests. None.

References

Association, A. P. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5®)*. American Psychiatric Publishing.

Attar-Schwartz, S. (2009). School functioning of children in residential care: The contributions of multilevel correlates. *Child Abuse & Neglect*, *33*(7), 429–440. https://doi.org/10.1016/j.chiabu.2008.12.010

Baghdadli, A., Assouline, B., Sonie, S., Pernon, E., Darrou, C., Michelon, C., Picot, M. C., Aussilloux, C., & Pry, R. (2012). Developmental trajectories of adaptive behaviors from early childhood to adolescence in a cohort of 152 children with autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *42*(7), 1314–1325. https://doi.org/10.1007/s10803-011-1357-z

Barber, B. L., Stone, M. R., Hunt, J. E., & Eccles, J. S. (2005). Benefits of activity participation: The roles of identity affirmation and peer group norm sharing. In *Organized activities as contexts of development: Extracurricular activities, after-school and community programs* (pp. 197–222). Psychology Press.

Barendse, E. M., Hendriks, M. P. H., Thoonen, G., Aldenkamp, A. P., & Kessels, R. P. C. (2018). Social behaviour and social cognition in high-functioning adolescents with autism spectrum disorder (ASD): Two sides of the same coin? *Cognitive Processing*, *19*(4), 545–555. https://doi.org/10.1007/s10339-018-0866-5

Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a "theory of mind"? *Cognition*, *21*(1), 37–46. https://doi.org/10.1016/0010-0277(85)90022-8

Bauminger, N. (2002). The facilitation of social-emotional understanding and social interaction in high-functioning children with autism: Intervention outcomes. *Journal of Autism and Developmental Disorders*, *32*(4), 283–298. https://doi.org/10.1023/a:1016378718278

Bauminger, N. (2007a). Brief report: Group social-multimodal intervention for HFASD. *Journal of Autism and Developmental Disorders*, *37*(8), 1605–1615. https://doi.org/10.1007/s10803-006-0246-3

Bauminger, N. (2007b). Brief report: Individual social-multi-modal intervention for HFASD. *Journal of Autism and Developmental Disorders*, *37*(8), 1593–1604. https://doi.org/10.1007/s10803-006-0245-4

Bauminger, N., Shulman, C., & Agam, G. (2003). Peer interaction and loneliness in high-functioning children with autism. *Journal of Autism and Developmental Disorders*, *33*(5), 489–507. https://doi.org/10.1023/a:1025827427901

Bauminger, N., Solomon, M., Aviezer, A., Heung, K., Brown, J., & Rogers, S. J. (2008). Friendship in high-functioning children with autism spectrum disorder: Mixed and non-mixed dyads. *Journal of Autism and Developmental Disorders*, *38*(7), 1211–1229. https://doi.org/10.1007/s10803-007-0501-2

Bauminger-Zviely, N., & Agam-Ben-Artzi, G. (2014). Young friendship in HFASD and typical development: Friend versus non-friend comparisons. *Journal of Autism and Developmental Disorders*, *44*(7), 1733–1748. https://doi.org/10.1007/s10803-014-2052-7

Bauminger-Zviely, N., Golan-Itshaky, A., & Tubul-Lavy, G. (2017). Speech acts during friends' and non-friends' spontaneous conversations in preschool dyads with high-functioning autism spectrum disorder versus typical development. *Journal of Autism and Developmental Disorders*, *47*(5), 1380–1390. https://doi.org/10.1007/s10803-017-3064-x

Bauminger-Zviely, N., Karin, E., Kimhi, Y., & Agam-Ben-Artzi, G. (2014). Spontaneous peer conversation in preschoolers with high-functioning autism spectrum disorder versus typical development. *Journal of Child Psychology and Psychiatry*, *55*(4), 363–373. https://doi.org/10.1111/jcpp.12158

Bauminger-Zviely, N., & Shefer, A. (2021). Naturalistic evaluation of preschoolers' spontaneous interactions: The autism peer interaction observation scale. *Autism*, *25*(6), 1520–1535. https://doi.org/10.1177/1362361321989919

Bavin, E. L., Kidd, E., Prendergast, L., Baker, E., Dissanayake, C., & Prior, M. (2014). Severity of autism is related to children's language processing. *Autism Research*, *7*(6), 687–694. https://doi.org/10.1002/aur.1410

