

Beyond Pointing: Development of the “Showing” Gesture in Children with Autism Spectrum Disorder

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While research on early indicators of autism spectrum disorder (ASD) has focused predominantly on infants' inability to point, other social gestures such as showing may also help to distinguish ASD from non-autistic language delays in high-risk populations. Parents of infants at high-risk (HR) for ASD ($n = 28$) and typically developing infants at low-risk (TD-LR; $n = 12$) reported their child's gesture use at nine and twelve months. Infants were followed until 24 months, at which time 8 high-risk children showed symptoms of ASD (ASD-HR), 14 showed symptoms of language delay (LD-HR), and 6 were developing typically (TD-HR). Results indicate a lack of pointing in both ASD-HR and LD-HR groups at twelve months, but decreased frequency of showing only in the ASD-HR group. These results suggest that the showing gesture might be a better indicator of ASD than pointing among infant siblings of children with ASD. Implications for early identification are discussed.

INTRODUCTION

Autism Spectrum Disorder

Autism Spectrum Disorder (ASD) is a group of neurodevelopmental disorders characterized by profound deficits in communication, social functioning, and the presence of repetitive and stereotyped behaviors or interests (American Psychiatric Association, 2004). It affects 1 in 110 children in the US (CDC, 2009) and in most cases impairs the child's ability to function independently (Howlin, 2005). Because there is currently no known cure, to date the best means of mitigating the negative effects of ASD are early identification. This way, children can begin an early behavioral intervention program (Klin, Chawarska, Rubin, & Volkmar, 2004).

ASD and nonverbal communication

Parents and clinicians use early indicators, such as delayed speech and language, to recognize ASD during the second year of life (Chawarska et al., 2007). Though communication is often impaired in ASD (American Psychiatric Association [DSM-IV-TR], 2004), identification during the first year of life cannot depend on verbal language alone. Even in typical development, children do not speak their first words until around twelve months of age and do not combine words into phrases until around 18 months (Tager-Flusberg, Paul, & Lord, 2005). Therefore,

early recognition and diagnosis must rely on indicators of nonverbal communication skills that typically emerge before twelve months of age.

Nonverbal communication

Nonverbal communication skills develop before verbal language and therefore can play an important role in identification of ASD during the first year of life (Baron-Cohen, Cox, Baird, Sweettenham, & Nightingale, 1996; Chawarska et al., 2007; Lord, 1995; Mundy, Sigman, Ungerer, & Sherman, 1986; Paul, 2007; Stone, Ousley, Yoder, Hogan, & Hepburn, 1997; Wetherby, 1986). Nonverbal communication behaviors such as pointing, waving goodbye, and smiling convey a message to another person without language (Tager-Flusberg et al., 2005). Nonverbal communication is particularly relevant to early ASD diagnosis because children use hand gestures such as reaching, pointing, and giving to express their desires before they can do so with verbal language. In typical development, gestures emerge around eight to ten months and are used frequently until around 18 months, when their use begins to fade as verbal language develops to replace them (Bates & Dick, 2002; Capone & McGregor, 2004).

Pointing

The vast majority of studies on nonverbal communication in ASD have focused on

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pointing gestures. Pointing emerges around eight to ten months in typically developing children (Bates & Dick 2004; Capone & McGregor, 2004), and accounts for the majority (60%) of gestures by twelve months (Kita, 2003). There are two types of pointing: protodeclarative and protoimperative (Paul, 2007; Tomasello, 2007). Protoimperative points represent desire for an object, e.g., pointing to a cookie. Protodeclarative points indicate the desire to share an experience with another person, e.g., a child pointing to an airplane overhead. Protodeclarative pointing requires joint attention, or the ability to share experiences with others by attracting or following their attention by looking or pointing (Paul, 2007; Tomasello, 2007; Loveland & Landry, 1986). Joint attention is an early emerging social cognitive skill and is impaired in autism (Dawson et al., 2004; Loveland & Landry, 1986).

Pointing in Autism Spectrum Disorders

In autism, protodeclarative pointing is impaired while protoimperative pointing remains relatively intact, especially in older children (Baron-Cohen, 1989; Camaioni, Perucchini, Muratori, & Milone, 1997; Camaioni, Perucchini, Muratori, Parrinini, & Cesari, 2003; Itoh, 2000). Because protodeclarative pointing requires social interest, its deficit is considered one of the critical ASD risk indicators on a number of screening instruments, including the Checklist for Autism in Toddlers (CHAT; Baron-Cohen, Allen, & Gillberg, 1992) and Modified Checklist for Autism in Toddlers (M-CHAT; Robins, Fein, Barton, & Green, 2001). Pointing deficits have proven to be an effective flag for autism as measured by the longitudinal stability of CHAT results. In a study that followed 16,000 children from 18 months to

3.5 years, Baron-Cohen et al. (1996) found that a deficit in protodeclarative pointing was one of the three best predictors of autism. (Gaze monitoring and pretend play also predicted autism.) An early deficit in protodeclarative pointing is consistent with the social impairments that characterize autism, and other highly social gestures are likely to be impaired early as well.

