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Brief report: Parent-guided movements during play with children with autism spectrum disorder

Natasha Yamane[a], **Arielle D. Snow**[a], **Deborah Fein**[b], **Letitia Naigles**[b], **Sylvie Goldman**[c,*]

[a]Columbia University Irving Medical Center, Department of Neurology, G.H. Sergievsky Center, New York, NY, USA

[b]University of Connecticut, Department of Psychological Sciences, Storrs, CT, USA

[c]Columbia University Irving Medical Center, Department of Neurology, Divisions of Child Neurology and Cognitive Neuroscience, New York, NY, USA

Abstract

Background: Children with autism spectrum disorder (ASD) demonstrate social and communication impairments from an early age. While researchers have long investigated parenting behaviors in relation to children's social and communication development, fewer studies have examined the relevance of movement-based parenting behaviors to facilitating communication and social engagement with young children. The present study aimed to investigate: (1) parent-guided movements (PGMs) within dyads of parents and typically developing (TD) children and children with ASD; and (2) children's ASD diagnostic and receptive language scores as predictors of PGM frequency.

Method: Video-recorded play interactions of 33 TD dyads (mean age: 20.4 months) and 31 dyads with ASD (mean age: 32.6 months) were matched on child's expressive language. Data were obtained from a longitudinal study on developmental language trajectories in ASD and coded for PGMs.

Results: Overall, parents of children with ASD initiated PGMs more frequently than parents of TD children during play ($U = 269.00$, $z = -3.58$, $p < 0.001$). PGM frequency was predicted by children's ADOS scores ($X^2 = 5.46$, $p = 0.02$, $OR = 1.26$, 95% CI [1.04, 1.54]) and receptive language ($X^2 = 4.15$, $p = 0.04$, $OR = 5.43$, 95% CI [1.10, 27.67]).

Conclusions: Findings suggest that parents of children with ASD and low receptive language may utilize more movement-based strategies to compensate for their children's impaired social engagement and verbal comprehension. This study offers insight on a particular movement-based modality characterizing ASD dyads that can be used as a measure in parent-mediated interventions.

*Correspondence to: Columbia University Irving Medical Center, 622 West 168th Street, PH18-331, New York, NY 10032, USA. sg3253@cumc.columbia.edu (S. Goldman).

Declaration of Competing Interest

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Keywords

Dyad; Parental strategies; Movement behaviors; Receptive language

1. Introduction

Social and communication impairments are among the earliest diagnostic signs of autism spectrum disorder (ASD). Children with ASD may demonstrate reduced orienting to social stimuli, lack of joint attention and eye contact, and decreased response to name (Zwaigenbaum et al., 2015). Recent trends in research on socio-behavioral interventions for autism show emerging evidence supporting the effectiveness of naturalistic play activities mediated by parents (Schreibman et al., 2015; Siller, Swanson, Gerber, Hutman, & Sigman, 2014). Research on parent-mediated interventions show that parental behaviors can impact aspects of child development, including language and communication (Brian, Smith, Zwaigenbaum, Roberts, & Bryson, 2016; Haebig, McDuffie, & Ellis Weismer, 2013; Siller & Sigman, 2002) and quality of play (Freeman & Kasari, 2013).

