

Acquisition of Multiple Questions in the Context of Social Conversation in Children with Autism

Rebecca A. Doggett · Anna M. Krasno ·
Lynn Kern Koegel · Robert L. Koegel

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Abstract Verbal initiations, such as questions, are essential components of social conversation often lacking in children with autism. Building on research showing that single questions can be taught in isolation, this study used a multiple baseline design to investigate whether a self-management intervention was effective for teaching concurrent acquisition and discrimination of three social questions in the context of conversation. Following intervention, participants rapidly increased their appropriate use of all three questions in a conversational context and maintained these gains over time. The participants also used questions appropriately with partners uninvolved in treatment. Additionally, the occasional presence of appropriate questions during baseline coupled with rapid improvement during intervention support theories that a lack of question-asking may be motivation-based rather than ability-based.

Keywords Autism · Intervention · Conversation · Question-asking · Communication · Self-management

R. A. Doggett · A. M. Krasno · L. K. Koegel ·
R. L. Koegel (✉)
Counseling, Clinical, and School Psychology Department,
University of California, Santa Barbara, CA 93106-9490, USA
e-mail: koegel@education.ucsb.edu

R. A. Doggett · A. M. Krasno · L. K. Koegel · R. L. Koegel
Koegel Autism Center, University of California,
Santa Barbara, CA 93106-9490, USA

Present Address:

R. A. Doggett
Yale Child Study Center, Yale University School of Medicine,
230 South Frontage Road, New Haven, CT 06520, USA

Introduction

Social conversation is a multifaceted construct that involves a natural and reciprocal exchange of information between two or more people who are engaged in an interpersonal interaction (McTear 1985). Conversation is a ubiquitous part of our social world and is necessary for everyday interactions as well as forming and maintaining relationships with others (Brinton and Fujiki 1989). However, according to diagnostic criteria, individuals diagnosed with autism exhibit a “marked impairment in the ability to initiate or sustain a conversation,” often leading to social isolation (APA 2000, p. 75; Marans et al. 2005). Whether this impairment stems from an inability or lack of motivation is a research question that remains unanswered.

Conversation is comprised of a series of initiations and responses to those initiations. In early development, children with autism make fewer social initiations than typically developing children and use language primarily for requesting objects and protesting, rather than engaging others in a communicative interaction (Stone et al. 1997; Wetherby and Prutting 1984). Impairments in initiations continue beyond childhood, as adolescents and adults with autism typically display an inadequate number of initiations, greatly contributing to a notable deficit in social pragmatics (Frea 1995; Koegel et al. 1998; Koegel and Koegel 2006; Wetherby and Prutting 1984). Without appropriate pragmatics, an individual is likely to be judged by others as boring, rude, disinterested, or inappropriate (Brinton and Fujiki 1989).

Question-asking is a fundamental initiation in social conversation that is used to sustain an interaction between individuals and avoid awkward pauses in the discourse (Kearsley 1976). One of the first questions that typically developing children ask is “*What’s that?*” (Brown 1968; Koegel et al. 1998). More complex *wh*- questions typically

emerge after a child's second birthday (Bloom et al. 1982). Although there is variability in the age of acquisition of expressive *wh*- questions, these forms are acquired sequentially, with *what* and *where* questions used around 26 months and *who* questions by 28 months (Bloom et al. 1982). *How*, *why*, *when*, and *which* questions usually emerge in that order, closer to the child's third birthday (Bloom et al. 1982). As conversation becomes more elaborate, questions are used to make sure that a dialogue is maintained and continued through a series of turns (McTear 1985).

Initiation of question-asking in children with autism has been found to be less frequent than in typical children (Hung 1977; Koegel 2000; Taylor and Harris 1995). In children with autism who ask questions, they are often used inappropriately (Hurtig et al. 1982). However, question-asking is critically important for a child with autism to be considered socially competent during conversation (Koegel 2000) and for more positive longitudinal outcomes (Koegel et al. 1999). Empirical research investigating interventions to improve social communicative initiations is emerging, but remains an area of great need (Koegel 2000; Paul 2008). Furthermore, verbal initiations are considered to be a pivotal area that, when targeted, can produce collateral gains in other desired behaviors that were not directly addressed in intervention (Koegel and Koegel 2006; Oke and Schreibman 1990; Taylor and Harris 1995). Additionally, the presence of initiations is a predictor of overall long-term outcome, highlighting the importance of teaching initiations in treatment programs (Koegel et al. 1999).