Other protodeclarative gestures: giving and showing

Though pointing is a crucial indicator of social functioning, other gestures such as showing and giving also reflect social skills and interest. *Showing* refers to a person's arm extending toward another person's face while holding an object (Wetherby, Yonclas, & Btyan, 1989; Stone et al., 1997). *Giving* refers to placing an object in another person's hand or pushing an object at least halfway toward another person (Wetherby et al., 1989; Stone et al., 1997). While many instances of giving serve protodeclarative purposes (e.g., giving an interesting object to a parent), others serve protoimperative purposes (e.g., handing a jar to a parent to get it opened) or occur in the context of sharing (e.g., giving a cracker or a toy to another person). Both showing and giving emerge around eight to ten months in typically developing children, concurrently with pointing (Capone & McGregor, 2004; Bates & Dick, 2004).

Giving and showing in Autism Spectrum Disorder

Little is known about the early development of giving and showing in children with ASD, but studies of older children with ASD have found deficits in both types of gestures. Children with autism at 52 months were less

likely to give, take, and show objects in response to adult cues compared to developmentally delayed children (Leekam & Ramsden, 2006). At 49 months, children with ASD showed similar differences in frequency of giving (DiLavore, Lord, & Rutter, 1995). Children with ASD demonstrated fewer “gestural joint attention skills” (defined as pointing and showing) at 45 months when compared to children with mental retardation matched on language, mental age, or IQ (Mundy, Sigman, & Kasari, 1990). Wetherby, Watt, Morgan, and Shumway (2007) found that a strong predictor of ASD between 24 and 36 months was “inventory of gesture,” which assessed the children’s use of eight gestures and included showing, pointing and giving. In an earlier prospective study, the authors found that limited showing was a red flag that differentiated children with ASD from both developmentally delayed and typically developing children. Frequency of pointing, however, did not differ between children with ASD and those with developmental delays. When Stone et al. (1997) measured giving and showing within the same age range, a significant difference was found for showing but not for giving between children with ASD and developmentally delayed and language-impaired children. These studies indicate that multiple aspects of nonverbal communication may be impaired in ASD and suggest that nonverbal gestures beyond pointing may also serve as early indicators of the disorder.

Importance of studying giving and showing in diagnosis

More data is needed to disambiguate ASD from other symptomologies, especially when diagnosed early. A longitudinal study

found that of 469 Danish people diagnosed with a developmental language delay as children, 10 later carried a diagnosis of ASD in adulthood (Mouridsen & Hauschild, 2009). Deficits in social gestures may provide an extra indicator in these ambiguous situations. Wetherby and Prizant (2002) found that a deficit in showing differentiated children with ASD from both developmentally delayed and typically developing children. Protodeclarative pointing, however, did not distinguish children with ASD from developmentally delayed children. A similar problem was also noted in the Baron-Cohen et al. (1996) study on 18-month olds. These results suggest that other signs beyond pointing are necessary for distinguishing between these groups. Showing and giving, which depend heavily on social skills, may serve this purpose.

Diagnosis in high-risk populations

Distinguishing ASD from similar non-autistic disorders is of particular concern when diagnosing children at high risk for ASD. Children with an older sibling with ASD have increased genetic risk for developing the disorder (approximately 20%; Rogers, 2009), and a substantial proportion of the high-risk group (18-30%; Landa, Holman, & Garrett-Mayer, 2007) do not meet diagnostic criteria for ASD but do exhibit other symptoms such as linguistic disorders and impaired social, cognitive, and linguistic skills. The siblings without ASD often show early deficits similar to children with ASD, such as diminished pointing, social smiling, receptive language, and overall use of gestures and words (Toth, Dawson, Meltzoff, Greenson, & Fein, 2007). Since the population of infants at high risk is often closely monitored by clinicians for signs of

ASD, robust indicators are needed to differentiate those who develop non-autistic symptomology from those who develop traditional ASD. Studies have shown that pointing may not serve this purpose because deficits in pointing are present both in children with ASD and in those with developmental delays (Toth et al., 2007). Investigation of other protodeclarative gestures such as giving and showing may help disambiguate the two groups (Leekam & Ramsden, 2006; Stone et al., 1997; Wetherby et al., 2007).