Begeer, S., Malle, B. F., Nieuwland, M. S., & Keysar, B. (2010). Using theory of mind to represent and take part in social interactions: Comparing individuals with high-functioning autism and typically developing controls. *European Journal of Developmental Psychology*, *7*(1), 104–122. https://doi.org/doi.org/10.1080/17405620903024263

Beidel, D. C., Rao, P. A., Scharfstein, L., Wong, N., & Alfano, C. A. (2010). Social skills and social phobia: An investigation of DSM-iV subtypes. *Behaviour Research and Therapy*, *48*(10), 992–1001. https://doi.org/doi.org/10.1016/j.brat.2010.06.005

Beidel, D. C., Turner, S. M., & Morris, T. L. (2000). Behavioral treatment of childhood social phobia. *Journal of Consulting and Clinical Psychology*, *68*(6), 1072–1080. https://doi.org/10.1037//0022-006X.68.6.1072

Birtwell, K. B., Willoughby, B., & Nowinski, L. (2016). Social, cognitive, and behavioral development of children and adolescents with autism spectrum disorder. In C. J. McDougle (Ed.), *Autism spectrum disorder* (pp. 19–30). Oxford University Press.

Bishop-Fitzpatrick, L., Smith DaWalt, L., Greenberg, J. S., & Mailick, M. R. (2017). Participation in recreational activities buffers the impact of perceived stress on quality of life in adults with autism spectrum disorder. *Autism Research*, *10*(5), 973–982. https://doi.org/10.1002/aur.1753

Blaževic, I. (2016). Family, peer and school influence on children's social development. *World Journal of Education*, *6*(2), 42–49. https://doi.org/10.5430/wje.v6n2p42

Bohnert, A., Lieb, R., & Arola, N. (2019). More than leisure: Organized activity participation and socio-emotional adjustment among adolescents with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *49*(7), 2637–2652. https://doi.org/10.1007/s10803-016-2783-8

Bohnert, A. M., Aikins, J. W., & Arola, N. T. (2013). Regrouping: Organized activity involvement and social adjustment across the transition to high school. *New Directions for Child and Adolescent Development*, *2013*(140), 57–75. https://doi.org/10.1002/cad.20037

Bölte, S., & Poustka, F. (2002). The relation between general cognitive level and adaptive behavior domains in individuals with autism with and without co-morbid mental retardation. *Child Psychiatry and Human Development*, *33*(2), 165–172. https://doi.org/10.1023/A:1020734325815

Boraston, Z., Blakemore, S.-J., Chilvers, R., & Skuse, D. (2007). Impaired sadness recognition is linked to social interaction deficit in autism. *Neuropsychologia*, *45*(7), 1501–1510. https://doi.org/10.1016/j.neuropsychologia.2006.11.010

Bottema-Beutel, K., Kapp, S. K., Lester, J. N., Sasson, N. J., & Hand, B. N. (2021). Avoiding ableist language: Suggestions for autism researchers. *Autism in Adulthood*, *3*(1), 18–29. https://doi.org/10.1089/aut.2020.0014

Brown, W. H., Bryson-Brockman, W., & Fox, J. J. (1986). The usefulness of J.R., Kantor's setting event concept for research on children's social behavior. *Child & Family Behavior Therapy*, *8*(2), 15–26. https://doi.org/10.1300/J019v08n02_03

Brown, W. H., Fox, J. J., & Brady, M. P. (1987). Effects of spatial density on 3-and 4-year-old children's socially directed behavior during freeplay: An investigation of a setting factor. In *Education and treatment of children* (pp. 247–258). Springer; West Virginia University Press.

Bulotsky-Shearer, R. J., Manz, P. H., Mendez, J. L., McWayne, C. M., Sekino, Y., & Fantuzzo, J. W. (2012). Peer play interactions and readiness to learn: A protective influence for African American preschool children from low-income households. *Child Development Perspectives*, *6*(3), 225–231. https://doi.org/10.1111/j.1750-8606.2011.00221.x

Cannon, C. J., Makol, B. A., Keeley, L. M., Qasmieh, N., Okuno, H., Racz, S. J., & De Los Reyes, A. (2020). A paradigm for understanding adolescent social anxiety with unfamiliar peers: Conceptual foundations and directions for future research. *Clinical Child and Family Psychology Review*, *23*(3), 338–364. https://doi.org/doi.org/10.1007/s10567-020-00314-4

Chen, X. (2012). Culture, peer interaction, and socioemotional development. *Child Development Perspectives*, *6*(1), 27–34. https://doi.org/10.1111/j.1750-8606.2011.00187.x

Chevallier, C., Kohls, G., Troiani, V., Brodkin, E. S., & Schultz, R. T. (2012). The social motivation theory of autism. *Trends in Cognitive Sciences*, *16*(4), 231–239. https://doi.org/10.1016/j.tics.2012.02.007

Clements, C. C., Zoltowski, A. R., Yankowitz, L. D., Yerys, B. E., Schultz, R. T., & Herrington, J. D. (2018). Evaluation of the social motivation hypothesis of autism: A systematic review and meta-analysis. *JAMA Psychiatry*, *75*(8), 797–808.

