

Cover Sheet

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Brief Report: Analysis of the Relationship Between Turn Taking and Joint Attention for Toddlers with Autism

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Abstract

The relationship between turn taking (i.e., back-and-forth preverbal communicative exchanges) and joint attention has not been studied in interactions between children with autism and caregivers. In joint attention, a form of preverbal social communication, young children socially share attention with a partner about objects, a competency that is difficult for toddlers with autism. Video data of interactions between caregivers and 61 toddlers with autism who received joint attention-focused intervention were analyzed to determine associations between turn taking and joint attention. Results indicate a positive relationship between the two forms of social communication. Further study is needed to determine the extent to which turn taking may play a foundational role in supporting joint attention development for toddlers with autism.

Keywords Autism · Correlation · Joint attention · Social communication · Turn taking

Introduction

Autism is a neurodevelopmental disorder that appears during early childhood and is characterized by challenges in social communication and restrictive, repetitive behaviors (DSM-V, American Psychiatric Association 2013). While there is wide developmental variability among children with autism, social communication remains a core challenge (Charman and Stone 2006; Mundy et al. 1986; Mundy 2016; Tager-Flusberg et al. 2001). Challenges in reading social meaning for children with autism are evident in early childhood (Mundy 2016; Tager-Flusberg 1993) and impact development in areas such as emerging communication, language, and play (Pickard and Ingersoll 2015; Toth et al. 2006).

At the preverbal level, social communication follows a developmental course from early dyadic forms to a more complex triadic manifestation (De Schuymer et al. 2011; Dunham and Dunham 1995; Harrist and Waugh 2002). Social attention in the preverbal form of parent-infant visual synchrony is typically discernable in early infancy (Feldman 2007); however, evidence is emerging that infants who will go on to a later autism diagnosis tend to show a preference

for non-social visual attention—a preference for looking at objects over visual exchange with a partner (Chawarska et al. 2009; Moriuchi et al. 2016). In later infancy, social interaction takes on more definitive patterns in the form of preverbal social imitative and turn-taking activity (Over and Carpenter 2013). In these interactions, the infant engages in reciprocal games such as peek-a-boo, which require active give and take with a social partner. Again, difficulties are evident in reciprocal dyadic social competencies for older infants who will receive a later autism diagnosis (Poon et al. 2012). These early dyadic forms of social communication are typically followed in later infancy by joint attention, which is first manifest nonverbally as social attention sharing in reference to objects (Mundy 2016).

The preverbal use of social communication has been linked not only to later indicators of social competency, such as understanding of social cues, understanding of intent, and interpersonal relationships (Camaioni et al. 2004; Travis and Sigman 1998; Mundy 2016), but also with later language development (Cochet and Byrne 2016; Harbison et al. 2017; Stone and Yoder 2001). Challenges in preverbal social communication may have implications for later development (Mundy et al. 1990; Tager-Flusberg et al. 2005). When compared to children who are typically developing and children with other disabilities, children with autism show less use of social communication (e.g., Mundy et al. 1990; Werner and Dawson 2005; Wetherby et al. 2007). For example, joint

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attention is uniquely challenging for children with autism as they engage less with peers and show fewer instances of joint attention than do children with typical development or Down syndrome (Mundy et al. 1986; Sigman and Ruskin 1999; Wetherby et al. 2007; Werner and Dawson 2005). These findings substantiate social communication as a core area of challenge for children with autism.

Joint Attention

Joint attention, which is considered to be a human-only competency (Tomasello and Carpenter 2007), can be defined as a form of triadic, cooperative visual attention between a communicative partner and an object or event for the purpose of sharing social interest (Mundy 2016). In typical development, joint attention emerges between 9 and 12 months and is consolidated by 18 months (Adamson et al. 2009; Charman 2003). During this period, infants and toddlers integrate their interests in external objects and events into their interactions with others (Bakeman and Adamson 1984; Bruner 1977, 1983). Competency in joint attention in early childhood is associated with later development of social, language, and cognitive ability (Charman 2003; Freeman et al. 2015; Jones et al. 2006; Mundy et al. 1990; Toth et al. 2006).

An absence of joint attention in early childhood is one of the first clear indicators of autism (Mundy et al. 1986), indicating its importance and triggering research to promote this competency in young children with autism (Kasari et al. 2006; Rocha et al. 2007; Schertz et al. 2018a). Joint attention, however, is not the only form of social communication that has been integrated into early intervention studies. Turn taking, a simpler form of social communication, has been incorporated into early interventions for young children with autism based on its theoretical value as a foundation for joint attention (Schertz et al. 2018a).

