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Article

Communicative behaviours of sibling dyads composed of a child with autism and a typically developing child

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Abstract

This study documented the communicative behaviors exhibited by sibling dyads comprised of one typically developing child and his/her sibling with autism. Six US families participated in one 45-minute home observation of sibling interactions, a 20-minute semi-structured interview with the typically developing child, and a 20-minute semi-structured interview with the siblings' parents. Dyads varied across birth order, ages, and genders. Observational data were coded to reveal 38 categories of communicative behaviors and their frequency of occurrence. Interviews yielded information about the siblings' usual interactions and parents' perceptions about their children's relationships. Families provided evidence of sibling support for the communication skills of the child with autism. Findings have implications for sibling-mediated facilitation of communicative behaviors in children with autism.

KEYWORDS: AUTISM; AUTISM – SIBLINGS; AUTISM – PARENTS; AUTISM – FAMILIES; AUTISM – SCHOOL-AGE CHILDREN

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Introduction

The Diagnostic and Statistical Manual of the American Psychological Association, fifth edition (DSM-5, 2013) defined autism spectrum disorder (ASD) as a developmental neurological disorder characterized by: (1) persistent deficits in social communication and social interaction; and (2) restrictive and repetitive patterns of behavior. Social communication and social interaction deficits manifest as difficulties with social-emotional reciprocity, nonverbal communication, and interpersonal relationships. Restrictive and repetitive patterns of behavior include repetitive movements (hand flapping, torso rocking), ritualized behaviors (e.g. compulsions for maintaining uninterrupted routines), fixated interests (hyper-focus on areas of fascination), and hypo-reactivity or hyper-reactivity to sensory input. These symptoms may cause persons with ASD to exhibit behaviors that they and their caregivers have difficulty managing.

Several factors appear to underlie the persistence of deficits in social communication and social interaction in persons with ASD. Considerable research has explored a fundamental deficit in individuals' underlying attention to social stimuli. This attentiveness is a basic component of the social cognition that is necessary for learning and interacting. Moscowitz (2005) defined social cognition as the mental processes involved in perceiving, attending to, remembering, thinking about, and making sense of the people in the social world. Social cognition enables people to acquire communicative behaviors from direct and indirect learning experiences. Atypical attention to social stimuli may make it difficult for persons with ASD to observe the social models that would demonstrate how to reciprocally communicate, interact, and alter behaviors to meet environmental demands. Deficits in social communication and social interaction may be a consequence of the inability to attend appropriately to relevant social models.

Hanley *et al*. (2014) suspected that individuals with ASD may reduce their attention to social stimuli because of their increased attention to background stimuli and objects. Dawson, Meltzoff, Osterling, Rinaldi, and Brown (1998) found that individuals with ASD oriented more frequently to nonsocial stimuli (e.g. a toy) than to social stimuli and thus proposed that individuals with ASD endure constant competition within their attentional systems to process social stimuli instead of nonsocial stimuli. Social eye contact complements attention to social stimuli; however, persons with ASD may attend to social stimuli but may not gaze at the eyes of the persons within their social field.

Building social communication and social interaction

Interventions to improve social communication and social interaction in children with ASD employ various approaches that help children direct their attention to social stimuli and communication models so that observational learning may occur. A typically developing child (henceforth 'TDC') acquires social communication skills observationally, by watching others and imitating what is witnessed (Taumpoepeau and Reese, 2014). Some interventions for children with ASD employ parents, peers, and/or siblings as models of social communication skills in context, in school, or at home (Winner and Crooke, 2009). For example, intervention programs such as the Preschool Autism Communication Trial (PACT) (Casenhiser, Shanker, and Stieben, 2011) help children attain attention, observational learning, and imitation skills by encouraging children with ASD to visually and auditorily attend to a model and imitate the modeled gestures, actions, vocalization, verbalizations, or spoken words. Observational learning is not a passive task. A learner must be engaged in an authentic, meaningful interactional context. Observation serves as the antecedent for active engagement.

Learning through parents and peers

Parents promote communication skills for children with ASD during daily activities. Often, parents learn to interpret their children's unique behaviors that may be unclear to other people (Krammer and Kowal, 2005). Parents adapt their language to meet the needs of their children and ensure their children's comprehension (Raghavendra, Olsson, Sampson, McInerney, and Connell, 2012). Children may have to do little to translate their observational learning into actions, because parents are often very explicit teachers.

Peers serve as models in academic and play settings. Peers are unlikely to modify their language to facilitate their peers' understanding (Cutting and Dunn, 2006; Kramer and Kowal, 2005). Peers generally seek to play or socialize with other children rather than to teach or guide them (Gordon-Pershey and Visoky, 2002; Guralnick, Connor, Hammond, Gottman, and Kinnish, 1996; Visoky and Poe, 2000). Children who learn from peers employ attention to social stimuli to achieve self-mediated observational learning. They regulate their attention so that they can notice their peers' behaviors; they observe the nature of the interactional context, and they learn about how participants continually negotiate meaning within that context. They select the types of responses that would best serve the interactional setting.

Learning through siblings

Siblings often experience life alongside one another and provide each other with friendship and support. They bond during experiences that are distinct to siblings. Parents commonly socialize siblings to take care of and teach one another (cf. Green, 2013; Orsmond and Seltzer, 2007; Sage and Jegatheesan, 2010). According to McHale, Updegraff, and Whiteman (2012), sibling influences are sometimes stronger than parental influences and are potentially as strong as peer influences.

Jones and Schwartz (2004) proposed that learning from a model requires a powerful relationship between a learner and a model, which is possibly descriptive of siblings because of their family ties and close bonds. Jones and Schwartz noted that models are effective when there is a lengthy relationship between the learner and the model; this is also potentially descriptive of many siblings because of their lifelong relationships.

Sibling dyads where one child has ASD

The interactions of sibling dyads where one child has ASD can be presumed to differ from dyads where both children are typically developing. A strong sibling relationship encompasses a mutual understanding that leads to reciprocal benefits. A weaker relationship may involve a lack of mutual understanding that does not lead to reciprocal benefits as readily. Difficulties with social-emotional reciprocity among siblings with ASD (henceforth 'SibA') might inhibit sibling dyads from developing stronger relationships. El-Ghoroury and Romanczyk (1999) identified that higher levels of intimacy were expressed by TDCs toward SibAs who evidenced stronger social cognition skills and with whom they could share social-emotional reciprocity.