Gestures tend not to be studied individually

Although gestures such as giving and showing may provide valuable diagnostic information, they have yet to be carefully studied. Studies that do include measurements of showing or giving usually analyze “gesturing” as a single construct or focus on pointing and do not analyze giving or showing independently. Charman, Drew, Baird, and Baird (2003) investigated summary scores on the MacArthur Communication Development Inventories (CDI) of “early” and “late” gestures but did not analyze differences in scores on specific items that assess showing and giving independently. Mitchell et al. (2006) replicated the same study with a younger sample and more control groups, but again focused on “early” and “late” gestures instead of the individual development of giving or showing. These studies yielded interesting results about global gesturing but did not explore profiles of specific gestures such as giving and showing. Data on the development of individual gestures could inform the dialog on very early indicators and aid in distinguishing language disorders from ASD.

STUDY OVERVIEW

The present study explores the development of pointing, showing, and giving at twelve months in children who were later diagnosed with ASD. The children were at high risk (approximately 20%; Rogers, 2009) for developing the disorder in comparison to the average American child (< 1%; CDC, 2009) because they had an older sibling with an ASD. Studying the high-risk population from birth yields insights into the early development of ASD (Zwaigenbaum et al., 2009). This study assessed early gesture development in infants who later showed symptoms of ASD or language delays at 24 months. The main objective was to investigate the individual profiles of giving, showing and pointing, and to compare the patterns of development in children with ASD to patterns among typically developing children as well as those with language delays.

We hypothesize the following:

- (1) ASD infants will generally gesture less frequently than language delayed (LD) and typically developing (TD) infants.
- (2) Pointing will be diminished in the ASD and LD groups compared to the TD group. Showing and giving will be diminished in the ASD group alone.
- (3) Across development from nine to twelve months, children who are later diagnosed with ASD will exhibit fewer gains in gestures compared to children in the LD and TD groups.

Method

Participants

Forty participants were recruited from an ongoing prospective longitudinal study of early social-cognitive development. Twenty-eight of the infants had an older sibling with ASD and therefore were at increased genetic risk for developing it. Gesture proficiency was measured at nine and twelve months using the MacArthur Communication Development Inventories (CDI). Based on assessments at 24 months, infants in the high-risk for ASD group were divided into three sub-groups: those diagnosed with ASD (ASD-HR; $n = 8$); language and communication delay but not ASD (LD-HR; $n = 14$); and infants developing typically (TD-HR; $n = 8$). A fourth group included typically developing children with no familial history of ASD and thus considered at low-risk for developing the disorder (TD-LR; $n = 12$). Males represented 42% of the TD-LR group, compared to 33% of the TD-HR group, 93% of the LD-HR group, and 88% of the ASD group (see Table 1). Participants in the TD-LR, TD-HR, and LD-HR groups did not differ in level of development as measured by the five scales of the Mullen Scales of Early Learning (receptive language, expressive language, visual reception, fine motor skills, and gross motor skills), with the exception of visual reception (see Table 1). Participants in the ASD-HR and LD-HR groups also had comparable scores on the developmental test (see Table 1), but infants with ASD had lower scores than the TD-HR group on expressive language scales and lower scores than the TD-LR group on expressive language, visual reception, and fine motor scales. As expected, children in ASD-HR group had significantly higher total scores on the

ADOS-T scale than the remaining diagnostic groups at 24 months (see Table 1).

ASD Inclusion Criteria

Eight participants at risk for ASD received a provisional diagnosis of ASD at 24 months. A team of two experienced clinicians evaluated each child over two days and assigned a provisional diagnosis based on DSM-IV criteria modified for children under the age of three (Chawarska & Volkmar, 2005) and performance on the Autism Diagnostic Observation Schedule–Toddler Module (Lord et al., 2000), Vineland Adaptive Behaviors Schedule-Expanded (Sparrow, Balla, & Cicchetti, 1984), and Mullen Scales of Early Learning (Mullen, 1995).

Language Delay Inclusion Criteria

The LD group included fourteen participants at risk for ASD who showed significant communicative delays at 24 month assessments but did not receive a diagnosis of ASD. Five participants received a clinical diagnosis of a language-related disorder (expressive language disorder, receptive language disorder, developmental delay, and two with mixed language disorder). In nine participants, expert clinicians identified impaired communicative functioning and social deficits in the subclinical range (Broader Autism Phenotype, BAP).