This study sought to focus on the pivotal area of question-asking; however, there are other areas that have been shown to be relevant to social conversation ability such as conversational repair (Alexander et al. 1997; Wetherby et al. 1998) and motivation (Koegel and Koegel 2006; Koegel et al. 2010). Conversational repair requires the ability to communicate intentionally, to engage in perspective taking, and to utilize a variety of effective communicative means (Alexander et al. 1997). Communicative repair is an important component of children's early conversation skills and usually emerges within the first 2 years of life (Alexander et al. 1997; Halle and Meadan 2007; Volden 2004;). Research has shown that children with ASD are similar to their typically-developing peers when responding to requests for communicative clarification; however, when responding to a bid for clarification, children with ASD more often provide an inappropriate response such as not complying with the question or changing the topic of conversation (Volden 2004). Providing an inappropriate response can catch the conversational partner off guard, and may cause the conversation to discontinue. Similarly, asking a question that is not semantically or syntactically appropriate to the context of the conversation can result in a conversational breakdown.

Appropriate use of question-asking during conversation serves a variety of functions and is a necessary skill for maintaining social discourse.

Motivation has been shown to be a pivotal area for the treatment of children with autism (Koegel and Koegel 2006; Koegel et al. 2010) and has been used to target verbal initiations. By using a motivational procedure incorporating child choice and natural reinforcement, children with autism successfully learned to ask the question "*What's that?*" and as a result, showed improvements in expressive vocabulary acquisition (Koegel et al. 1998). Furthermore, the participants were able to generalize their newly-learned question-asking skills to new settings and to new conversational partners (Koegel et al. 1998). In another study, the use of child-preferred stimulus items combined with a natural reinforcement procedure was used to teach "*Where is it?*" to children with autism who did not use that question expressively (Koegel et al. 2010). The participants successfully and quickly acquired the question form. Moreover, the data showed generalization of the use of this question as well as collateral gains in language structures (Koegel et al. 2010). It remains unclear in the literature whether children with ASD lack the ability to ask questions or if the ability is present, but there is a lack of motivation. There is an emerging line of research that details the use of motivating operations when teaching children with autism to ask questions (Betz et al. 2010; Endicott and Higbee 2007; Koegel and Koegel 2012; Lechago et al. 2010) and highlights the importance of considering motivation for children with autism in conversational discourse. Although some children may have the question-asking behavior in their repertoire, they may use it inconsistently, perhaps due to a lack of motivation for gaining social information.

Self-management is an additional intervention procedure (Koegel and Koegel 2006) that has shown promise for increasing the rate of question-asking in this population (Boettcher 2004; Palmen et al. 2008). Self-management may be particularly appropriate for social communication interventions as children become aware of, and monitor, their own behavior. Further, the associated reinforcement can motivate children to interact socially, which is often challenging for this population (Klin and Volkmar 2000; Paul 2003).

Currently, the literature lacks research regarding the transition between learning single basic question structures such as "*What's that?*" and "*Where is it?*" in reference to objects, and learning to use a variety of *wh*-question forms to request social information in an ongoing reciprocal social interaction. Much of the literature teaches children with autism to initiate regarding tangible objects that are present in the setting as opposed to teaching them to elicit social information about another's lived experience. This type of information is often the basis of conversation

(Baldwin and Moses 1996; Brinton and Fujiki 1989; Stivers et al. 2009). Extended social conversation also requires the use of, and discrimination between, multiple types of questions, as well as the ability to ask appropriate questions given changing topics. Although questions to seek social information could be taught in isolation, it is not clear if they can be acquired concurrently within the naturalistic context of social discourse. The present study attempts to address these issues by investigating whether a self-management intervention would be effective for the concurrent acquisition and appropriate use of multiple social questions during conversation.

The specific research questions were as follows:

1. Is a self-management intervention effective for teaching the appropriate use of *what*, *where*, and *who* questions concurrently in the context of social conversation?
2. Is a self-management intervention effective for teaching children to request social information?
3. Will children use the acquired questions appropriately during social conversation after the intervention ends?
4. Will the gains be evident when the children speak to conversational partners not involved in intervention?