Role symmetry, which implies a sense of similarity or equality of social roles, may contribute to social-emotional reciprocity and therefore to stronger relationships. However, Knott, Lewis, and Williams (2007) found that sibling dyads composed of TDCs and SibAs exhibited role asymmetry. Knott *et al.* reported that, regardless of age, TDCs exhibited assertive communicative responsibilities when engaging with their SibAs, with the SibAs being more passive communicators. TDCs initiated, led, and modeled interactional behaviors that SibAs responded to or merely accepted. However, SibAs evidenced assertiveness in the form of prosocial communicative behaviors (e.g. sharing, cooperating, requesting, praising, comforting, physical affection, laughing, and smiling) and antagonistic communicative behaviors (e.g. physical aggression, object struggle, commanding, and threating) when engaging with their TDC siblings.

Whether symmetrical in their sibling roles or not, SibAs have been shown to be communicatively interactive with their TDC siblings. Some SibAs verbally initiated social interactions with their TDC siblings more often than with their parents (Knott *et al*., 2007).

Typical siblings can provide optimal models for observational learning. Past studies reported that TDC siblings were effective in teaching positive behavior (Grindle, Kovshoff, Hastings, and Remington, 2009), as well as social communication skills and play skills (Tsao, Davenport, and Schmiege, 2012) to their SibAs. Tsao *et al*. stated that SibAs benefited from observing their siblings' typical social interactions. Knott *et al*. (2007) found that sibling dyads composed of TDCs and SibAs spent almost 40 minutes of every at-home hour together, which was a substantial amount of time during which observational learning could occur.

The ages of the siblings may have an impact on their interactions. Younger TDCs can offer positive benefits to SibAs. Younger TDCs may exhibit social cognition skills similar to those that SibAs exhibit. Brewton, Nowell, Lasala, and Goin-Kochel (2012) found that children with ASD were more likely to acquire social skills from younger TDCs than from older TDCs. Meyers and Vipond (2005) observed that older TDCs could be more effective because they model higher-level skills, promote structure within social interactions, offer corrective feedback, and exhibit the persistence to teach social skills.

TDCs' feelings toward their SibAs and their knowledge of ASD

Orsmond and Seltzer (2007) interviewed TDCs to collect information about their feelings toward their SibAs. TDCs felt positively about their SibAs and wanted to play with them frequently, but they felt embarrassed when their SibAs engaged in disruptive behavior. Green (2013) found that TDCs expressed mixed feelings toward their SibAs. Negatively, TDCs shared feelings of disappointment and discomfort when their SibAs were unable to communicate thoughts and when the TDCs were unable to interpret the SibAs' communicative attempts. Positively, TDCs reported that growing up with their SibAs afforded them less sibling conflict, greater family resilience, increased self-perceived competence, increased flexibility, and positive psychosocial and emotional development. Green (2013) found that TDCs felt greater admiration and acceptance of their SibAs and showed less verbal aggression toward their SibAs than was found in sibling dyads where both children were typically developing.

Another consideration that could affect sibling relationships is the TDCs' knowledge about ASD. How parents teach their TDCs about ASD is unique for every family. According to Glasberg (2000), parents often overestimate

how much their TDCs understand about ASD. Glasberg (2000) interviewed TDCs ages 5 to 17 years and discovered that these TDCs viewed their SibAs from a preoperational standpoint, which means that the TDCs thought that their SibAs could see, feel, and hear the same way as they did. In the Sage and Jegatheesan (2010) study, many of the participating TDCs were unable to explain ASD or provide characteristics of the disorder.

Rationale for and purpose of the present study

Past researchers recommended continued exploration of TDCs' communication behaviors and feelings toward their SibAs (Pilowsky, Yirmiya, Doppelt, Gross-Tsur, and Shalev, 2004), and TDCs' understanding of ASD (Baker, 2000; Orsmond and Seltzer, 2007; Sage and Jegatheesan, 2010). Sibling dyad research has the potential to describe the ways that observational learning for children with ASD occurs, and may suggest strategies for how parents and professionals teach TDCs to engage with their SibAs. Studies of TDCs' knowledge about ASD are crucial to helping families provide successful learning environments at home, and may inform education for TDCs that could reconcile some of their misconceptions, frustrations, or unease. More research is needed to lay the foundation for sibling-mediated interventions and offer a rationale for its benefits.

The purpose of this study was to document communicative behaviors exhibited by a sample of TDCs and their SibAs during interactions within one 45-minute home observation. Under investigation were the role symmetry of the siblings as revealed by the TDCs' directive and teaching behaviors and the communicative behaviors exhibited by the SibAs that reflected observational learning. TDCs were interviewed to elicit information about their perceptions of their SibAs and their knowledge about ASD. Parent interviews elicited perceptions of their children's relationships and of their TDCs' understanding of ASD.

The research questions were:

1. What communicative behaviors occur between TDCs and SibAs in their home settings?
2. How do TDCs describe their interactions with their SibAs?
3. How do parents describe the relationship of their TDC and their child with ASD, and their TDC's understanding of ASD?

Methods

Participants

The researchers obtained the approval of their university's Institution Review Board for human participants in research, as well as written consent from the clinical director of an autism center where the researchers intended to recruit participants (and where the second author was employed). The director provided email addresses of parents whose children attended the center, allowed the researchers to send parents a recruiting email, and allowed the second author to speak at a parent meeting.

The autism center is located within a US Midwestern metropolitan area. About 50 to 60 students ages 2.5 to 22 years are schooled there. Teachers implement applied behavior analysis treatment and interest-based intensive instruction to teach academics and life skills.

Participant selection parameters included being age 4 to 17 years, on the basis that this age range would provide a view of children at various points in their development, and that TDCs would be living at home with their SibAs. The researchers hoped to obtain a diverse sample of children with ASD representative of the US demographic. The Special Education Elementary Longitudinal Study (Sanford, Levine, and Blackorby, 2008) indicated that 68% of US school-age children with ASD were Caucasian, and 15% were African American (with the remaining 17% composed of other demographic groups, such as Hispanic or Asian, and unidentified persons). The autism center enrolment was near 80% Caucasian and 20% African American.