Procedure

Parents reported their infants' gesture use using the MacArthur Communication and Development Inventories (CDI), which provides a comprehensive profile of a child's communication skills (Fenson et al., 1993). The present study used responses on the Words and Gestures version in the subsection "First Communicative Gestures." This

Table 1. Group means (standard deviation) on Mullen Scales of Early Learning and ADOS-T tests at 24 months.

Sample characterization					
Measure	ASD-HR	LD-HR	TD-HR	TD-LR	P-value
<i>N</i>	8	14	6	12	
% male	88%	93%	33%	42%	
Mullen (12 months)					
Visual Reception	51.1 (3.6) ^a	49.9 (11.7) ^a	59.9 (7.1) ^{ab}	62.0 (6.8) ^b	.004
Gross Motor	39.8 (7.0)	46.2 (11.5)	48.0 (12.5)	44.0 (11.9)	.510
Fine Motor	48.9 (8.3) ^a	59.1 (9.3) ^{ab}	60.5 (9.8) ^{ab}	60.6 (10.4) ^b	.047
Receptive Language	41.1 (11.2)	39.6 (8.9)	45.2 (9.7)	48.2 (6.8)	.104
Expressive Language	33.6 (7.0) ^a	42.0 (6.5) ^{ab}	49.9 (18.6) ^b	49.7 (10.6) ^b	.009
ADOS-T (12 months)					
Social Affect	14.9 (3.3) ^a	10.9 (3.7) ^{ab}	9.2 (5.9) ^{bc}	6.5 (3.0) ^c	< .001
Restricted & Repetitive Behavior	2.4 (1.9)	1.5 (1.6)	.8 (1.0)	7.5 (3.6)	.161
Total Score (SA + RRB)	17.3 (4.2) ^a	12.4 (4.4) ^{ab}	10.0 (6.5) ^{bc}	7.5 (3.6) ^c	< .001
ADOS-T (24 months)					
Social Affect	11.9 (5.7) ^a	7.3 (3.8) ^{ab}	3.0 (2.7) ^{bc}	2.3 (1.9) ^c	< .001
Restricted & Repetitive Behavior	2.1 (1.2) ^a	1.1 (1.1) ^{ab}	.6 (.6) ^b	.7 (.7) ^b	.019
Total Score (SA + RRB)	14.0 (6.4) ^a	8.3 (4.2) ^b	3.6 (3.2) ^{bc}	3.0 (2.1) ^c	< .001

Values within each row with different superscripts differ at $p < .05$ with Tukey's Honestly Significant Difference correction for multiple comparisons.

sub-section contains 12 items and asks parents to report how frequently their child uses particular gestures. Sample gestures assessed include showing, giving, pointing, waving goodbye, and nodding. Parents read a description of the gesture, such as “Extends arm to show you something he/she is holding” and then checked whether the

child performed the gestures “often,” “sometimes,” or “not yet.” For the purposes of this study, responses were coded according to whether the child performed the gesture proficiently, indicated by frequent use and a response of “often.” This coding scheme was employed because the gestures of interest were those used functionally, not

Table 2. Proportion of children in ASD-HR, LD-HR, TD-HR, and TD-LR groups demonstrating gesture “often” based on parent report. Gestures that occurred infrequently were excluded from analysis.

	9 months				12 months			
	ASD-HR	LD-HR	TD-HR	TD-LR	ASD-HR	LD-HR	TD-HR	TD-LR
Show	13%	14%	0%	25%	38%	79%	67%	75%
Point	0%	0%	17%	25%	25%	36%	33%	58%
Give	0%	7%	0%	8%	50%	64%	67%	50%
Pick me up	25%	64%	50%	58%	63%	50%	50%	75%
Wave Bye	0%	7%	0%	0%	13%	21%	50%	58%
Shake Head 'No'	0%	7%	0%	0%	0%	7%	17%	17%
Nod Head 'Yes'	0%	0%	0%	0%	0%	7%	0%	0%
Hush' finger	0%	0%	0%	0%	0%	0%	0%	0%
Open/close hand	0%	0%	0%	8%	0%	21%	17%	0%
Blow kisses	0%	0%	0%	0%	0%	14%	0%	8%
Smack lips 'Yum'	13%	7%	0%	17%	13%	7%	0%	17%
Shrug 'All gone'	0%	0%	0%	0%	0%	0%	0%	8%