It is well understood that parents of children with ASD adapt their behaviors according to their children's particular characteristics of ASD (Boonen et al., 2015; Ku et al., 2019b; Reed & Osborne, 2014). A large body of research has studied parenting behaviors among Typically Developing (TD) and ASD parent-child dyads, particularly the role of parenting in children's acquisition of social and communication skills. Indeed, many researchers have compared a variety of parenting dimensions between parents of TD and ASD children, including emotional availability and attachment (van Ijzendoorn et al., 2007), parental directive behaviors (Blacher, Baker, & Kaladjian, 2013; Freeman & Kasari, 2013; Lambrechts et al., 2015), and parental warmth and support (Boonen et al., 2015; Kasari, Sigman, Mundy, & Yirmiya, 1988). Parental direction involves parents' attempts to reinforce or restrict a child's behavior, such as supervision or rule-setting, while parental warmth and support relate to the parent's emotional responsiveness and sensitivity. Often, parents employ these strategies to facilitate engagement and increase communication with their children. For example, Kasari et al. (1988) and Blacher et al. (2013) investigated differences in responsiveness and control among caregivers of children with TD, ASD, and other developmental disabilities (DDs). Caregivers of the latter groups were found to use more control strategies than caregivers of TD children. Siller and Sigman (2002) video-coded parental behavioral synchrony with the child as a measure of parental responsiveness. Similar to parents of children with TD and other DDs, parents of children with ASD were able to synchronize their verbal and nonverbal behavior with their children's toy-directed attention. Further, the authors found an association between higher levels of parental verbal and nonverbal synchrony and improved communication skills in the children over one, 10, and 16 years. Haebig et al. (2013) also reported similar findings on parental responsiveness and associations with children's social behaviors and language outcomes. Specifically, parental verbal responsiveness was found to be associated with language outcomes in minimally verbal children with ASD three years later. Children whose parents utilized more "follow-in comments" (i.e., describing the child's action or focus of attention without

redirecting the child's behavior during play) demonstrated better language outcomes three years later compared to those of parents who produced fewer of these types of comments.

While the corpus of work on parenting strategies in families of children with ASD has grown in the last decade, the majority of studies has thus far focused on verbally based strategies, such as parental language during play (Midouhas, Yogaratnam, Flouri, & Charman, 2013; Siller & Sigman, 2002), or the quality of parents' affective behavior (Boonen et al., 2015). To our knowledge, very few studies have included movement-based parenting behaviors in the context of examining parenting strategies with child variables. In their study on verbal and nonverbal children with ASD and their parents, Doussard-Roosevelt, Joe, Bazhenova, and Porges (2003) found that, compared to mothers of verbal children with ASD, mothers of nonverbal children with ASD utilized more "approach behaviors," including physical contact and movement to elicit social responses from their children. Earlier work by Lemanek, Stone, and Fishel (1993) investigated similar measures of parent behaviors with child compliance in families of preschoolers with TD, ASD, developmental delays, and language impairments. In their study, behaviors of interest included verbal and nonverbal behaviors, the latter of which involved movement-based strategies such as increasing physical proximity or placing the child's hand on a toy. Their findings revealed that, compared to parents of children with TD, DDs, and language impairments, parents of children with ASD used more structuring and prompting behaviors, including nonverbal attention-getting and increasing physical proximity.

To date, physical behaviors and strategies used by parents of children with ASD have received little attention from the research community. Consequently, there is a lack of understanding about the role of parents' movement-based strategies in socially engaging their children with ASD who often have limited verbal comprehension. Thus, the primary aim of the current study was to extend previous research on movement-based parental strategies and children's language skills by utilizing an adapted movement-based code called *parent-guided movement* (PGM) from our prior work (Abbruzzese, Yamane, Fein, Naigles, & Goldman, 2021). Importantly, we acknowledge that motor delays related to cognitive, functional, and language impairments (Bhat, 2020) may also impact parenting behavior in families of children with ASD (Gladfelter, Johnson, & Odeh, 2020); however, this study focuses on movement from the perspective of the parent. Additionally, to the best of our knowledge, none of the children in this study presented significant motor abnormalities. Therefore, a secondary aim was to measure the effect of children's clinical diagnoses of ASD and receptive language level on PGM frequency as a means to understand parents' movement-based strategies with regards to their children's autism severity and concurrent verbal comprehension.