Sample

The respondents to recruitment included five Caucasian families and one African American family; thus, the sample obtained was about 84% Caucasian and 16% African American, which was close to the autism center's demographic and somewhat close to the US demographic. This sample did not include any children from other demographic groups. All resided in suburbs where the 2013 median income per household was estimated at $49,000 to $71,000 (United States Census, 2015).

Some of the families had other children who did not participate in the study, but data on the number of other children in the families was not obtained. None of the families had other children who qualified for the study (ages 4 to 17 years). As participants, Family 1 included mother, a younger TDC sister, age 4, and an older SibA brother, age 9. Family 2 included mother, father, a younger TDC sister, age 12, and an older SibA sister, age 15. Family 3 included mother, a younger TDC brother, age 11, and an older SibA brother, age 15. Family 4 included mother, father, an older TDC brother, age 16, and a younger

Table 1: *Characteristics of Sibling Dyads*

Birth Order	*Family1*	*Family2*	*Family3*	*Family4*	*Family5*	*Family6*
Younger TDC	Female 4 yrs.	Female 12 yrs.	Male 11 yrs.			
Older SibA	Male 9 yrs.	Female 15 yrs.	Male 15 yrs.			
Older TDC				Male 16 yrs.	Male 12 yrs.	Female 12 yrs.
Younger SibA				Female 11 yrs.	Male 10 yrs.	Male 7 yrs.

SibA sister, age 11. Family 5 included mother, an older TDC brother, age 12, and a younger SibA brother, age 10. Family 6 included mother, father, an older TDC sister, age 12, and a younger SibA brother, age 7.

Table 1 shows the birth order, genders, and ages of the six sibling dyads. There was an equal number of TDCs who were older and who were younger, and an equal number of male TDCs and female TDCs. Four SibAs were male and two SibAs were female. Range of ages for TDCs was 4 to 16 years; for SibAs, 7 to 15 years.

Procedures

Families permitted the second author to conduct one home visit consisting of one 45-minute observation of the TDCs interacting with their SibAs while engaging in daily activities, followed by a 20-minute semi-structured interview with the TDC, and then a 25-minute semi-structured interview with the parent(s). At the start of each visit, the participants signed adult consent and child assent forms, and the researcher asked the TDCs and the SibAs to engage in activities of their choosing (e.g. play, snack, a simple household chore, and/or a backyard outdoor activity) while the researcher remained nearby to observe. No audio or video recording was utilized in order to maintain the naturalness of the environment and reduce apprehension about confidentiality. The researcher's field notes captured verbal and nonverbal communicative behaviors exhibited by the TDCs and by the SibAs.

The researcher asked parents whether they wanted to be present for the TDC's semi-structured interview and whether the TDCs were going to stay for the parents' semi-structured interview. Responses to the semi-structured interview questions were written down. The researcher then left the home visit and coded the field notes on the same day as the visit.

Instrumentation

Coding the communicative behaviors observed

Although the researcher entered the observations with the intent of capturing open-ended field notes, the researchers had some *a priori* conceptions of the verbal and nonverbal communicative behaviors that might be observed based on behaviors suggested by similar studies of communicative interactions (Baranek, Watson, Boyd, Poe, David, and McGuire, 2013; Bass and Mulick, 2007; Ferraioli, Hansford, and Harris, 2012; Gordon-Pershey and Visoky, 2002; Knott *et al.*, 2007; Malesa, Foss-Feig, Yoder, Warren, Walden, and Stone, 2012; Meyers and Vipond, 2005; Oppenheim-Leaf, Leaf, Dozier, Sheldon, and Sherman, 2012; Van der Paelt, Warreyn, and Roeyers, 2014). The researchers constructed a list of codes for verbal and nonverbal communicative behaviors that could be assigned to the communicative behaviors documented in the field notes. Coding would collapse the open-ended notes into categories of communicative behaviors.

The researchers identified 20 codes for communicative behaviors. Of these 20, the researchers anticipated that both the TDCs and the SibAs would exhibit 11 communicative behaviors:

- *Body movement used to convey a communicative message; sign language or gesture* (point, wave)
- *Action used to convey positive emotions* (holding hands, hugging, smiling, laughing, comforting, patting)
- *Spoken message to cause discomfort* (criticism, quarreling)
- *Unspoken message to cause discomfort* (hitting, destroying toys)
- *Questions*
- *Invitation directed toward another to engage in a social interaction* (initiation using language, initiation using motoric behavior, initiation using gesture)
- *Eye contact*
- *Giving an object by handing or pushing it closer*
- *Answer in a positive way* (verbal or nonverbal)
- *Directing sounds to an object*
- *Say the same communicative message as another person* (repeating verbatim, repeating partially verbatim, attempting to repeat).

The researchers anticipated that only the TDCs would exhibit four communicative behaviors:

- *Verbal language to promote behavior* (encouragement, praise)
- *Body movements to promote behavior* (high-five, sensory input, nodding)

- *Supports to assist in a task* (rephrase, simplify steps, explanation, verbal model, motoric model)
- *Regulate actions* (commands).

The researchers anticipated that only the SibAs would exhibit five communicative behaviors related to the symptoms of ASD (American Psychological Association, 2013; Autism Speaks, 2015):

- *Vocalization not directed to any person* (random sounds)
- *Directing eyes* (looking at TDC, looking at TDC's play materials, looking at what TDC is doing but not engaging)
- *Parallel play* (playing independently near TDC)
- *Stop communicative interaction* (by walking away or not engaging)
- *Copy motoric behavior*.

The researchers suspected that there would be a need for additional codes to be established inductively after the home observations, to code any unanticipated communicative behaviors. Codes established after the home observations are referred to in the Results section of this report as *a posteriori* codes.