Turn Taking

Turn taking, a form of dyadic synchrony, can be defined as mutual back-and-forth preverbal communicative exchanges between a child and a communicative partner (Schertz et al. 2018a; Harrist and Waugh 2002). It is a form of reciprocal engagement between one communicative partner and another for the purpose of sharing social interest. Turn taking may appear, for instance, when a child stacks a block to make a tower, the caregiver stacks another block, and the actions are repeated. During this exchange, the child successively responds to and initiates socially-oriented back-and-forth interaction without relying on verbal or physical

prompts from the communicative partner to engage (Schertz et al. 2018a).

Early turn taking at the preverbal level may play a part in later development. It has been proposed, for instance, that it lays the groundwork for communication and language skills (Dunham and Dunham 1995; Tomasello and Farrar 1986), understanding of shared meaning (Newson 1977), and self-regulation (Dunham and Dunham 1995; Feldman et al. 1999). By participating in turn taking, young children are learning to participate in social interactions and to understand that other people have different personal viewpoints and interests (Brunner, 1983; Dromi 1993; Newson 1977).

Turn taking has been included as a component of various intervention models for children with autism who have difficulty with social communication. For example, Milieu Teaching (Alpert and Kaiser 1992), Pivotal Response Training (Koegel et al. 1989), Floortime (Greenspan and Wieder 2006), Responsive Teaching (Mahoney and MacDonald 2007), the Early Start Denver Model (ESDM; Rogers and Dawson 2010), and Joint Attention Mediated Learning (JAML; Schertz et al. 2018a) all incorporate turn-taking components to improve outcomes for children with autism. In JAML, for instance, the parent promotes reciprocity by encouraging child-initiated gestures and by responding to the child's actions as if the child is aware of the parent's perspective (Schertz et al. 2018a). In addition, the ESDM incorporates turn taking to promote learning objectives, such as expressive communication and joint attention for children with autism (Rogers and Dawson 2010). Turn taking is a defined task in the Early Social Communication Scales, an assessment used to measure nonverbal communicative skills, including initiating and responding to joint attention, in young children (Mundy et al. 2003).

Some studies have resulted in joint attention gains in interventions involving turn taking. For example, Kim, Wigram, and Gold (2008) incorporated turn-taking activities into improvisational music therapy, which resulted in improvements in joint attention. Joint attention gains were also seen in children who completed intervention and demonstrated prior competency in a turn-taking phase (Schertz et al. 2018a). Other interventions with a turn-taking component have resulted in language gains, play gains, and increased instances of joint attention (Alpert and Kaiser 1992; Isaksen and Holth 2009; Rieth et al. 2014; Schertz et al. 2018a), highlighting the importance of considering turn taking in intervention for children with autism.

Purpose of the Study

While turn taking has been theorized as foundational to joint attention (Schertz et al. 2018a) and turn-taking components have been implemented to promote joint attention

for children with autism (e.g., Isaksen and Holth 2009; Schertz et al. 2018a), correlational analyses on associations between turn taking and joint attention in interactions observed between children with autism and their caregivers are not reported in the literature. Because of turn taking's potential foundational role in supporting joint attention, investigating the relationship between turn taking and joint attention may provide new insight on the value of turn taking as a component in intervention to promote higher forms of social communication, such as joint attention, for young children with autism. The purpose of this study is to explore the relationship between turn taking and joint attention in interactions between caregivers and toddlers with autism who have benefited from intervention. We hypothesized a positive association between turn taking and joint attention (both its responding and initiating forms) during interactions between caregivers and toddlers with autism.

Methods

Participants

Sixty-one toddlers with autism, who completed the post-assessment in the experiment group of the JAML study (Schertz et al. 2018a), were included in the present study. To be eligible for JAML, children were under 30 months of age at the start of the study, were assessed as meeting the threshold for autism on the Autism Diagnostic Observation Schedule-II (ADOS-T; Lord et al. 2012), and showed an absence of joint attention when observed during 10-min caregiver-child interactions. Children with a co-occurring diagnosis were excluded. Participant and caregiver characteristics for the present study are presented in Table 1.

Procedure

Data collected from the three JAML intervention sites were compiled for the current study. The following sections describe the JAML data collection process and also how data were collected and measured for the present study.