Method

Participants

Two elementary school-age children (ages 7:6 and 9:10) participated in this study. Demographic data for the participants are provided in Table 1. While no formal diagnostic instrument was used, there was reliability in the diagnosis according to clinical judgment by two independent diagnostic centers with expertise in diagnosing autism according to DSM-IV-TR criteria (APA 2000). The inclusion criteria for participation were: (1) chronological age between 6 and 10 years old; (2) functioning academically at age level; (3)

social interactions, as reported by parents and clinicians, to be so severely impaired that the children rarely interacted with peers; (4) spoke in sentences of at least four words; and (5) little or no use of appropriate questions relevant to the conversational context. The participants’ communication ability was assessed by clinician and parent report. The first two children referred to our Center who met the inclusion criteria were selected to participate in this study. Parents of both children signed IRB approved consent forms and the families were not paid to participate.

Maria

Maria was a 7-year-old (7:6) Latina female whose family spoke English at home. She was fully included in a regular education 1st grade classroom with support. Her adaptive communication as measured by the Vineland Adaptive Behavior Scales 2nd Edition (VABS-II; Sparrow et al. 2005) was in the moderately low range. On the VABS social domain, she scored in the moderately low range as well. Maria had a large vocabulary consisting of body parts, colors, letters, and descriptive words. Receptively, Maria was able to follow a three-part instruction, and understood “*wh-*” questions. In regard to her use of expressive grammatical morphemes, Maria was able to use the -ing verb ending, the plural, a variety of articles, prepositions, and the regular and irregular past tense. Her mean sentence length was 5 words, measured by a 5-min language sample. She was able to engage in reciprocal conversation for at least 5 min with multiple verbal exchanges and asked “*what*” questions. Specifically, repeated language samples indicated that she asked, “*What is it?*” in a rote/scripted manner in response to all opportunities. However, repeated language samples indicated that she did not ask a variety of questions. Specifically, she asked *what* questions in response to all situations. For example, if the conversational partner said “*I’m going on a trip this weekend*” she would respond with “*What is it?*” or if the conversational partner said “*Someone is coming to visit me today*” she also responded with “*What is it?*” Thus, she appeared to have some limited understanding of the semantic intent of the conversational partner but did not have enough semantic understanding or syntactical structure to respond appropriately with the correct “*wh-*” question.

Sarah

Sarah was a 9-year-old Latina female (9:10) whose family spoke both English and Spanish at home. She was fully included in a regular education 4th grade classroom with support. Her adaptive communication was in the moderately low range as measured by the VABS-II. Her social domain score on the VABS was in the moderately low range. Sarah

Table 1 Demographic data for participants

	Maria	Sarah
Chronological age	7:6	9:10
Gender	Female	Female
Ethnicity	Latina	Latina
Academic functioning level	At age level, with support	At age level, with support
VABS* communication domain	Moderately low	Moderately low
VABS* social domain	Moderately low	Moderately low

* Vineland Adaptive Behavior Scales, 2nd Edition

had a large vocabulary consisting of body parts, colors, and descriptive words. She could recall past experiences and provide basic parts of a story. Receptively, she was able to follow a three-part instruction, understood “*wh-*” questions, and could listen to an informational talk for at least 15 min. In regard to grammatical morphemes, she used the plural, -ing verb endings, could use some prepositions (e.g., in and on), and used the regular and irregular past tense with some errors. Her mean sentence length was 6 words, measured by a 5-min language sample. She could carry on a conversation for at least 5 min and could re-tell stories in detail with accuracy. Similar to Maria, she would often speak for long periods of time without asking questions to her conversational partner. She was able to ask a variety of “*what*” questions (e.g., “*What’s that?*” “*What are you doing?*” and “*What are you eating?*”), but infrequently asked these questions during interactions. When a conversational partner emitted a clear statement soliciting a question (e.g., “*I went someplace fun this weekend*”) she would usually provide an irrelevant response or did not respond at all to the bid. This absence suggested either a lack of semantic and syntactic ability or a lack of motivation.

Design

In order to allow for flexibility of the research design in applied settings (Watson and Workman 1981), and to ensure that there was no possibility of interdependence of the baselines (Kazdin 2011), a non-concurrent multiple baseline across participants design was used to address the research questions. In accordance with the multiple baseline design, prior to the start of intervention, baseline measures were staggered across participants, with four sessions for Maria and eight sessions for Sarah. The design also included probes post-intervention to assess question-asking with new conversational partners and a long-term follow-up phase to assess maintenance of behavior, 6 months post-intervention for Maria and 1 year post-intervention for Sarah.