The process of obtaining valid data was dependent upon the data collection skills of the field researcher. Contemporaneous recording of fast-paced interactional data requires well-developed observational skills. The preparation and training of the second author for this task was four-fold. The first aspect of training was embedded in the process of developing the *a priori* codes. The careful planning and selecting of codes prepared the second author for what to observe and document in the TDCs' and SibAs' verbal and nonverbal communicative behaviors. During the planning process the authors discussed examples of the behaviors that would be included in each code, as well as examples of behaviors that would not meet the description of each code. Second, the first author had the prior experience of capturing 10,000 minutes of preschool children's interactional behaviors by using a similar process of open-ended notetaking and subsequent coding on the day of the observation (Gordon-Pershey and Visoky, 2002). The first author trained the second author based on this experience, using examples of the data collection tools from the prior study. The authors met regularly to review the notes and the codings, and reached agreement through discussion rather than through independent ratings. Third, the second author worked at the autism center that the participants attended and was experienced at logging children's behavior data. She possessed the professional knowledge of how to clinically describe the behaviors of children with ASD. Fourth, the authors had professional training as speech-language pathologists, which involves the accurate real-time documentation of verbal and interactional behaviors in clinical settings. The study was designed to use data collection methods that are very similar to the

methods that yield valid performance data in clinical observation contexts. If the SibAs were being assessed clinically, the data collection techniques would have been comparable and, as in many clinical settings, no audio or video data would be captured.

Interview questions

The 17 semi-structured interview questions (see Appendix) for the TDCs evolved from a modification of the interview questions used by Baker (2000) and from past studies that suggested that TDCs' knowledge about ASD might influence their sibling relationships (Glasberg, 2000; Green, 2013; Grindle *et al.*, 2009; Sage and Jegatheesan, 2010). For the parents, the researcher generated eight questions based on the literature that discusses parenting children with ASD (Tsao *et al.*, 2012), parental views regarding the etiology of ASD (Sage and Jegatheesan, 2010), and the psychosocial effects of having a child with ASD (Green, 2013; Latta, Rampton, Rosemann, Peterson, Mandleco, Dyches, and Roper, 2014).

Data yielded by the instrumentation

Coding verified the participants' demonstration of communicative behaviors. Across the sibling dyads, the codes allowed for aggregation of findings. Within the dyads, the totals captured their unique communicative interactions. The interviews with TDCs and parents yielded supplemental data. These triangulated data conveyed whether the sources of data were complementary or contradictory.

Results

The field notes recorded the following synopses of the interactions.

SibA1 communicated using vocalizations but exhibited no functional language. The children played in the basement with their mother upstairs in the kitchen. The children initially played with separate toys. SibA1 eventually joined TDC1 on a trampoline, at which point many communicative behaviors took place.

SibA2 spoke only one sentence at a time. She did not converse. SibA2 appeared frustrated when she was unable to convey her thoughts. She exhibited mild physical aggression toward TDC2. Interactions occurred in the kitchen and family room. An older TDC brother who did not participate, the father, and the mother remained in view, continuing about their household routines. TDC2 initiated an art activity lasting 15 minutes. SibA2 played the piano for a short duration. SibA2 selected a book to read with TDC2. Both children read aloud, with TDC2 assisting SibA2.

SibA3 communicated in single sentences to convey basic wants and needs, given encouragement and cues. He was echolalic and vocalized to self-stimulate when he was not interacting with others. The mother facilitated sibling interactions by suggesting games, offering assistance in turn taking, and providing a snack. Interactions occurred in the kitchen and family room. The children engaged in a tabletop game and a floor game. Then, TDC3 played a video game alone while SibA3 was hugged and rocked by his mother.

SibA4 communicated using one- or two-word phrases. She was often silent. The mother and father continued their household routines in the kitchen while the children sat in the family room. SibA4 stayed in the family room for approximately 15 minutes and then joined her mother in the kitchen for a snack. TDC4 watched television in the family room. No interactions between the siblings were observed.

SibA5 generated spontaneous language at the sentence level and incorporated delayed echolalia as functional expression. Interactions occurred in the kitchen, family room, and dining room. TDC5 assisted SibA5 with written homework for 10 minutes. Next, SibA5 engaged in drawing and watching iPad videos. He acted out the video scenes with delayed echolalia and animated facial expressions. TDC5 remained in sight of SibA5. TDC5 checked-in by touching SibA5 occasionally and looking at him. TDC5 did not place any demands for conversing or playing.

SibA6 used phrases to convey wants and needs. SibA6 initiated verbal expression to invite TDC6 to play. SibA6 produced vocalizations to express emotions. Interactions occurred in the kitchen, bedroom, family room, and basement. The children engaged in chase, tickle, and a snack. The mother remained in the kitchen continuing her household routines.

Creating a posteriori *codes*

The observations of the six families resulted in adding 18 *a posteriori* codes of communicative behaviors. The cumulative *a posteriori* coding process is described below on a family-by-family basis.

After coding family 1 field notes according to all of the *a priori* codes, the researchers tallied 52 communicative behaviors out of the 175 observed communicative behaviors (29.71%) that could not be coded using the *a priori* codes. The 52 communicative behaviors were comprised of 29 communicative behaviors (55.76%) by TDC1 and 23 communicative behaviors (44.23%) by SibA1. The researchers established six *a posteriori* codes. Listed below are the four codes established for TDC1, followed in parentheses by the number of times the behavior occurred:

TDC copies motoric behavior of SibA (14)
Hand-over-hand prompt (7)
Narrate (4)
Take a desired object (2)

One code was established for SibA1:

Sounds with motoric self-stimulation (9)

One code was established for TDC1 and SibA1:

Does not respond (2 for TDC1; 14 for SibA1)

The communicative codes established *a posteriori* after family 1 were used *a priori* when observing family 2, family 3, family 4, family 5, and family 6. After coding family 2 field notes using all of the codes, the researchers tallied 57 communicative behaviors out of the 327 observed communicative behaviors (17.43%) that could not be coded. The 57 communicative behaviors were comprised of 35 communicative behaviors (61.4%) by TDC2 and 22 communicative behaviors (38.59%) by SibA2. The researchers established six *a posteriori* codes. One code accounted for the 35 communicative behaviors exhibited by TDC2:

Teaching moments (20)

Four codes accounted for the 22 communicative behaviors of SibA2:

Perseveration (10)
Grabbing (7)
Mad face (2)
Head-butting (2)

One code was established for TDC2 and SibA2:

Statement (15 for TDC2; 1 for SibA2)

The communicative codes established after family 2 were used *a priori* when observing family 3, family 4, family 5, and family 6. After coding family 3 field notes using all of the codes, the researchers tallied 49 communicative behaviors out of the 160 observed communicative behaviors (30.63%) that could not be coded. The 49 communicative behaviors were comprised of three communicative behaviors (6.12%) by TDC3 and 46 communicative behaviors (93.87%) by SibA3. The researchers established three *a posteriori* codes. One code accounted for the communicative behaviors by TDC3:

Tease remark (2)

One code was established for SibA3:

Vocal self-stimulation (45)

One code was established for TDC3 and SibA3:

Taking turns (1 for TDC3; 1 for SibA3)

The codes established after family 3 were used *a priori* when observing family 4, family 5, and family 6. The family 4 siblings did not engage in any interactions during the observation. No *a posteriori* codes were established for family 4.