JAML Intervention Description

The JAML intervention, a larger study which was implemented in Indiana, Kansas, and North Carolina, was designed to promote preverbal communication through parent mediation in three phases (i.e., focusing on faces, turn taking, and joint attention) in natural home settings. Parents were introduced to these phases throughout the intervention process. Schertz et al. (2018a) adapted Klein's (2003) five mediated learning principles: focusing, organizing and planning, giving meaning, encouraging, and expanding, all

Table 1 Participant characteristics

Participant characteristics: M (SD)	61 Participants
Child age (months)	24.70 (4.03)
Gender (% male)	78.70
Ethnicity (%)	
White	65.6
Black	14.8
Hispanic non-white	6.6
Other	13.1
ADOS- T severity score	
Social affect	16.38 (3.43)
RRB	2.74 (1.72)
Caregiver age (years)	31.18 (5.97)
Caregiver education (%)	
No high school diploma	13.1
High school diploma or GED	6.6
Some college/no degree	29.5
Associate degree	1.6
Bachelor's degree	36.1
Graduate degree	13.1
Caregiver income (%)	
Less than \$19,091	19.7
Between \$19,091 and \$30,970	8.2
Between \$30,971 and \$39,999	11.5
Between \$40,000 and \$59,999	14.8
Over \$60,000	45.9

RRB restricted and repetitive behavior

of which focus on active engagement in the learning process. The JAML phases were implemented through these principles (Schertz et al. 2018a).

Intervention sessions took place once weekly in participants' homes for 32 weeks. During these visits, an Intervention Coordinator (IC) provided parents with conceptual guidance on targeted outcomes and mediated learning principles. Rather than instructing parents on specific strategies, ICs shared "ideas other parents have used" verbally, in print, and with video examples to support parent's agency in promoting the current targeted outcome by using mediated learning principles flexibly based on unique child and family preferences. For example, for promoting the targeted outcome "responding to joint attention" after seeing examples other parents have used, a parent might use the mediated learning principle "giving meaning" by showing a novel toy to the child and, after the child looks at the toy, encourage a look to the parent's face by holding her face directly in front of the child with an inviting smile. The IC collected 10-min video-recordings of caregiver-child interactions each week and reviewed the video recordings with the caregiver to guide them in reflecting on their use of the mediated learning principles at each phase.

Data Collection

Data were collected pre-, post-, and 6 months following intervention from the three JAML sites (Schertz et al. 2018a). However, the current study only used the post-assessment video coding data from the experiment group because the participants would have theoretically already progressed to joint attention by completion of the intervention, therefore, potentially showing more instances of joint attention than at the entry of intervention. Only 61 out of 64 participants were included in the present study due to three participants having incomplete post-assessment videos. For the present study, pre-existing, post-assessment video data were collected for each of the 61 participants from the three JAML intervention sites. These included 183, 10-min videos of parent–child interaction collected at three post-assessment sessions.

Coding Procedure

Video data were coded by two trained observers, who were blind to group assignment for the three JAML sites and who reached 85% agreement during training sessions. Interobserver agreement was calculated by dividing agreement of an interval occurrence by the sum of agreement and disagreement and multiplying by 100. Throughout the study, trained observers independently coded 25% of the videos and conducted interobserver reliability on an ongoing basis, which was then calculated by Cohen's Kappa (Cohen 1968). The mean Kappa (and range) for each variable were 0.96 (0–1.0) for turn taking; 0.71 (0–1.0) for responding to joint attention; and 0.74 (0–1.0) for initiating joint attention.

Each 10-min video was spliced into 10-s intervals. Video coding was based on the Precursors of Joint Attention Measure (PJAM) (Schertz 2013) coding manual, which is partial and continuous and results in the total frequency of each variable. An interval coding system (Yoder and Symons 2010) was used in which each occurrence of turn taking, initiating joint attention, and responding to joint attention was coded as occurring or not occurring in each 10-s interval of every 10-min video, which has a total of 60 intervals (Schertz et al. 2018a). A designation of “1” was coded when a variable was observed during a given interval, regardless of the total number of interval occurrences and “0” was coded for no occurrences. An interval coding system was used to support interobserver agreement for reliability. By using this system, two video observational coders could indicate where they had disagreement. The three measures, Turn Taking (TT), Responding to Joint Attention (RJA), and Initiating Joint Attention (IJA), were coded simultaneously as the participants showed the target actions per video. For instance, during a 10-s interval, if a child showed TT and IJA, the coder would mark TT and IJA for that interval.

Measures

The three variables for this study (i.e., turn taking, responding to joint attention, and initiating joint attention) are all characterized by reciprocal forms of interactive engagement, with the distinction that turn taking is a dyadic social exchange between the child and parent and joint attention is a triadic exchange that also requires an object with social exchange. Both turn taking and joint attention are transactional in nature; that is, one partner's actions depend on the other person. All three variables, TT, RJA, and IJA, were measured using the PJAM coding instrument (Schertz 2013). Specific coding criteria are described following.