Collins, W. A. (1988). *Research on the transition to adolescence: Continuity in the study of developmental processes (M. R. Gunnar & W. A. Collins, Eds. 1 ed., Vol. 21)*. Psychology Press.

Coplan, R. J., & Arbeau, K. A. (2009). Peer interactions and play in early childhood. In K. H. Rubin, W. M. Bukowski, & B. Laursen (Eds.), *Handbook of peer interactions, relationships, and groups* (pp. 143–161). The Guilford Press.

Corbett, B. A., Swain, D. M., Coke, C., Simon, D., Newsom, C., Houchins-Juarez, N., Jenson, A., Wang, L., & Song, Y. (2014). Improvement in social deficits in autism spectrum disorders using a theatre-based, peer-mediated intervention. *Autism Research*, *7*(1), 4–16. https://doi.org/10.1002/aur.1341

Crompton, C. J., DeBrabander, K., Heasman, B., Milton, D., & Sasson, N. J. (2021). Double empathy: Why autistic people are often misunderstood. *Frontiers for Young Minds*, *9*, 4–11. https://doi.org/10.3389/frym.2021.554875

Crompton, C. J., Hallett, S., Ropar, D., Flynn, E., & Fletcher-Watson, S. (2020). I never realised everybody felt as happy as I do when I am around autistic people: A thematic analysis of autistic adults' relationships with autistic and neurotypical friends and family. *Autism*, *24*(6), 1438–1448. https://doi.org/10.1177/1362361320908976

Crompton, C. J., Ropar, D., Evans-Williams, C. V., Flynn, E. G., & Fletcher-Watson, S. (2020). Autistic peer-to-peer information transfer is highly effective. *Autism*, *24*(7), 1704–1712. https://doi.org/10.1177/1362361320919286

Crosland, K., & Dunlap, G. (2012). Effective strategies for the inclusion of children with autism in general education classrooms. *Behavior Modification*, *36*(3), 251–269. https://doi.org/10.1177/0145445512442682

D'Cruz, A. M., Ragozzino, M. E., Mosconi, M. W., Shrestha, S., Cook, E. H., & Sweeney, J. A. (2013). Reduced behavioral flexibility in autism spectrum disorders. *Neuropsychology*, *27*(2), 152–160. https://doi.org/10.1037/a0031721

Davis, R., & Crompton, C. J. (2021). What do new findings about social interaction in autistic adults mean for neurodevelopmental research? *Perspectives on Psychological Science*, *16*(3), 649–653. https://doi.org/https://doi.org/10.1177/1745691620958010

DeBrabander, K. M., Morrison, K. E., Jones, D. R., Faso, D. J., Chmielewski, M., & Sasson, N. J. (2019). Do first impressions of autistic adults differ between autistic and nonautistic observers? *Autism in Adulthood*, *1*(4), 250–257. https://doi.org/https://doi.org/10.1089/aut.2019.0018

Denham, S. A., Wyatt, T. M., Bassett, H. H., Echeverria, D., & Knox, S. S. (2009). Assessing social-emotional development in children from a longitudinal perspective. *Journal of Epidemiology & Community Health*, *63*(Suppl 1), i37–52. https://doi.org/10.1136/jech.2007.070797

Dishion, T. J., & Tipsord, J. M. (2011). Peer contagion in child and adolescent social and emotional development. *Annual Review of Psychology*, *62*(1), 189–214. https://doi.org/10.1146/annurev.psych.093008.100412

Dominick, K. C., Davis, N. O., Lainhart, J., Tager-Flusberg, H., & Folstein, S. (2007). Atypical behaviors in children with autism and children with a history of language impairment. *Research in Developmental Disabilities*, *28*(2), 145–162. https://doi.org/10.1016/j.ridd.2006.02.003

Dougherty, B. S., Fowler, S. A., & Paine, S. C. (1985). The use of peer monitors to reduce negative interaction during recess. *Journal of Applied Behavior Analysis*, *18*(2), 141–153. https://doi.org/10.1901/jaba.1985.18-141

Englund, M. M., Levy, A. K., Hyson, D. M., & Sroufe, L. A. (2000). Adolescent social competence: Effectiveness in a group setting. *Child Development*, *71*(4), 1049–1060. https://doi.org/10.1111/1467-8624.00208

Fabes, R. A., Martin, C. L., & Hanish, L. D. (2011). Children's behaviors and interactions with peers. In *Handbook of peer interactions, relationships, and groups (1 ed.)*. The Guilford Press.