2. Methods

2.1. Participants

A total of 64 video recordings of parent-child dyads were obtained from a longitudinal study investigating trajectories of language acquisition in children with ASD (Naigles & Fein, 2017). All videos used in the current study were recorded from the first of six home visits. Dyads were recruited from the community and predominantly from White, middle-

class suburban households, with parents who had attended at least a two-year college. Of the 64 videos, 33 were of TD children (7 girls; mean age: 20.36 months, *SD* = 1.61) and 31 were of children with ASD (5 girls; mean age: 32.62 months, *SD* = 6.13). At recruitment, investigators confirmed that none of the children had a reported family history of autism. Each child was administered a battery of cognitive (verbal and nonverbal) and language assessments with the Mullen Scales of Early Learning (MSEL; Mullen, 1995) and MacArthur Communicative Development Inventory (CDI; Fenson et al., 1993), respectively. Autism diagnosis was confirmed by experienced clinicians using the Childhood Autism Rating Scale (CARS-2; Schopler, Van Bourgondien, Wellman, & Love, 2010) and Autism Diagnostic Observation Schedule—Module 1 (ADOS; Lord, Rutter, Dilavore, & Risi, 2008). Children were matched on expressive language using raw scores on the expressive language subtest of the MSEL (Table 1). All parents provided informed consent in the original study, which was approved by the Institutional Review Boards of the University of Connecticut and Columbia University Irving Medical Center.

2.2. Measures

2.2.1. Autism diagnosis—All children were evaluated for ASD using the ADOS, the gold-standard diagnostic tool for autism, that consists of structured play-based activities used to elicit social interaction and language, as well as identifying repetitive and restricted behaviors. Children received a cumulative total ADOS score and scores for the two domains of Social Affect (SA) and Restrictive and Repetitive Behaviors (RRB). Children were also evaluated with the CARS-2, a 15-item screening tool with each item scored on a scale ranging from 1 (“normal behavior”) to 4 (“severely abnormal behavior”). Higher scores indicate more severe symptoms of autism.

2.2.2. Receptive language—For the purpose of this study, standardized measures of children’s receptive language from clinical assessment with the MSEL and parent-reported scores on the “Total Understands” section of the CDI were utilized.

2.3. Materials

Parent-child interactions were video-recorded during the administration of an adapted version of the Screening Tool for Autism in Two-Year-Olds (STAT; Stone & Ousley, 1997), which consists of 12 play-based activities such as pretend-play with dolls, interactive play with a ball or truck, imitation, requests, and joint attention (e.g., pointing or reaching).

2.4. Procedure

Parent-guided movements (PGMs) were adapted from prior work on the Child Postural Variability Coding system (Abbruzzese et al., 2021) and defined as *any movement initiated by the parent on the child’s body, whole or part (with the exception of the child’s hands or wrists), that immediately changes the child’s current movement or posture*. These movements included any restraining or restricting behaviors (e.g., pulling on the child’s shirt, holding back the child), as well as picking up the child or shifting a part of the child’s body. Behaviors that were not coded included grooming (e.g., wiping the nose or fixing hair) and soothing (e.g., hugging, high-fiving, or tickling).

2.4.1. Video coding—The first 10 min of each video-recorded play session was coded without audio for the occurrence of each PGM using Datavyu (Datavyu Team, 2014). Videos were excluded if multiple family members were present or if the child was restrained in a highchair or seat. Coders were instructed to skip to the fifth minute mark of the video if any of the two conditions were observed: (1) the child was out-of-view of the camera for the first minute of the video; and (2) another person, such as a research assistant, was observed to be overly involved in the interaction (e.g., moving the child, giving too many instructions to the parent, talking to the child). A coding interval of five seconds was chosen based on repeated interrater reliability analyses that revealed the strongest agreement for this time unit.

Two graduate-level research assistants in psychology, blinded to child's age and diagnostic status, were trained in coding PGMs using a randomly selected sample of 19 videos. Both coders demonstrated strong interrater reliability on the PGM code (Cohen's $\kappa = 0.872$, 95% CI, 0.652–0.915, $p < 0.001$).

2.5. Analysis

Ordinal logistic regression analyses were performed to assess the effects of children's receptive language and autism diagnosis on frequency of PGMs. Children's total receptive language scores on the MSEL and CDI were categorized as "high" or "low" using the median of each sample of scores as a cutoff ($Mdn_{MSEL} = 24.0$; $Mdn_{CDI} = 159.5$). Similarly, due to their non-normal distribution across cohorts, PGM frequencies were categorized as "high," "medium," or "low" using cutoff values that separated the groups' frequency distributions most uniformly.