The codes established after family 3 were used *a priori* when observing family 5 and family 6. After coding family 5 field notes according to all of the codes, the researchers tallied six communicative behaviors out of the 162 observed communicative behaviors (3.7%) that could not be coded. The six unaccounted for communicative behaviors were comprised of one behavior (16%) by TDC5 and one behavior (16%) by SibA5. The researchers established two *a posteriori* codes. One code accounted for the communicative behavior by TDC5:

Comforting (1)

One code was established for SibA5:

Crying (5)

The communicative codes established after family 5 were used *a priori* when observing family 6. After coding family 6 field notes using all of the codes, the researchers tallied five occurrences of communicative behaviors out of the 356 observed communicative behaviors (1.40%) that could not be coded. The five communicative behaviors (100%) produced by SibA6 were assigned one code:

General signs of affection unaccounted for (6)

In summary, 38 codes documented every communicative behavior exhibited by the TDCs and the SibAs. Twenty codes were established deductively, based on the literature, *a priori*, and 18 were established inductively, based on observed behaviors, *a posteriori*. The amount of data that required *a posteriori* coding was 82.87%, comprised of 29.71% in family 1, 17.43% in family 2, 30.63% in family 3, 0% in family 4, 3.7% in family 5, and 1.4% in family 6. Only 17.13% of the data was accounted for by the *a priori* codes.

Aggregate of across-dyad communicative behaviors

Some communicative behaviors were exhibited by both the TDCs and the SibAs; some were exhibited only by the TDCs; and still others only by the

Table 2: Frequency of Occurrence of the Communicative Behaviors Used by TDCs and SibAs

	Used by TDCs and SibAs	*Used by TDCs*	*Used by SibAs*
A priori for TDCs and SibAs			
Body movement used to convey a communicative message; sign language or gesture (point, wave)	TDCs 1 (0.17%) SibAs 1 (0.17%)		
Action used to convey positive emotions (holding hands, hugging, smiling, laughing, patting)	TDCs 8 (1.36%) SibAs 56 (9.06%)		
Spoken message to cause discomfort (criticism, quarreling)	0		
Unspoken message to cause discomfort (hitting, destroying toys)			6 (0.97%)
Questions	TDCs 44 (7.51%) SibAs 7 (1.13%)		
Invitation directed toward another to engage in a social interaction (initiation using language, initiation using motoric behavior, initiation using gesture)	Language: TDCs 29 (4.95%) SibAs 26 (4.21%) Motor and gesture: TDCs 47 (8.02%) SibAs 19 (3.07%)		
Eye contact	TDCs 37 (6.31%) SibAs 37 (5.99%)		
Giving an object by handing or pushing it closer		9 (1.53%)	
Answer in a positive way (verbal or nonverbal)	TDCs 42 (7.17%) SibAs 123 (19.90%)		
Directing sounds to an object			3 (0.49%)
Say the same communicative message as another person (repeat verbatim, partially verbatim, attempt to repeat)	TDCs 8 (1.36%) SibAs 17 (2.75%)		
A posteriori for TDCs and SibAs			
Does not respond	TDCs 21 (3.58%) SibAs 51 (8.25%)		
Statement	TDCs 35 (6%) SibAs 4 (0.65%		
Taking turns	TDCs 1 (0.17%) SibAs 1 (0.16%)		
A priori for TDCs			
Verbal language to promote behavior (encouragement, praise)		30 (5.11%)	
Body movements to promote behavior (high-five, sensory input, nodding)	TDCs 2 (0.34%) SibAs 2 (0.32%)		

Supports to assist in a task (rephrase, simplify steps, explanation, verbal model, motoric model)		33 (5.63%)	
Regulate actions (commands)		130 (22.18%)	
A posteriori for TDCs			
TDC copies motoric behavior of SibA		16 (2.73%)	
Hand-over-hand prompt		8 (1.37%)	
Narrate		8 (1.37%)	
Take a desired object		5 (0.85%)	
Teaching moment		25 (4.27%)	
Tease remark		7 (1.19%)	
Comforting		1 (0.17%)	
A priori for SibAs			
Vocalization not directed to any person (random sounds)			49 (7.93%)
Directing eyes (looking at TDC, looking at TDC's play materials, looking at what TDC is doing but not engaging)			40 (6.47%)
Parallel play (play independently near TDC)	TDCs 1 (0.17%) SibAs 1 (0.16%)		
Stops communicative interaction by walking away or not engaging	0		
Copy motoric behavior			3 (0.49%)
A posteriori for SibAs			
Sounds with motoric self-stimulation			90 (14.56%)
Perseveration			11 (1.78%)
Grabbing			8 (1.29%)
Mad face			2 (0.32%)
Head-butting			2 (0.32%)
Vocal self-stimulation			45 (7.29%)
Crying			7 (1.13%)
General signs of affection unaccounted for			6 (0.97%)

SibAs. The total number of communicative behaviors produced by the TDCs was 586. The total number of communicative behaviors exhibited by the SibAs was 594. The grand total was 1,180 behaviors.

Table 2 reports the frequency of occurrence of the communicative behaviors used by the TDCs and SibAs, or by the TDCs alone, or by the SibAs alone. Of the 11 anticipated behaviors for the TDCs and the SibAs, seven were observed: *bodily movement to convey a communicative message; action used*

to convey positive emotion; questions; initiations using language, motor, or gesture; eye contact; answer in a positive way; say the same message as another person. *Giving an object* was anticipated for both siblings, but only enacted by TDCs. Two behaviors anticipated for both siblings were used only by the SibAs (*unspoken message to cause discomfort; directing sounds to an object*). One behavior was not observed (*spoken message to cause discomfort*).