Fombonne, E. (2003). Epidemiological surveys of autism and other pervasive developmental disorders: An update. *Journal of Autism and Developmental Disorders*, *33*(4), 365–382. https://doi.org/10.1023/a:1025054610557

Gates, J. A., Kang, E., & Lerner, M. D. (2017). Efficacy of group social skills interventions for youth with autism spectrum disorder: A systematic review and meta-analysis. *Clinical Psychology Review*, *52*, 164–181. https://doi.org/10.1016/j.cpr.2017.01.006

Gest, S. D., Farmer, T. W., Cairns, B. D., & Xie, H. (2003). Identifying children's peer social networks in school classrooms: Links between peer reports and observed interactions. *Social Development*, *12*(4), 513–529. https://doi.org/10.1111/1467-9507.00246

Gotham, K., Pickles, A., & Lord, C. (2009). Standardizing ADOS scores for a measure of severity in autism spectrum disorders. *Journal of Autism and Developmental Disorders*, *39*(5), 693–705. https://doi.org/10.1007/s10803-008-0674-3

Granieri, J. E., McNair, M. L., Gerber, A. H., Reifler, R. F., & Lerner, M. D. (2020). Atypical social communication is associated with positive initial impressions among peers with autism spectrum disorder. *Autism*, *24*(7), 1841–1848. https://doi.org/10.1177/1362361320924906

Guo, S. (2005). Analyzing grouped data with hierarchical linear modeling. *Children and Youth Services Review*, *27*(6), 637–652. https://doi.org/10.1016/j.childyouth.2004.11.017

Guralnick, M. J., Neville, B., Hammond, M. A., & Connor, R. T. (2007). The friendships of young children with developmental delays: A longitudinal analysis. *Journal of Applied Developmental Psychology*, *28*(1), 64–79. https://doi.org/10.1016/j.appdev.2006.10.004

Happé, F., & Frith, U. (1995). Theory of mind in autism. In *Learning and cognition in autism* (pp. 177–197). Springer. https://doi.org/10.1007/978-1-4899-1286-2_10

Hartup, W. W. (1992). Peer relations in early and middle childhood. In *Handbook of social development: A lifespan perspective*. (pp. 257–281). Springer. https://doi.org/10.1007/978-1-4899-0694-6_11

Hartup, W. W. (2005). Peer interaction: What causes what? *Journal of Abnormal Child Psychology*, *33*(3), 387–394. https://doi.org/10.1007/s10802-005-3578-0

Hauck, M., Fein, D., Waterhouse, L., & Feinstein, C. (1995). Social initiations by autistic children to adults and other children. *Journal of Autism and Developmental Disorders*, *25*(6), 579–595. https://doi.org/10.1007/BF02178189

Heasman, B., & Gillespie, A. (2019a). Learning how to read autistic behavior from interactions between autistic people. *Behavioral and Brain Sciences*, *42*, E93. https://doi.org/10.1017/S0140525X18002364

Heasman, B., & Gillespie, A. (2019b). Neurodivergent intersubjectivity: Distinctive features of how autistic people create shared understanding. *Autism*, *23*(4), 910–921. https://doi.org/10.1177/1362361318785172

Hertz-Lazarowitz, R. (1989). Cooperation and helping in the classroom: A contextual approach. *International Journal of Educational Research*, *13*(1), 113–119. https://doi.org/10.1016/0883-0355(89)90020-7

Hill, J. P. (1980). *Understanding early adolescence: A framework*. Center of Early Adolescence.