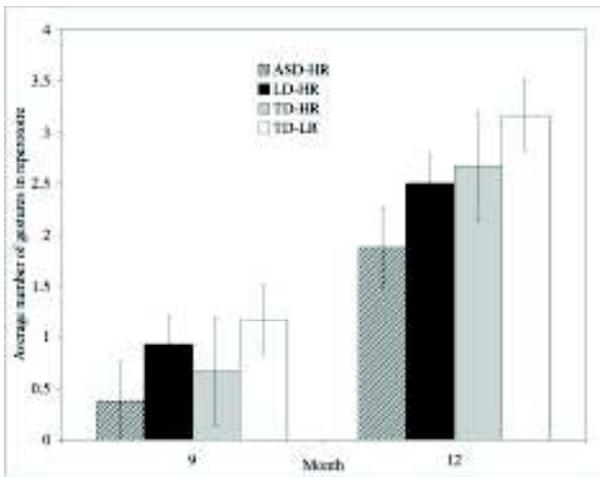


Figure 1. Average number of functional gestures (± 1 SE) in child's repertoire based on parent report for children at high risk for ASD and diagnosed with ASD, LD, or typically-developing and typically-developing children at low risk. Gestures that occurred infrequently (ie., exhibited often by fewer than 25% of all groups) were omitted.

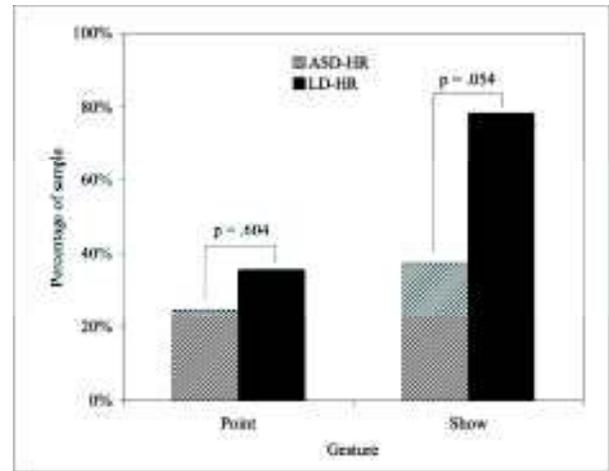


Figure 2. Proportion of children with ASD and children with LD who often point or show at 12 months. At twelve months, parents of children at risk for developing ASD reported how frequently their child exhibited showing or pointing. A larger proportion of children who were diagnosed with a language delay at 24 months often showed objects than children who were later diagnosed with ASD. There was less difference between groups in the proportion that frequently pointed at 9 months.

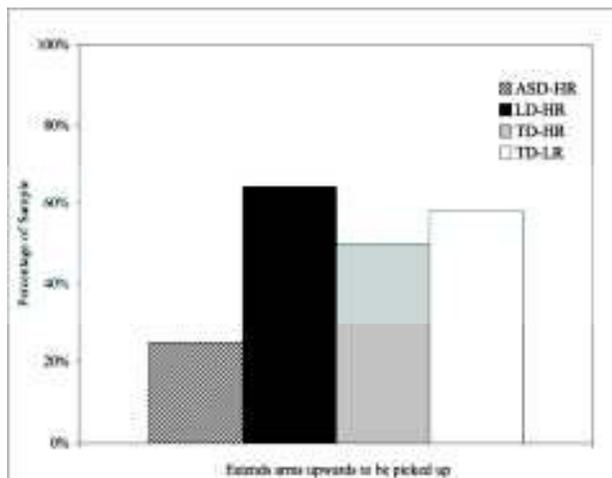


Figure 3. Proportion of ASD-HR, LD-HR, TD-HR, and TD-LR children who often reach to be picked up at 9 months.

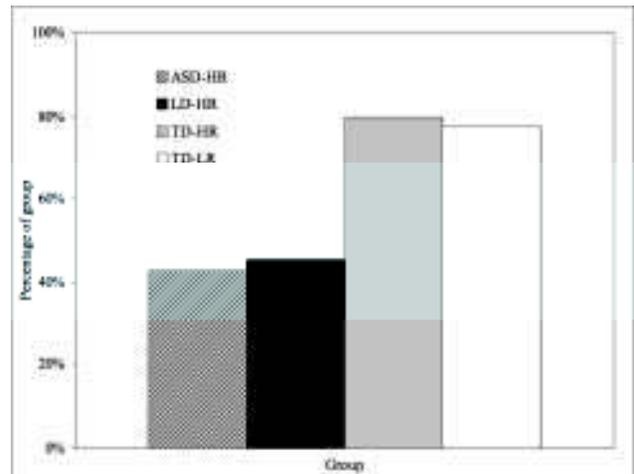


Figure 4. Proportion of ASD-HR, LD-HR, TD-HR, and TD-LR children who did not demonstrate functional use of any of the five gestures of interest (point, show, give, reach to be picked up, and waves goodbye) at 9 months and did develop the gesture by 12 months.