3. Results

To analyze differences in PGM frequency between the TD and ASD groups, a Mann-Whitney U test was performed. Median frequencies of PGMs were significantly higher in the ASD group ($Mdn = 4.00$) than in the TD group ($Mdn = 2.00$), $U = 269.00$, $z = -3.58$, $p < 0.001$.

Unadjusted and adjusted ordinal logistic regression models were utilized to assess whether children's receptive language predicted PGM frequency. Our adjusted model controlled for child's age and gender, as well as parent education level (Table 2). Among ASD dyads, a child's low total receptive language score was associated with an increase in the odds of a parent's PGM frequency. Specifically, a low CDI score had a statistically significant effect on a parent's PGM frequency level (Wald $X^2 = 4.15$, $p = 0.04$), with an OR of 5.43 (95% CI, 1.10–27.67). In contrast, children's receptive language scores on the MSEL did not have an effect on parents' PGM frequency.

Overall, children's raw scores on the ADOS and CARS-2 significantly predicted parents' PGM frequency (Table 3). After adjusting for diagnostic group, age, gender, and parent education level, ordinal logistic regression analyses revealed that a child's higher scores on the ADOS and CARS-2 were significantly associated with greater odds of his or her parent's PGM frequency (ADOS: Wald $X^2 = 4.65$, $p = 0.03$; CARS-2: Wald $X^2 = 5.09$, $p = 0.02$).

SA scores significantly predicted PGM frequency (Wald $X^2 = 5.46$, $p = 0.02$), with an *OR* of 1.26 (95% CI, 1.04–1.54), while RRB scores did not.

4. Discussion

The current study extends prior work on movement-based parental strategies and children's language (Doussard-Roosevelt et al., 2003; Haebig et al., 2013; Lemanek et al., 1993) by: (1) examining movement-based parental behaviors called *parent-guided movement*s (PGMs) during play in parent-child dyads with and without ASD, and (2) investigating the effects of children's ASD diagnoses and receptive language levels on such movements. Examining physical, movement-based behaviors is critical to furthering our understanding of parent-child interactions in families of children with ASD, which can have important implications in the design of interventions (e.g., NDBIs). So far, little attention has been given to examining the importance of parental movement behaviors in facilitating or enhancing reciprocity and social engagement in young children with ASD.

Consistent with previous findings (Doussard-Roosevelt et al., 2003; Lemanek et al., 1993), overall results of this study demonstrate that parents of children with ASD initiated PGMs more frequently than parents of TD children during play. Analyses using our novel coding scheme showed that frequency of PGMs was significantly predicted by children's scores on the CARS-2 and on the SA domain, but not on the RRB domain of the ADOS. Among dyads with ASD, children's scores on the receptive language subscale of the clinician-administered MSEL did not predict frequency of PGMs. However, scores on parent-reported CDI had significant effects on the frequency of observed PGMs. Altogether, these findings suggest that parents' movement behaviors are driven by their children's lack of social response, rather than their children's restrictive interests or repetitive behaviors during the observed interaction. Indeed, a secondary review of the video recordings revealed that no stereotypic or repetitive behaviors were observed during the coded segments. Additionally, parents' use of movement-based strategies may be motivated by his or her own perception of the child's joint attention (Kelty-Stephen, Fein, & Naigles, 2020) and level of verbal comprehension, regardless of clinicians' scores on standardized testing.

While the present findings highlight important considerations that lay the groundwork for research on parent-mediated NDBIs, they should be interpreted in the context of the following limitations. First, the design of the original study (Naigles & Fein, 2017) included a racially homogeneous, male-skewed child cohort. Given the historical paucity of research on minority children and girls with ASD, efforts should be made to recruit more diverse cohorts of children to investigate effects of child's gender as well as racial and cultural factors on parents' practices during play. Secondly, only a handful of fathers participated in the original study. Future studies on parent-child interactions are encouraged to recruit more fathers, as the role of fathers versus mothers in mediating and reinforcing certain skills in children will become more relevant as advancements are made in the development of parent-mediated NDBIs.