Horner, R. D. (1980). The effects of an environmental, enrichment, program on the behavior of institutionalized profoundly retarded children. *Journal of Applied Behavior Analysis*, *13*(3), 473–491. https://doi.org/doi.org/10.1901/jaba.1980.13-473

Howes, C., Rubin, K. H., Ross, H. S., & French, D. C. (1988). Peer interaction of young children. *Monographs of the Society for Research in Child Development*, *53*(1), i–92. https://doi.org/10.2307/1166062

Huefner, J. C., & Ringle, J. L. (2012). Examination of negative peer contagion in a residential care setting. *Journal of Child and Family Studies*, *21*(5), 807–815. https://doi.org/10.1007/s10826-011-9540-6

Hull, L., Petrides, K., & Mandy, W. (2020). The female autism phenotype and camouflaging: A narrative review. *Journal of Autism and Developmental Disorders*, *7*(4), 306–317. https://doi.org/10.1007/s40489-020-00197-9

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

Hutchins, T. L., Prelock, P. A., & Bonazinga, L. (2012). Psychometric evaluation of the theory of mind inventory (ToMI): A study of typically developing children and children with autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *42*(3), 327–341. https://doi.org/10.1007/s10803-011-1244-7

Itskovich, E., Zyga, O., Libove, R. A., Phillips, J. M., Garner, J. P., & Parker, K. J. (2021). Complex interplay between cognitive ability and social motivation in predicting social skill: A unique role for social motivation in children with autism. *Autism Research*, *14*(1), 86–92. https://doi.org/10.1002/aur.2409

Jaswal, V. K., & Akhtar, N. (2019). Being versus appearing socially uninterested: Challenging assumptions about social motivation in autism. *Behavioral and Brain Sciences*, *42*, e82, 81–73. https://doi.org/10.1017/S0140525X18001826

Jones, D. R., & Mandell, D. S. (2020). To address racial disparities in autism research, we must think globally, act locally. *Autism*, *24*(7), 1587–1589. https://doi.org/10.1177/1362361320948313

Kang, E., Gadow, K. D., & Lerner, M. D. (2020). Atypical communication characteristics, differential diagnosis, and the autism spectrum disorder phenotype in youth. *Journal of Clinical Child & Adolescent Psychology*, *49*(2), 251–263. https://doi.org/10.1080/15374416.2018.1539912

Kantor, J. (1959). Interbehavioral psychology: Origin and development. In J. R. Kantor (Ed.), *Interbehavioral psychology: A sample of scientific system construction* (pp. 3–19). Principia Press. https://doi.org/10.1037/13165-001

Kaufman, A. S., & Kaufman, N. L. (2004). *Kaufman brief intelligence test - second edition (KBIT-2)*. American Guidance Service.

Kim, H., Keifer, C., Rodriguez-Seijas, C., Eaton, N., Lerner, M., & Gadow, K. (2019). Quantifying the optimal structure of the autism phenotype: A comprehensive comparison of dimensional, categorical, and hybrid models. *Journal of the American Academy of Child & Adolescent Psychiatry*, *58*(9), 876–886 e872. https://doi.org/10.1016/j.jaac.2018.09.431

Kimhi, Y. (2014). Theory of mind abilities and deficits in autism spectrum disorders. *Topics in Language Disorders*, *34*(4), 329–343. https://doi.org/10.1097/TLD.0000000000000033

King, A. (1990). Enhancing peer interaction and learning in the classroom through reciprocal questioning. *American Educational Research Journal*, *27*(4), 664–687. https://doi.org/10.3102/00028312027004664

Kok, A. J., Kong, T. Y., & Bernard-Opitz, V. (2002). A comparison of the effects of structured play and facilitated play approaches on preschoolers with autism. A case study. *Autism*, *6*(2), 181–196. https://doi.org/10.1177/1362361302006002005

Ladd, G. W., Price, J. M., & Hart, C. H. (1988). Predicting preschoolers' peer status from their playground behaviors. *Child Development*, *59*(4), 986–992. https://doi.org/10.2307/1130265

Lai, M. C., Kassee, C., Besney, R., Bonato, S., Hull, L., Mandy, W., Szatmari, P., & Ameis, S. H. (2019). Prevalence of co-occurring mental health diagnoses in the autism population: A systematic review and meta-analysis. *The Lancet Psychiatry*, *6*(10), 819–829. https://doi.org/10.1016/S2215-0366(19)30289-5

Lartseva, A., Dijkstra, T., & Buitelaar, J. K. (2014). Emotional language processing in autism spectrum disorders: A systematic review. *Frontiers in Human Neuroscience*, *8*, 991. https://doi.org/10.3389/fnhum.2014.00991

Lecheler, M., Lasser, J., Vaughan, P. W., Leal, J., Ordetx, K., & Bischofberger, M. (2021). A matter of perspective: An exploratory study of a theory of mind autism intervention for adolescents. *Psychological Reports*, *124*(1), 39–53. https://doi.org/10.1177/0033294119898120