Of the four anticipated behaviors for the TDCs, all were observed: *verbal language to promote behavior; supports to assist in a task; regulating actions;* and *bodily movements to promote behavior*. The SibAs also produced *bodily movements to promote behavior*. Of the five anticipated behaviors for the SibAs, three were enacted: *vocalizations not directed to any person; directing eyes at TDCs' actions;* and *copy motor behavior*. SibAs and TDCs both engaged in *parallel play*. No participants *stopped interactions* by walking away.

The three *a posteriori* codes for communicative behaviors by the TDCs and SibAs were: *does not respond; statement;* and *taking turns*. The seven *a posteriori* codes for communicative behaviors by the TDCs were: *TDC copies motoric behavior of SibA; hand-over-hand prompt; narrate; take a desired object; teaching moment; tease remark;* and *comforting*. The eight *a posteriori* codes for communicative behaviors by the SibAs were: *sounds with motoric self-stimulation; perseveration; grabbing; mad face; head-butting; vocal self-stimulation; crying;* and *general signs of affection unaccounted for elsewhere*.

Comparing TDCs and SibAs across dyads

In comparing the aggregate data for the TDCs and the SibAs, the most frequently occurring communicative behavior exhibited by the TDCs was *regulate actions* (commands), with 130 occurrences. This represented 22.18% of their total behaviors. SibAs did not produce commands. The most frequently occurring communicative behavior exhibited by the SibAs was *answering in a positive way*, with 123 occurrences (19.90% of their total behaviors). TDCs also *answered in a positive way*, 42 times (7.17% of their behaviors). The next most frequently occurring behavior was the SibAs' *production of sounds with motoric self-stimulation*, at 90 behaviors (14.56% of their overall behavior). TDCs did not *produce sounds with motoric self-stimulation*. SibAs produced 56 behaviors (9.06%) that involved *actions to convey positive emotions*. TDCs did this as well, on eight occasions (1.36%). To summarize the less frequent occurrences, a few behaviors occurred as about 8% of the demonstrated behaviors: TDCs *initiated using motor and gesture; asked questions*; and *answered in a positive way*; SibAs *produced vocalization not directed to any person; vocal self-stimulation*; and *did not respond*. All other behaviors occurred with lower frequency than about 8%.

Within dyad data

Within each sibling dyad, the communicative behaviors captured the unique interactions exhibited by the TDCs and the SibAs. Some of the behaviors are described below.

Family 1

Participants included a TDC sister, 4 years old (TDC1), and a SibA brother, 9 years old (SibA1). TDC1 persistently pursued play with SibA1. TDC1 *regulated actions* with 45 commands, such as, 'Don't let go until I'm done. Put your hands together'. TDC1 *exhibited initiation using motoric behavior* 14 times and *using language* five times. TDC1 provided *hand-over-hand prompts* on seven occasions (e.g. TDC1 took SibA1 by both hands and said, 'Jump'). TDC1 *narrated* four times, and produced three *statements*, 12 *prompts*, six *actions used to convey positive emotions*, and four *teaching moments*. SibA1 *responded* to TDC1 48.15% of the time.

Family 2

Participants included a TDC sister, 12 years old (TDC2), and a SibA sister, 15 years old (SibA2). TDC2 was patient when engaging with SibA2. TDC2 *initiated communicative behaviors* 22 times, where SibA2 *initiated communicative behaviors* twice. TDC2 *regulated actions* using commands 63 times ('Come on. Keep reading'; 'Keep nice hands'), asked *questions* 25 times, made 15 *statements*, and had 20 *teaching moments* (explained words in a book). TDC2 *used verbal language to promote behavior* 25 times ('You're doing so well'). SibA2 *responded* to TDC2 69.62% of the time.

Family 3

Participants included a TDC brother, 11 years old (TDC3), and a SibA brother, 15 years old (SibA3). Their mother facilitated interactions, suggested activities, and assisted with SibA3's initial participation. TDC3 offered 10 commands to *regulate actions*, 11 *language initiations*, one *narration* (when playing a tabletop game, TDC3 said, 'This guy is so hard to put in'), and two *statements* (e.g. 'Last turn'). SibA3 *looked at* TDC3 seven times and at TDC3's play materials six times. SibA3 *produced sounds with motoric self-stimulation* 45 times and *vocal self-stimulation* 45 times.

Family 4

Participants included a TDC brother, 16 years old (TDC4), and a SibA sister, 11 years old (SibA4). TDC4 sat on the couch watching television while SibA4 sat on another couch playing with her iPad. SibA4 looked up from her iPad 14

times to look at TDC4. TDC4 did not offer any language to SibA4 during the observation. SibA4 eventually walked into the kitchen to be near her mother.

Family 5

Participants included a TDC brother, 12 years old (TDC5), and a SibA brother, 10 years old (SibA5). TDC5 assisted SibA5 with homework while exhibiting 12 commands to *regulate actions* (e.g. 'Recount'). TDC5 asked four *questions*. TDC5 *encouraged* SibA5 17 times. SibA5 *responded* 82.35% of the time.

Family 6

Participants included a TDC sister, 12 years old (TDC6), and a SibA brother, 7 years old (SibA6). TDC6 and SibA6 played chase and tickle for 40 minutes. Both children demonstrated reciprocal roles. TDC6 *verbally and motorically initiated play* 29 times. SibA6 complied 86% of the time.

In sum, within dyad data revealed that the TDCs exhibited communicative behaviours to facilitate interactions. SibAs exhibited communicative behaviors to observe and respond to their TDCs during interactions. SibAs' rates of response to TDCs, per family, were 48.15%, 69.62%, 0%, 0%, 82.35%, and 86% of the time. SibAs did not exhibit initiation.

Semi-structured interviews with TDCs and parents

All of the parents remained present for each TDC's interview, but no TDCs were present for the parent interviews. Responses are reported here in summary form.