Setting

All phases of the study took place in the participants’ natural environments. For both children, baseline and intervention were implemented at their schools immediately after school with a familiar clinician in the child’s classroom. For Maria, additional probes were collected with adults and peers who were not present during any of the intervention sessions but with whom Maria was already comfortable. These probes were conducted in a different classroom than where intervention took place. For Sarah, an additional probe was collected at her home with a familiar adult who had not been present during the intervention sessions. These probes were taken to see if the

children demonstrated the question-asking skills learned in the intervention with conversational partners who were new and who were not providing external rewards.

Clinicians

An advanced graduate student specializing in autism spectrum disorders conducted the clinical sessions. Sessions were videotaped and portions were viewed during weekly supervision sessions by a Ph.D. level supervisor.

Procedure

During all conditions, the clinician provided context with opportunities to ask several early emerging questions. While not representative of all questions a child might ask, they allowed for a first step in assessing the feasibility of teaching multiple questions in the context of a conversational interchange.

Baseline

Baseline consisted of videotaped conversation samples between the participant and the clinician as part of ongoing therapy that targeted a variety of social, language, and behaviors goals but did not directly target question-asking. During these probes, the clinician was blind to the hypothesis and unaware that an additional condition would be implemented. The participants were already familiar with the clinician.

During baseline, the dyad held a natural conversation that included the following components. The clinician provided a variety of statements designed to assess conversation, including asking the child questions and providing the child with several types of prompts in order to provide opportunities for the participant to reply back by asking a variety of different *wh*-question forms. In our previous clinical experience and published research we have used a clinical tool to prompt question asking by using non-obligatory indirect questions or comments. Examples of these leading statements include the clinician saying, “*I went somewhere really fun this past weekend,*” “*I met up with someone really nice yesterday,*” and “*I had something yummy to eat this morning.*” The questions were designed to provide approximately equal opportunities for the child to use *where*, *who*, and *what*, respectively. During this phase, no intervention targeting question-asking or any other conversation skills took place.

Intervention

Intervention was conducted in the context of a natural conversation wherein three types of early-onset questions

would be likely to occur. Specifically, during each session of intervention, the clinician explicitly taught the children when it is appropriate to use the words *what*, *where*, and *who*, when asking questions. In this phase, the participants were already comfortable with the clinician. The clinician would simply say that the word *what* is used when asking a question about a thing. For *where*, the clinician would say that this word is used when asking someone about a place. For *who*, the clinician would say that *who* is about a person. The clinician then provided several training opportunities for the child to respond to. The clinician also said that it was important to wait for the clinician to say the whole opportunity before the child responded. The clinician said, “I went somewhere fun yesterday. What would you ask?” The child attempted to respond and if she gave an inappropriate response, the clinician would correct the *wh*-word she used. Training opportunities were provided for all three question types. The clinician provided a relevant response to the question asked, both during explicit training and during all conversation probes. The clinician did not move into the conversation probe until the child showed understanding of when to use the three question forms. All three questions were taught concurrently.

For additional guidance during intervention, verbal prompting of the concepts that “*What* is for asking about a thing, *who* is for a person, and *where* is for a place” was accompanied by a colorful visual aid (i.e., a printed card) that stated the same concepts as were taught verbally. The visual aid was used because both participants enjoyed reading and because it has been shown that children with autism often learn better through the visual modality (Marans et al. 2005). The visual aid was present during all of the intervention sessions but was not a direct prompt for how to answer the opportunities provided by the clinician in conversation. In other words, the child could not simply look at the visual aid prompt and know immediately how to answer the clinician’s opportunity for a question. Since the visual aid only stated “*What* is for asking about a thing, *who* is for a person, and *where* is for a place,” it was necessary for the child to listen to the opportunity for a question (“I went somewhere fun yesterday”), figure out that the clinician was talking about a place, and then use the correct *where* question-asking form.

To increase the child’s motivation for learning the new skill, self-management was used and the participants were trained according to a protocol for teaching self-management to people with disabilities (Koegel et al. 1992). The target behavior for the self-management was to ask the correct *wh*-question in response to an opportunity for a *wh*-question provided by the clinician. During the explanation of the self-management, the child was given a choice of how many points she wanted to earn. To earn one point (i.e., put a check in a self-management box), the clinician