Lee, V. E. (2000). Using hierarchical linear modeling to study social contexts: The case of school effects. *Educational Psychologist*, *35*(2), 125–141. https://doi.org/10.1207/S15326985EP3502_6

Leff, S. S., & Lakin, R. (2005). Playground-based observational systems: A review and implications for practitioners and researchers. *School Psychology Review*, *34*(4), 475–489. https://doi.org/10.1080/02796015.2005.12088010

Lerner, M. D., De Los Reyes, A., Drabick, D. A. G., Gerber, A. H., & Gadow, K. D. (2017). Informant discrepancy defines discrete, clinically useful autism spectrum disorder subgroups. *Journal of Child Psychology and Psychiatry*, *58*(7), 829–839. https://doi.org/10.1111/jcpp.12730

Lerner, M. D., Hutchins, T. L., & Prelock, P. A. (2011). Brief report: Preliminary evaluation of the theory of mind inventory and its relationship to measures of social skills. *Journal of Autism and Developmental Disorders*, *41*(4), 512–517.

Lerner, M. D., & Mikami, A. Y. (2012). A preliminary randomized controlled trial of two social skills interventions for youth with high-functioning autism spectrum disorders. *Focus on Autism and Other Developmental Disabilities*, *27*(3), 147–157. https://doi.org/10.1177/1088357612450613

Lerner, M. D., Mikami, A. Y., & Levine, K. (2011). Socio-dramatic affective-relational intervention for adolescents with asperger syndrome & high functioning autism: Pilot study. *Autism*, *15*(1), 21–42. https://doi.org/10.1177/1362361309353613

Locke, J., Shih, W., Kretzmann, M., & Kasari, C. (2016). Examining playground engagement between elementary school children with and without autism spectrum disorder. *Autism*, *20*(6), 653–662. https://doi.org/10.1177/1362361315599468

Lord, C., Rutter, M., DiLavore, P., Risi, S., Gotham, K., & Bishop, S. (2012). *Autism diagnostic observation schedule-2nd edition (ADOS-2)*. 284, Los Angeles, CA: Western Psychological Corporation.

Macintosh, K., & Dissanayake, C. (2006). A comparative study of the spontaneous social interactions of children with high-functioning autism and children with asperger's disorder. *Autism*, *10*(2), 199–220. https://doi.org/10.1177/1362361306062026

Mahoney, J. L., Vandell, D. L., Simpkins, S., & Zarrett, N. (2009). Adolescent out-of-school activities. In R. M. Lerner, & L. Steinberg (Eds.), *Handbook of adolescent psychology (3 ed., Vol. 2)*. John Wiley & Sons, Inc.

Margolin, G., Oliver, P. H., Gordis, E. B., O'Hearn, H. G., Medina, A. M., Ghosh, C. M., & Morland, L. (1998). The nuts and bolts of behavioral observation of marital and family interaction. *Clinical Child and Family Psychology Review*, *1*(4), 195–213. https://doi.org/10.1023/a:1022608117322

Matson, J. L., & Adams, H. L. (2014). Characteristics of aggression among persons with autism spectrum disorders. *Research in Autism Spectrum Disorders*, *8*(11), 1578–1584. https://doi.org/10.1016/j.rasd.2014.08.004

Matson, J. L., & Nebel-Schwalm, M. (2007). Assessing challenging behaviors in children with autism spectrum disorders: A review. *Research in Developmental Disabilities*, *28*(6), 567–579. https://doi.org/10.1016/j.ridd.2006.08.001

Mendelson, J. L., Gates, J. A., & Lerner, M. D. (2016). Friendship in school-age boys with autism spectrum disorders: A meta-analytic summary and developmental, process-based model. *Psychological Bulletin*, *142*(6), 601–622. https://doi.org/10.1037/bul0000041

Milton, D., Heasman, B., & Sheppard, E. (2018). Double empathy. In F. Volkmar (Eds.), *Encyclopedia of autism spectrum disorders*. Springer Nature.

Milton, D. E. (2012). On the ontological status of autism: The double empathy problem. *Disability & Society*, *27*(6), 883–887. https://doi.org/10.1080/09687599.2012.710008

Morrison, K. E., DeBrabander, K. M., Jones, D. R., Faso, D. J., Ackerman, R. A., & Sasson, N. J. (2020). Outcomes of real-world social interaction for autistic adults paired with autistic compared to typically developing partners. *Autism*, *24*(5), 1067–1080.