those still in development and used only sometimes. This study examined participants' scores on each individual gesture, which is notable because previous studies combined all individual gestures into a single summary score (Charman et al., 2003; Mitchell et al., 2006). Each parent completed the CDI as part of a larger battery of surveys mailed 2 to 3 weeks prior to their child's scheduled 9- and 12-month visits. Parents returned the surveys at the time of the visit, which was scheduled within a month to the date of the chronological age (with two exceptions when the child could not visit until 2 and 3 months following their birthday).

Results

General Frequency of Gesturing

Frequencies of Gestures

At both nine and twelve months, seven of the twelve gestures were reported as occurring "not yet" or only "sometimes" in at least 89.8% of children at nine and twelve months across all groups. Therefore, these gestures were excluded from subsequent analyses. At nine months, the only gesture that occurred frequently enough by all groups to allow for analysis was "extending one's arms to be picked up." At twelve months, infants demonstrated five gestures frequently enough for analysis: pointing, showing, giving, waving goodbye, and extending one's arms to be picked up.

Limited frequency of gestures in children with ASD

A visual inspection of Figure 1 suggests that children with ASD generally gestured less than other children at both time points. A mixed models 4 (diagnostic group: ASD-

HR, LD-HR, TD-HR, TD-LR) \times 2 (time: 9 months, 12 months) ANOVA on the total number of gestures with repeated measures on the last factor indicated a significant effect of time, $F(1, 36) = 38.99, p < .001$, and no effect of diagnosis $F(3, 36) = 1.47, p < .238$, or diagnosis \times time interaction $F(3, 36) = .24, p < .868$. To test our specific hypothesis regarding between-group differences, we followed up with a post-hoc test comparing the four groups. Infants with ASD had significantly fewer gestures than infants in the TD-LR group $t(36) = -2.09, p < .043, d = -.70$, but differences between other groups were not significant (ASD-HR versus LD-HR: $p < .230$; ASD-HR versus TD-HR: $p < .363$).

Patterns in Pointing, Showing and Giving at Twelve Months

Pointing

Children with autism pointed less frequently than all other children at twelve months. In comparison to the TD-LR group, the group with ASD pointed less than half as frequently (58.3% and 25.0%, respectively), although the difference failed to reach significance, chi-square (1, 20) = 2.16, $p = .142$. Children in the ASD-HR and LD-HR groups pointed at similar frequencies (25.0% and 35.7%, respectively), chi-square (1, 22) = .27, $p = .604$.

Showing

In contrast to pointing, the frequency of showing differed significantly between the ASD-HR and LD-HR groups at twelve months. A chi-square test indicated a marginally significant difference between groups in the proportion of participants demonstrating proficiency in the showing

gesture (ASD-HR: 37.5%; LD-HR: 78.6%; chi-square (1, 22) = 3.71, $p = .054$). The frequency of showing was similar across the LD-HR, TD-LR (75.0%), and TD-HR (66.7%) groups.

A binary logistic regression was conducted to determine which gestures (i.e., pointing, showing, giving, waving goodbye, and extending arms to be picked up) at 12 months best predicted that a twelve-month infant with some communicative delays would develop ASD instead of a language delay. We fitted a series of models to the data and began by including all five gestures with high frequency at twelve months as predictors of diagnostic outcome. The best fit model included only the showing and pointing gestures, and showing was found to be a stronger predictor of diagnosis than pointing (showing: $b = 2.30$, $p < .077$; pointing: $b = -.88$, $p < .522$). The odds ratio, which indicates the likelihood of belonging to a group, indicated that showing, not pointing, was a stronger predictor of diagnosis (showing: $e^b = 10.00$; pointing: $e^b = .42$). The odds of belonging to the LD-HR group are 10 times greater than the odds of belonging to the ASD-HR group, given that the infant is proficient in showing. Thus, high-risk infants who engage in frequent showing at 12 months are less likely to be diagnosed with ASD at 24 months than high-risk infants who are not proficient in the showing gesture at twelve months. While the presence of either pointing or showing at 12 months increases the odds that the infant belongs to the LD group, those odds are much higher when the infants use functional showing (10.00) as opposed to functional pointing (.42).