Overall, the TDCs provided relevant responses without hesitation but did not offer detail to explain their responses. All of the TDCs described SibAs' play mostly as physical, such as playing on swings, playing catch, chasing, and wrestling. The TDCs (except for TDC1, age 4) described their own play as involving video games, board games, and sports. They described their play with their SibA as physical, or as sitting with iPads, videos, and television, and some pretend play, reading, and drawing. They (except for TDC1, age 4) mentioned that their SibAs don't understand board games, video games, sports, or games where children interact. Their frequency of play was 'not often' or a few times per week, and SibAs were reported to play for short periods of time, ranging from a few minutes to about 15 minutes per session. Four of the TDCs said they like to play with their SibA. All TDCs except the 4-year-old stated that autism is a problem with how the brain works and that people with autism cannot speak and communicate well. They (except for TDC1, age 4) variously characterized their SibAs as playful, active, and liking to be alone. TDCs wanted their SibA to be treated like everyone else.

Parents expressed that they explained to their TDCs that autism is a problem where children have difficulty communicating, although each of the parents used their own ways of describing this need. They described the SibA as different, but not 'less', and, as a general trend, told TDCs to be understanding, patient, and kind, and to love their sibling 'the way he is' and that 'It's no one's fault'.

Parents all said there was no specific time when they spoke to their children about autism. Some told their children as soon as the diagnosis was made, but others explained the autism to the TDCs over time, as the TDCs perceived differences or concerns. They all confirmed that they answered TDCs' questions and dealt with problems as they arose. Some stated that tutors and therapists spoke to their TDCs. Some used educational videos. Parents, each in their own words, stated that their TDCs needed time to understand autism. TDCs continued to ask questions about what is wrong and why their siblings do not get better, and show anger and frustration. Some children had misconceptions about autism, such as thinking of autism as being an illness or as being something that the SibA could try to change.

All parents described sibling play among the TDCs and SibAs as physical and rough-and-tumble. The parents noted that SibAs tend to play alone or watch others play. All of the parents stated TDCs show protectiveness, patience, and parent-like behaviors. They also stated that their children did not spend a lot of time playing together, but that they got along when they did. Parents reported that both TDCs and SibAs showed annoyance and tolerance.

Regarding whether the observed interaction was typical, parents explained that their children did not usually play together for as long a time as they had during the observation, but that play was typical.

Comparing observational and interview data

Analyses explored whether the observed communicative behaviors corresponded with the interview responses for each of the families.

Family 1: Some questions appeared too advanced for TDC1, age 4, to answer. TDC1 did not understand that SibA1 was different from her. TDC1 would ask her parents why SibA1 did not talk, and whether SibA1 was younger than she. The data were complementary in that TDC1 played in physical and imaginary ways that were consistent with the information reported during the interviews. TDC1 attempted to modify games to gain SibA1's interest, as revealed by her prompts and encouraging actions.

Family 2: TDC2 stated that SibA2 gets annoyed when forced to do something she does not want to do. TDC2 appeared to understand ASD and SibA2's needs. Parents described TDC2 as a helper who assists SibA2 with

homework and daily activities and watches SibA2 when the parents are away. Parents stated TDC2 learned about ASD from witnessing SibA2's behaviors and development. Parents described SibA2 as social and wanting to be around others, but stated that SibA2 preferred to watch people instead of participating in activities. The data were complementary in that TDC2 engaged with SibA2 in a fashion similar to the way that their relationship was described. TDC2 assisted and taught SibA2 for most of the observation.

Family 3: The mother reported that TDC3 acted bossy at times toward SibA3, but the siblings' relationship is good. TDC3 thought he was older than SibA3. TDC3 participated in home interventions with SibA3. TDC3 and SibA3 rarely interact at home. The siblings independently play video games or watch YouTube. The data were complementary in that TDC3 interacted with SibA3 in a manner that was consistent with the information shared during the interviews. TDC3 engaged with SibA3 when the mother facilitated SibA3's participation. SibA3 exhibited many self-stimulatory behaviors that may have made it difficult for TDC3 to structure communicative interactions and maintain play.

Family 4: The interviews suggested that TDC4 did not fully understand ASD. TDC4 defined ASD as 'Not talking'. TDC4 described playing with SibA4 as sitting around or wrestling. Parents reported that TDC4 assumes that his SibA4 has intelligence and people 'baby' SibA4. Parents stated that TDC4 bosses SibA4 around, and that TDC4 is not willing to 'get into her world'. Parents reported educating TDC4 about ASD and explaining situations as they occurred. The data were complimentary in that TDC4 did not engage with SibA4 during the home observation. The interviews reported very little sibling play and interaction; most of the time SibA4 engages with parents instead of with TDC4.

Family 5: TDC5 had a good understanding of ASD. TDC5 reported that he only plays with his SibA5 for 10–15 minutes because SibA5 needs a break. TDC5 said that he stops playing when SibA5 gets frustrated. TDC5 stated that he always tries to invite SibA5 to play, even when his friends are over. The mother reported educating TDC5 about ASD a little at a time, while instructing him to 'Be patient and kind'. TDC5 recently researched ASD to write a paper for school. The mother shared that TDC5 feels, on the whole, sad and angry that SibA has autism, but that TDC5 and SibA5 'love each other immensely'. TDC5 wonders why his SibA5 had to have ASD. The mother described TDC5 as a teacher. The data were complementary in that TDC5 interacted with SibA5 in a fashion that was consistent with the interviews. TDC5 engaged directly with SibA5 for a short time then allowed SibA5 a break due to SibA5's emotional arousal. TDC5 demonstrated good understanding of SibA5's needs throughout the observation.

Family 6: TDC6 understood aspects of ASD but still required additional education. The parents shared that TDC6 feels sad because TDC6 wants SibA6 to have friends. When asked, 'How do you think SibA6 feels when he plays?' TDC6 responded, 'I think he understands that I am his sister and playing around is what we are supposed to do'. The parents reported that TDC6 plays with SibA6 on SibA6's terms. They get along well. The data were complementary in that TDC6 interacted with SibA6 in a fashion that corresponded with the interviews. TDC6 demonstrated understanding of SibA6's needs by engaging in play that was appealing to SibA6.