Parsons, L., Cordier, R., Munro, N., & Joosten, A. (2019). A play-based, peer-mediated pragmatic language intervention for school-aged children on the autism spectrum: Predicting who benefits most. *Journal of Autism and Developmental Disorders*, *49*(10), 4219–4231. https://doi.org/10.1007/s10803-019-04137-3

Pellegrini, A. D., Huberty, P. D., & Jones, I. (1995). The effects of recess timing on children's playground and classroom behaviors. *American Educational Research Journal*, *32*(4), 845–864. https://doi.org/10.3102/00028312032004845

Peterson, C. C., Garnett, M., Kelly, A., & Attwood, T. (2009). Everyday social and conversation applications of theory-of-mind understanding by children with autism-spectrum disorders or typical development. *European Child & Adolescent Psychiatry*, *18*(2), 105–115. https://doi.org/10.1007/s00787-008-0711-y

Poljac, E., Hoofs, V., Princen, M. M., & Poljac, E. (2017). Understanding behavioural rigidity in autism spectrum conditions: The role of intentional control. *Journal of Autism and Developmental Disorders*, *47*(3), 714–727. https://doi.org/10.1007/s10803-016-3010-3

Ponnet, K., Buysse, A., Roeyers, H., & De Corte, K. (2005). Empathic accuracy in adults with and without PDD during a dyadic conversation. *Journal of Autism and Developmental Disorders*, *35*(5), 585–600. https://doi.org/10.1007/S10803-005-0003-Z

Ponnet, K., Buysse, A., Roeyers, H., & De Corte, K. (2005). Empathic accuracy in adults with a pervasive developmental disorder during an unstructured conversation with a typically developing stranger. *Journal of Autism and Developmental Disorders*, *35*(5), 585–600. https://doi.org/10.1007/s10803-005-0003-z

Ratto, A. B., Turner-Brown, L., Rupp, B. M., Mesibov, G. B., & Penn, D. L. (2011). Development of the contextual assessment of social skills (CASS): A role play measure of social skill for individuals with high-functioning autism. *Journal of Autism and Developmental Disorders*, *41*(9), 1277–1286. https://doi.org/10.1007/s10803-010-1147-z

Richter, F. D., & Tjosvold, D. (1980). Effects of student participation in classroom decision making on attitudes, peer interaction, motivation, and learning. *Journal of Applied Psychology*, *65*(1), 74–80. https://doi.org/10.1037/0021-9010.65.1.74

Roberts, C., Pratt, C., & Leach, D. (1990). Classroom and playground interaction of students with and without disabilities. *Exceptional Children*, *57*(3), 212–224. https://doi.org/10.1177/001440299105700304

Roberts, S. J., Fairclough, S. J., Ridgers, N. D., & Porteous, C. (2013). An observational assessment of physical activity levels and social behaviour during elementary school recess. *Health Education Journal*, *72*(3), 254–262. https://doi.org/10.1177/0017896912439126

Rubin, K. H., Bukowski, W. M., Parker, J. G., & Bowker, J. C. (2008). Peer interactions, relationships, and groups. In W. Damon, R. M. Lerner, D. Kuhn, R. S. Siegler, & N. Eisenberg (Eds.), *Child and adolescent development: An advanced course* (pp. 141–180). John Wiley & Sons, Inc.

Rum, Y., Zachor, D. A., & Dromi, E. (2021). Prosocial behaviors of children with autism spectrum disorder (ASD) during interactions with their typically developing siblings. *International Journal of Behavioral Development*, *45*(4), 293–298. https://doi.org/10.1177/0165025420971042

Russo-Ponsaran, N. M., Lerner, M. D., McKown, C., Weber, R. J., Karls, A., Kang, E., & Sommer, S. L. (2019). Web-based assessment of social-emotional skills in school-aged youth with autism spectrum disorder. *Autism Research*, *12*(8), 1260–1271.

Rutter, M., Bailey, A., & Lord, C. (2003). *The social communication questionnaire: Manual*. Western Psychological Services.

Rutter, M., Le Couteur, A., & Lord, C. (2003). *Autism diagnostic interview-revised*. 30, Los Angeles, CA: Western Psychological Services.