4.1. Implications

Results of this study have important implications for research supporting the design and evaluation of parent-mediated interventions addressing social and communication skills. Intervention programs for children with ASD point to key ingredients related to parental involvement, in particular, coaching practices aimed at increasing parental sensitivity and responsiveness in unstructured play (Crowell, Keluskar, & Gorecki, 2019), as well as increasing the child's joint attention in more structured play contexts (Schertz, Odom, Baggett, & Sideris, 2013). Importantly, parent-guided movements (PGMs) and other movement-based behaviors can be used as a quantifiable measure in parent-mediated intervention studies (Liu & Schertz, 2021; Vibert et al., 2020), for example, by studying parental behaviors across different groups of children with DDs and play contexts (Ku et al., 2019a).

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Table 1

Descriptive statistics of the population.

Variable	TD (*n* = 33)	ASD (*n* = 31)	*t*/*z*-stats	*p* value
Gender	26 boys, 7 girls	26 boys, 5 girls	0.51	0.60
Age (months)	20.36 (1.61)	32.62 (6.13)	− 11.10	< 0.001
MSEL, Expressive	19.97 (5.12)	17.84 (7.29)	1.36	0.18
MSEL, Receptive	24.32 (3.76)	21.61 (9.23)	1.48	0.14
CDI, Understands	188.67 (88.15)	159.03 (108.20)	1.21	0.23
ADOS, Total	0.79 (1.30)	13.90 (3.84)	− 18.39	< 0.001
ADOS, Social Affect	0.26 (0.73)	8.90 (2.82)	− 16.86	< 0.001
ADOS, Restricted and Repetitive Behaviors	0.09 (0.30)	1.97 (1.58)	− 6.70	< 0.001
CARS	15.80 (1.59)	36.06 (6.75)	− 16.79	< 0.001
Parental Education[a]	8.11 (1.95)	7.60 (2.45)	0.90	0.37

Note. All values are Means (Standard Deviation) of raw scores.

[a]Parental education was measured by years beyond 8th grade.

Table 2

Odds ratios of parent-guided movement frequency predicted by receptive language within groups.

Predictor	TD (*n* = 33)		ASD (*n* = 31)		TD[a] (*n* = 33)		ASD[a] (*n* = 31)	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
CDI, Understands								
High	ref	ref	ref	ref	ref	ref	ref	ref
Low	1.96	0.47–8.11	3.76	0.86–16.49	1.93	0.40–9.34	5.43*	1.10–27.67
MSEL, Receptive								
High	ref	ref	ref	ref	ref	ref	ref	ref
Low	2.38	0.59–9.65	2.50	0.61–1.00	3.62	0.53–24.81	3.35	0.73–15.37

Abbreviations: OR = odds ratio; CI = confidence interval; ref = reference category.

Significance:

* $p < 0.05$.

** $p < 0.01$.

[a] Adjusted for age, gender, and parent education level.

Table 3

Odds ratios of parent-guided movement frequency predicted by diagnostic scores.

Predictor	OR	95% CI	OR[a]	95% CI[a]
ADOS, Total	1.12**	1.05–1.20	1.19*	1.02–1.40
Social Affect (SA)	1.15**	1.06–1.24	1.26*	1.04–1.54
Restricted and Repetitive Behaviors (RRB)	1.53*	1.08–2.17	1.20	0.75–1.91
CARS	1.09***	1.04–1.15	1.15*	1.02–1.29

Abbreviations: OR = odds ratio; CI = confidence interval.

Significance:

* $p < 0.05$.

** $p < 0.005$.

*** $p < 0.001$.

[a] Adjusted for diagnosis, age, gender, and parent education level.