TT

Turn taking is a dyadic, back-and-forth interaction between a child and a communicative partner (Harrist and Waugh 2002; Schertz et al. 2018a). Instances of TT were coded when the child initiated or responded to back-and-forth social exchanges with the parent (Schertz et al. 2018a). These instances were credited when the toddler showed one of at least two actions as part of a full turn-taking routine completed within no more than two consecutive 10-s (time) intervals. For an action, while showing playful intent, the child must engage in repetitive and predictable sequences with the parent. The child may initiate or respond to the parent's lead and the child's actions depend on the parent's but are not necessarily a direct imitation of the parent's actions. Within two consecutive intervals, the child must respond more than once to a parent's turn-taking initiation or if the child initiates, he or she must repeat an action at least once after a parent's response. An instance of turn taking, for example, appears when a child initiates rolling a ball to his or her parent, the parent rolls the ball back, and then the child waits to have his or her turn to roll the ball again to the parent. Through TT, the caregiver encourages social engagement in a reciprocal transaction with the child or vice versa. Turn taking was not coded if the parent used verbal prompts, such as “your turn,” rather than allowing the child to engage by his or her own volition.

Joint Attention

Joint attention is defined in this study as triadic engagement requiring an exchange of looks between a partner and an object or event with both partners engaging socially in reference to the object or event (Mundy 2016; Mundy et al. 2003; Schertz et al. 2018a). Joint attention can take on initiating and responding forms.

RJA

Instances of RJA were coded when the child responded to the parent's bid to draw his or her attention to an object while exchanging looks between the parent and the object to share social interest. During an instance of RJA, for example, the parent holds a stuffed animal close to the child's face as a means of sharing social interest in the toy. The child responds by actively looking between the object and the parent's face. RJA was not coded if the parent solicited the child's attention for the purpose of having the child follow directions or comply with a specific request, for instance, by saying, "Look at the bear" or "Look at my eyes."

IJA

Initiating joint attention in the PJAM requires alternating eye gaze or pointing gestures between a person and an object or event for the purpose of sharing social interest (Mundy 2016; Mundy et al. 2003; Schertz et al. 2018a). Instances of IJA were credited when the child drew a parent's attention to an object or event for the clear purpose of sharing social interest while exchanging looks between the parent and object or event. Drawing attention may appear, for example, when the child deliberately points to and looks at an object, holds out or taps an object for the purpose of showing, or comments on an object. These actions are observable as social in nature; that is, they show evidence of social engagement with the parent, for example, by showing excitement about sharing their experience of the object with the parent, such as with an accompanying laugh or smile. IJA was not credited if there was no exchange of looks between the parent's face, the child, and object or event with positive social affect. IJA was also not credited for requesting (e.g., reaching as if to ask the parent for help obtaining a desired object, or giving candy to the parent as if to request that the parent remove the wrapper). This is a more conservative interpretation of joint attention than some have used (Kasari et al. 2006, 2008), but was adopted to provide assurance that joint attention was fully represented in the child's repertoire.

Results

A correlational design was used to address the hypotheses that the number of TT instances is correlated with the number of instances of IJA and with the number of instances of RJA. Spearman's rank-order correlation coefficient (r_s), a non-parametric measure (Spearman 1904), was used to determine the strength and direction of the relationship between TT and the two joint attention variables (IJA and RJA) in interactions between the toddlers and their caregivers. Spearman's r_s is appropriate for the data

set because it measures increasing or decreasing trends, which may or may not be linear, can work with interval-scaled data, and is robust to outliers (Altman and Krzywinski 2015). This method of analysis was chosen because the data were not normally distributed and because of outliers in our sample. Through testing, the data met Spearman's r_s assumptions, making it a suitable approach for this study. The data were interval-scaled and met the assumption of monotonic relationships, which were identified by graphing data in scatter plots. Descriptive statistics for TT, RJA, and IJA are presented in Table 2. The possible range of intervals per child is 0 to 180 for TT, RJA, and IJA from 3 videos.

Correlational analysis revealed a significant positive relationship between instances of TT and IJA, $r_s(59) = 0.28$, $p < .05$, one-tailed. Specifically, there was a tendency for participants who showed more TT to also show more IJA. The coefficient of determination (R^2) was calculated and indicated that 7.84% of the variance in TT is shared with IJA. No significant relationship was found between TT and RJA, $r_s(59) = 0.14$, $p = 0.14$, one-tailed.