Shaia, W. E., Nichols, H. M., Dababnah, S., Campion, K., & Garbarino, N. (2020). Brief report: Participation of black and African-american families in autism research. *Journal of Autism and Developmental Disorders*, *50*(5), 1841–1846. https://doi.org/10.1007/s10803-019-03926-0

Shattuck, P. T., Seltzer, M. M., Greenberg, J. S., Orsmond, G. I., Bolt, D., Kring, S., Lounds, J., & Lord, C. (2007). Change in autism symptoms and maladaptive behaviors in adolescents and adults with an autism spectrum disorder. *Journal of Autism and Developmental Disorders*, *37*(9), 1735–1747. https://doi.org/10.1007/s10803-006-0307-7

Shrout, P. E., & Fleiss, J. L. (1979). Intraclass correlations: Uses in assessing rater reliability. *Psychological Bulletin*, *86*(2), 420–428. https://doi.org/10.1037//0033-2909.86.2.420

Simmons, G. L., Ioannou, S., Smith, J. V., Corbett, B. A., Lerner, M. D., & White, S. W. (2021). Utility of an observational social skill assessment as a measure of social cognition in autism. *Autism Research*, *14*(4), 709–719. https://doi.org/10.1002/aur.2404

Smetana, J. G., Robinson, J., & Rote, W. M. (2015). Socialization in adolescence. In J. E. Grusec & D. Hastings (Eds.), *Handbook of socialization: Theory and research* (2 ed., pp. 66–84). The Guilford Press.

Stone, W. L., & Caro-Martinez, L. M. (1990). Naturalistic observations of spontaneous communication in autistic children. *Journal of Autism and Developmental Disorders*, *20*(4), 437–453. https://doi.org/10.1007/BF02216051

Strain, P. S., Wilson, K., & Dunlap, G. (2011). Prevent-teach-reinforce: Addressing problem behaviors of students with autism in general education classrooms. *Behavioral Disorders*, *36*(3), 160–171. https://doi.org/10.1177/019874291003600302

Strang, J. F., van der Miesen, A. I., Caplan, R., Hughes, C., daVanport, S., & Lai, M.-C. (2020). Both sex-and gender-related factors should be considered in autism research and clinical practice. *Autism*, *24*(3), 539–543. https://doi.org/10.1177/1362361320913192

Szatmari, P., Bryson, S., Duku, E., Vaccarella, L., Zwaigenbaum, L., Bennett, T., & Boyle, M. H. (2009). Similar developmental trajectories in autism and asperger syndrome: From early childhood to adolescence. *Journal of Child Psychology and Psychiatry*, *50*(12), 1459–1467. https://doi.org/10.1111/j.1469-7610.2009.02123.x

Thomas, A., Chess, S., & Birch, H. G. (1970). The origin of personality. *Scientific American*, *223*(2), 102–109. https://doi.org/10.1038/scientificamerican0870-102

Usher, L. V., Burrows, C. A., Schwartz, C. B., & Henderson, H. A. (2015). Social competence with an unfamiliar peer in children and adolescents with high functioning autism: Measurement and individual differences. *Research in Autism Spectrum Disorders*, *17*, 25–39. https://doi.org/10.1016/j.rasd.2015.05.005

van Hoorn, J., van Dijk, E., Meuwese, R., Rieffe, C., & Crone, E. A. (2016). Peer influence on prosocial behavior in adolescence. *Journal of Research on Adolescence*, *26*(1), 90–100. https://doi.org/10.1111/jora.12173

Veiga, G., De Leng, W., Cachucho, R., Ketelaar, L., Kok, J. N., Knobbe, A., Neto, C., & Rieffe, C. (2017). Social competence at the playground: Preschoolers during recess. *Infant and Child Development*, *26*(1), e1957. https://doi.org/10.1002/icd.1957

Velikonja, T., Fett, A.-K., & Velthorst, E. (2019). Patterns of nonsocial and social cognitive functioning in adults with autism spectrum disorder: A systematic review and meta-analysis. *JAMA Psychiatry*, *76*(2), 135–151.

von Salisch, M., & Saarni, C. (2001). Introduction to the special section: Emotional development in interpersonal relationships. *International Journal of Behavioral Development*, *25*(4), 289–289. https://doi.org/10.1080/016502501750210410

Williams, K. T., & Williams, K. T. (2007). *EVT-2: Expressive vocabulary test*. Pearson Assessments.

Williams, S. T., Ontai, L. L., & Mastergeorge, A. M. (2010). The development of peer interaction in infancy: Exploring the dyadic processes. *Social Development*, *19*(2), 348–368. https://doi.org/10.1111/j.1467-9507.2009.00542.x