Discussion

The present study supplemented the findings about role symmetry reported in the literature (Brewton *et al*., 2012; Knott *et al*., 2007; Meyers and Vipond, 2005). The dyads demonstrated role asymmetry, where the TDCs assumed greater communicative responsibility. TDCs directed play using commands, prompts, positive verbalizations, questions, and teaching moments. SibAs exhibited response behaviors. Younger as well as older TDCs had the more directive role and taught their SibAs. Interviews revealed role asymmetry as well. TDCs believed they had to assist SibAs in play and that SibAs could not play games of high complexity and skill. The TDCs who were the younger members of the dyads readily directed the play of their older SibAs. Parents reported that the TDCs were directive or helpful, which imply role asymmetry.

The literature on TDCs' feelings toward their SibAs was supplemented by the present data. Mixed feelings, with disappointment and discomfort in the presence of love and bonding (cf. Green, 2013), were evidenced. Prior reports about TDCs' incomplete knowledge of ASD (Glasberg, 2000; Sage and Jegatheesan, 2010) were borne out, including Glasberg's discovery that some TDCs viewed their SibAs as having the same capabilities as they. TDCs appeared aware of SibAs' feelings. For example, TDC5 responded to SibA5's frustration over homework by encouraging SibA5 to complete his homework, and then he allowed SibA5 time for solo play. When SibA6 showed that he was happy playing with TDC6, TDC6 responded to SibA6's happiness by giving SibA6 the play he desired for 40 minutes.

Another supplement to past literature pertains to the SibAs' percentage of response to their TDCs' initiations for communicative interactions. SibAs demonstrated attentiveness and may have attained some benefits through observational learning. Knott *et al*. (2007) found that SibAs responded to their TDCs' initiations approximately 50% of the time. The present study found that four of the SibAs responded to TDCs' communicative behaviors close

to or greater than 50% of the time: SibA1 (48.15%); SibA2 (69.62%); SibA3 (66.67%); SibA5(82.35%); SibA6 (86.11%).

Finally, the present study contributed to the study of the methodology for coding communicative behaviors within interactional contexts. The need for inductive coding was evidenced. It was not possible to fully predict the behaviors that would be displayed. The researchers agreed as they rated the data that the *a priori* codes could not accommodate all behaviors. As each family's data were coded, the researchers applied additional reflection on the literature and on their clinical knowledge of autism to create the *a posteriori* codes. It would be unfair to conclude that the past literature did not yield enough information from which the *a priori* codes could be formed. It would also be unfair to conclude that the researchers did not utilize the literature fully. This study demonstrated the utility of allowing *a posteriori* coding to supplement the analysis of data. The fact that the number of behaviors that could not be coded diminished as the study progressed speaks to the consistency of the codes and mitigates threats to the validity of the codes. This study yielded a more complex array of the possible communicative interactions between TDC-SibA dyads than was shown in prior research.

Implications

Families 1, 2, 5, and 6 provided evidence supporting the potential of sibling-mediated interventions for children with ASD. These TDCs engaged with their SibAs without parent facilitation, exhibited communicative behaviors that structured joint play, encouraged SibAs' participation, and maintained communicative interactions. Interviews revealed that these dyads had good sibling relationships that involved caregiving, playing with their SibAs on a fairly regular basis, and teaching their SibAs.

All TDCs were to some extent educated about ASD, yet the parents believed that their TDCs still did not fully grasp ASD. TDCs in families 3 and 4 may benefit from additional education about ASD, to increase their understanding of their SibAs' needs. Parents may help their children by offering TDCs instructions for how to engage their SibAs.

Limitations

Several limitations may have affected the data obtained, with the most pervasive limitation being the Hawthorne effect, wherein the participants' performance may have been unnatural under observation. However, the communicative interactions across the six sibling dyads appeared authentic. The

parents validated that the interactions were typical, except that the dyads played for a longer period of time than they usually did.

The second limitation was that the researchers did not use video recording. However, even if the data obtained during the home observations were not flawlessly captured, the researchers collected substantial data to depict the communicative interactions observed. The field researcher, who was familiar with documenting the behaviors of children at the autism center and was professionally competent in collecting data during clinical speech-language services, was trained in data collection procedures for this study by the first author, who had used the procedures for taking open-ended notes and then coding the data successfully in a prior study (Gordon-Pershey and Visoky, 2002). The authors discussed each rating and reached agreement. These careful procedures for obtaining valid and reliable codes were used to address the limitation that electronic recording was not used.

Future research

More research into sibling dyads can contribute to designing procedures for sibling-mediated interventions. Studies can reveal the communicative behaviors to target for SibAs, identify the sibling interactions that are most conducive to learning, and explore the supports that are needed for TDCs. In the present study, the TDCs showed that certain conditions are beneficial, such as adaptively playing with the SibA on his/her own terms, allowing the SibA to have shorter play periods, and engaging in physical play or quiet play as the SibA desires. TDCs can learn to appreciate that observational learning is a basis for engagement, so TDCs can learn to allow their SibAs to observe as well as participate, and can be encouraged to reward their SibAs for both actions. Adults can help TDCs understand that their SibAs can aspire to self-directed behaviors and can promote more symmetrical sibling roles. These conditions may be useful starting points for targeting sibling-mediated interventions for children with ASD.

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Appendix

TDC semi-structured interview questions

1. Tell me what (SibA name) knows how to play?
2. Tell me what games you like to play?
3. Which games does (SibA name) play with you?
4. Tell me what (SibA name) plays and does?
5. Tell me what (SibA name) can't play and do?
6. How do you invite (SibA name) to play with you?
7. How often do you play with (SibA name)?
8. How often does (SibA name) play with you when you ask?
9. How long will (SibA) play with you?
10. How often does (SibA name) play with you and your friends?
11. What games you like to play with (SibA name)?
12. Which games do you like to play that (SibA name) plays?
13. Do you like to play with (SibA name)? Why or why not?
14. What is autism?
15. Who taught you about autism?
16. How does (SibA name) act? Why?
17. How do you feel about (SibA name)?

Parent semi-structured interview questions

1. What have you told your TDC about autism?
2. When did you talk to your TDC about autism?
3. Do you think your TDC understood your explanation about autism?
4. Where did you get your information about autism?
5. How do your children typically play? Describe.
6. Do your TDC and child with autism participate in activities together? What kinds?
7. How do you think they feel about each other?
8. Did I observe a typical interaction? Explain why or why not.