Giving

The frequency of giving did not differ significantly between groups at twelve months. Parents reported the frequency “often” for 50.0% of children with ASD, 64.3% of LD-HR children, 66.7% of TD-HR children, and 50.0% of TD-LR children.

Exploratory Analyses of Gesturing at Nine Months

Nine-month old infants exhibited low frequencies of most gestures. The only notable result was the proportion of parents who reported that their child “often” extended his or her arms upward to signal a wish to be picked up. In the typically developing groups, 58.3% of parents of low-risk infants and 50.0% of parents of high-risk infants reported this frequency, as did 64.3% of parents in the LD-HR group. A chi-square analysis suggests a trend between these groups and the ASD-HR group, where the proportion was only 25.0%, chi-square (1, 40) = 3.03, $p = .082$.

Group Differences in Acquisition of Gestures

The children with ASD exhibited fewer gains in gestures between nine and twelve months compared to the two typically developing groups. Of the infants who did not exhibit any of the five gestures of interest (the most frequent gestures) at nine months, only 43% of the ASD-HR group developed pointing or showing by twelve months, in contrast to 80% of the TD-HR group and 78% of the TD-LR group. Although these differences between groups are not significant, they illustrate a pattern of slower gesture acquisition in children with ASD.

DISCUSSION

The results of this study reaffirm previous findings that frequency and repertoire of gestures can provide important insights for clinicians assessing children at risk for ASD in their first year. The most notable finding is the potential value of the showing gesture as a predictor of ASD in high-risk children. Due to the prospective nature of the study, the number of infants included in the analysis was low, which contributed to the failure of some observed effects to reach statistical significance. However, the study is ongoing and we are currently analyzing data from a larger sample. Thus, the analyses presented in this paper are necessarily preliminary. The results thus far indicate the following:

- (1) Infants who are later diagnosed with ASD may gesture less frequently than high-risk infants who later develop language delays as well as typically developing infants from both high- and low-risk samples.
- (2) At twelve months, a lack of showing may differentiate ASD-HR from LD-HR better than a lack of pointing.
- (3) At nine months, the only gesture demonstrated by any group at a high frequency was extending one's arms upward to be picked up, which was diminished in the ASD-HR group compared to all other groups.
- (4) Children with ASD may acquire fewer gestures between nine and twelve months compared to typically developing children.

Each of these results will now be addressed in turn.

Children with ASD gesture less frequently

Data suggest that children with ASD exhibit fewer gestures than typically developing children at low risk at both twelve and nine months. This pattern replicates the results of past studies that measured gestures with the CDI (Charman et al., 2003; Mitchell et al., 2006) and with other measures (Carpenter, Pennington, & Rogers, 2002; DiLavore et al., 1995; Leekam & Ramsden, 2006; Mundy et al., 1990; Stone et al., 1997; Wetherby et al., 2007). ASD impairs communication, so it follows that early nonverbal communicative forms such as gestures should also be impaired.

Value of the showing gesture

The frequency of showing might differentiate high-risk infants who later develop ASD from those who will develop language delays or mild social difficulties. At twelve months, both the ASD-HR and LD-HR groups lacked proficiency in pointing. However, only the ASD-HR group exhibited limited frequency of showing. In fact, in this study, if a parent reported at twelve months that a child with communication difficulties and at risk for ASD often showed objects and toys, the calculated odds that the child would be diagnosed with LD rather than ASD were ten times greater at 24 months. Proficient pointing, however, did not strongly predict LD over ASD. This difference between pointing and showing could prove useful for clinicians during the diagnostic process. Infants with increased genetic risk for developing ASD, such as those in this study, are often monitored closely for early signs of the disorder. The high-risk infants in the LD group did not receive a diagnosis of ASD by a team of expert clini-

cians at 24 months, and early behaviors that distinguish them from the high-risk infants who were diagnosed with ASD could help clinicians diagnose earlier and more effectively.