Discussion

Individuals with autism have challenges in joint attention, and early intervention research has focused on promoting joint attention by incorporating a turn-taking component (e.g., Kasari et al. 2006; Rocha et al. 2007; Schertz and Odom 2007; Schertz et al. 2018a). The purpose of this study was to explore the relationship between turn taking and joint attention. In partial support of our hypothesis, we found a relationship between turn taking and initiating joint attention but no significant relationship between turn taking and responding to joint attention. Specifically, children who were more competent in turn taking were more competent in initiating joint attention. This finding points to the need for further research to investigate whether promoting competency in turn taking may support learning to initiate joint attention.

Table 2 Descriptive statistics for TT, RJA and IJA measures in number of 10-s intervals

Variable	M	SD	Range
TT	4.62	10.02	0–60.00
RJA	8.78	8.34	0–33.00
IJA	9.44	9.38	0–41.00

Note The possible range of total intervals for TT, RJA, and IJA is 0–60

Implications

Studies of associations between joint attention and later development have generated important knowledge about preverbal social underpinnings. For example, Mundy et al. (1990) explored the relationship of joint attention to later language in children with autism and Morales et al. (2000) investigated the correlation between temperament, responding to joint attention, and receptive and expressive language. Both studies found a significant association of joint attention with later language development, highlighting the importance of acquiring this competency in early childhood. However, prior to the present study, there have been no reported attempts to analyze associations between joint attention and its theorized foundational precursors, such as turn taking (Schertz et al. 2018a). Although not causal, the findings of this study add support to the theory that turn taking is foundational for joint attention.

Because of turn taking's potential foundational role in supporting initiating joint attention, our findings have implications for future practice. Including a turn-taking component in intervention for young children with autism may, by accelerating progress toward the more advanced social communication competency of joint attention, also advance learning of verbal forms of social communication which, others (e.g., Charman 2003; Jones et al. 2006; Toth et al. 2006) have shown, is linked to learning of joint attention. Further study is needed to substantiate these findings and explore whether differences with respect to responding and initiating forms of joint attention and their relation to turn taking are upheld.

A question remains of why the association between turn taking and initiating joint attention was significant whereas that between turn taking and responding to joint attention was not. On the one hand this finding might have been unexpected since, across multiple studies, initiating joint attention has been found to be somewhat more difficult than responding for toddlers with autism to acquire and maintain (e.g., Jones et al. 2006; Mundy et al. 1994; Schertz and Odom 2007; Schertz et al. 2013, 2018a). A possible explanation is that turn taking requires a degree of voluntary initiative (i.e., to keep the back-and-forth engagement going) whereas responding to joint attention depends on a partner's initiation. This feature of initiative in turn taking may better prepare the child for initiating than for responding to others' joint attention overtures because both turn taking and initiating joint attention involve expressive forms of social communication while responding to joint attention does not require initiation. Turn taking was defined in this study as social non-instrumental interactions between the children with autism and caregivers (Schertz et al. 2018b). Distinctions between instrumental and social turn taking should be explored in

future studies to more specifically identify how each form may relate to joint attention.

Limitations

This study has a few limitations that should be considered. Increasing the *n* may result in a greater power and a more significant effect size. Another limitation is that this study is secondary to an intervention study (i.e., JAML) that was not primarily designed to analyze the relationship between turn taking and joint attention. A disadvantage of secondary data is that it is not drawn from a study specifically designed to test the hypotheses (Cheng and Phillips 2014). It might therefore be pertinent in the future to investigate this correlation using data from a study designed to directly address the given hypotheses.

The JAML intervention is transactional, meaning that one partner's actions depend on another partner's action. Therefore, a child's engagement in TT or JA may be positively or negatively influenced by the parent's sensitivity or responsiveness, a factor that was not measured in this study. Finally, as was discussed previously, turn taking is theorized to be foundational to joint attention; however, this research did not address this directional relationship and, thus, this theory in relation to this study should be considered with caution. Because of the correlational nature of the present study, future studies should examine these variables longitudinally, which may provide further insight into turn taking as a foundation to joint attention.

Conclusion

To identify the relationship between turn taking and both forms of joint attention, this study analyzed instances of turn taking, responding to joint attention, and initiating joint attention for 61 toddlers with autism who received intervention to promote learning in all three areas. Results indicate a positive relationship between instances of turn taking and initiating joint attention and point to the need for further study of these associations and of foundational intervention approaches that promote joint attention for young children with autism.

Author Contributions KL conceived, designed, and implemented the study, and coordinated and developed all sections of the manuscript. HHS contributed to the introduction and discussion sections and provided access to the data set. All authors read and approved the final manuscript.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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