In addition, if confirmed in the final analysis, our finding on decreased frequency of showing in infants with ASD could contribute to public discussion about early signs. Public education about autism traditionally emphasizes pointing as the hallmark gesture that is absent in autism. However, ASD impairs pointing in a complex way that is difficult to communicate in a few bullet points on a waiting room pamphlet. Protoimperative pointing remains intact in ASD, and only protodeclarative pointing, or pointing to an object or event of shared interest, is impaired (Baron-Cohen, 1989; Camaioni et al., 1997; Camaioni et al., 2003; Itoh, 2000). Parents who are aware of the commonly accepted “first signs” and who often witness their child point protoimperatively may falsely discount ASD as an explanation for their child’s social difficulties. The showing gesture may offer a clearer alternative to pointing as a warning sign for ASD, and the two gestures could complement each other in educational materials on early signs. Unlike pointing, showing is used only to initiate a shared social experience and not to indicate a need. A lack of showing may be easier for some parents to identify than a lack of pointing, which refers only to protodeclarative pointing and excludes protoimperative pointing. In contrast, pointing may be a more salient gesture because it is marked by a very specific hand posture. Publicity about the early signs of ASD may be more effective if both pointing and showing are used. While the former is more salient, the latter is more accurate.

Giving

Contrary to our hypothesis, the giving gesture did not uniquely characterize the ASD group. In fact, similar proportions of children across all groups demonstrated proficiency in giving. If parents report data that accurately reflects child behavior, it is remarkable that infants with ASD do not exhibit deficits in giving, as previous research has yielded contradictory results on the impairment of giving later in childhood (impaired: DiLavore et al., 1995; Mundy et al., 1986; not impaired: Stone et al., 1997). Our results may reflect the versatility of the giving gesture; children may give to share (protodeclarative) or to request something, such as help with opening a toy (protoimperative).

Reaching to be picked up

At nine months, few infants demonstrated many gestures proficiently, with the exception of extending their arms upward to be picked up. This result mirrors Kanner’s (1943) original remarks about children with autism, whom he claimed could be identified in part by their failure to anticipate being picked up by their parents. It was the only gesture demonstrated frequently by more than a quarter of any group at nine months, and therefore, as Kanner indicated, it could be used to distinguish children with autism from typically developing children.

Children with ASD develop fewer gestures between nine and twelve months

The data suggest that children with ASD may develop fewer gestures between nine and twelve months compared to typically developing children. Previous studies indicate that gestures are impaired in 18-month old infants who later develop ASD (Baron-

Cohen et al., 1996; Mitchell et al., 2006), but little is understood about the development of gestures in ASD during this time period.

Summary and Future Directions

The data suggest that children with ASD exhibit fewer gestures overall at nine and twelve months. In addition, it suggests that high-risk infants whose parents report that they often show objects or toys at twelve months are less likely to be diagnosed with ASD, but might show less severe impairments involving language developing and mild social difficulties at 24 months. At nine months, children with ASD extended their arms to be picked up half as frequently as typically developing children and children with language delays, regardless of risk status. Data also suggest that children with ASD and LD may acquire fewer gestures between nine and twelve months than their typically developing peers.

Further investigation with a larger sample is needed to explore whether these trends reflect true differences between groups. The larger subject pool from which these participants were recruited is maturing, and the data is currently being analyzed for more children from this unique population.

Further research is also needed to explore the reliability of parent report data from the CDI. Parents were not trained and may vary in their interpretation of the CDI categories of frequency of “not yet,” “sometimes,” and “often.” We attempted to compensate with a coding scheme that combined “not yet” and “sometimes” responses, which both indicate relatively low frequencies of the behavior; however, reliability issues likely persist. Clinician assessments of children using the CDI could be used to val-

idate parent reports. In addition, during diagnostic evaluation, clinicians could assess the type, frequency, and communicative function of gestures used, which would help elucidate the ambiguities of gesture classification by parents*. However, clinicians lack the extensive perspective of parents, whose reports still contribute to the discussion of early signs of ASD. Parents, not trained observers or clinicians, daily witness their child play and communicate in a naturalistic setting and are in the best position to identify ASD early. Therefore, the publicly advertised “early signs of ASD” should be easy for parents to utilize, and therefore should be based on research about which signs were actually observed by parents of children with ASD.

One implication of these results concerns future studies of gesture in ASD. While studies often combine all gestures and report a composite score (Charman et al., 2003; Leekam, 2006; Mitchell et al., 2006; Mundy et al., 1990; Wetherby et al., 2007), the results of this study indicate that the data on individual gestures should not be overlooked. Trends differed between specific gestures such as pointing, showing, and giving, and a summary score would have ignored these differences. Examining

* Parents may struggle to interpret descriptions of gestures on the CDI. For example, the CDI describes the reaching gesture as “Requests something by extending arm and opening and closing hand.” Few parents reported proficiency in this item at nine or twelve months, although reaching is known to emerge between ten and twelve months (Capone & McGregor, 2004). These results suggest that the questionnaire may not accurately capture infant gesturing through parent report.

the CDI data on gestures in a new way yielded a potential new warning sign for ASD.

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