told the child what she needed to do. The clinician said that the child earned a point by asking a question in response to the opportunity given by the clinician using the appropriate *wh*-word. To mark the point, she would make a check, color in, or cross off a box on the self-management sheet in order to keep track. The intervention started only after it was clear that the child understood what she needed to do in order to check a box. The question did not have to include the correct tense in order to be correct. For Maria, there was an average of 18 points (opportunities) per probe, and for Sarah the average was 14. Both children would typically choose to earn about 10 points and then would want to continue the interaction even after all points were collected. The children chose a reinforcer to earn following collection of all the points. For the younger participant, Maria, the schedule of reinforcement was adapted so that she would receive positive reinforcement after she checked each box (e.g., a mini M&M) and would get a larger reward upon completion of checking all of the boxes (e.g., computer game time). Sarah, who was older and familiar with self-management, received a reinforcer only after checking all of the boxes. She often chose reading her favorite book or drawing a picture as a reinforcer. After choosing reinforcers, both participants would write a word indicating what they wanted at the bottom of the self-management sheet to help maintain motivation. The clinician was to provide the child with as many opportunities as there were boxes on the self-management sheet and to provide approximately equal opportunities for *what*, *who*, and *where* opportunities. There were an approximately equal number of opportunities provided by the conversational partner for each question type, and all of the probes had at least two opportunities per *wh*-question. The opportunities for each question type were presented concurrently in a semi-random order, with the provision that each question type was asked an approximately equal number of times. Over the course of the conversation, the clinician was also to remind the child to check off the boxes as necessary. The subsequent intervention sessions were similar to the first one; the explicit teaching was repeated and the visual aid was presented again. The intervention sessions were conducted once per week for each child.

Probes with New Conversational Partners

These probes were taken with familiar peers and/or an adult who was not involved in the intervention. The conversational partners were individuals who the child already knew and was comfortable around. The purpose of these conversation probes was to assess whether the children would demonstrate the question-asking skills learned in intervention in the presence of new conversational partners

without external reinforcers for responding. These probes were taken without the visual intervention aid or the self-management sheet. They were taken at school for Maria and at home for Sarah. The peer or adult was asked to talk about personal experiences such as what he/she had done over the weekend or the day before, and was asked to talk with the child for approximately 10 min. The conversational partner was instructed to provide the child with leading statements to give her approximately equal opportunity to ask *who*, *what*, and *where* questions. For Maria, the first probe was taken with a peer and the second was taken with an adult. For Sarah, one probe was taken with an adult. They were videotaped by clinicians who were not involved in the intervention and who were naïve to the hypotheses of the study.

Long-Term Follow-Up

Conversation probes were taken after intervention had ended. For Maria, a follow-up probe was taken with an adult clinician 6 months after intervention and for Sarah, 1 year post-intervention. The procedure for these probes was the same as for the probes with new conversational partners.

Dependent Measures

Percent of Appropriate Question Use in Social Conversation

In order to assess whether the children were using the questions appropriately, they had to meet three criteria: (1) the children had to use *what*, *where*, and *who* questions correctly for object, place, and person, respectively; (2) the questions were used to request social information; and (3) the child had to use the question functionally (i.e., not in a rote or scripted manner). A correct response required all three components. Overall percent correct usage for *what*, *where*, and *who* questions was calculated separately as well as overall correct usage of the three *wh*-type questions together.

Across conditions, the coders transcribed each leading statement and response. To be included as a leading statement, the clinician had to clearly provide the participant with an opportunity to ask a *what*, *where*, or *who* question. For example, an opportunity for a *where* question would be, "I went somewhere really fun this weekend." Opportunities for *who* and *what* would be, "I saw a good friend yesterday," and "I ate something yummy," respectively. For the child's response, the coders decided whether or not the participant had used the appropriate *wh*-question given the leading statement, whether the question requested social information from the conversational partner, and whether the participant responded in a functional manner

rather than in a rote/scripted manner. A request for social information was defined as a question that elicited information about the partner's personal experience. If the participant initially asked a question using the incorrect *wh*-word, and then self-corrected and asked the question using the correct *wh*-word, this was counted as a correct response. An inappropriate response was defined as when the participant did not ask a question, i.e., gave an irrelevant response, when the participant asked a question but used the incorrect *wh*-word, when the participant asked an off-topic question, when the participant requested non-social information, or responded in a rote/scripted manner. For example, a designation of correct would be given in the following example: "I went somewhere really fun yesterday (leading statement)...where did you go? (child's response)." A designation of incorrect would be given in the following example: "I went somewhere really fun yesterday (leading statement)...what is it? (child's response)."

Additional Analysis of Responses

The type of responses given by each participant was analyzed for each question for baseline, intervention, and long-term follow-up conversation probes. Percentages were calculated out of the total number of leading statements presented for each *wh*-question type during a given phase of the study. Responses scored as incorrect were classified into 6 categories: rote/scripted, no response, wrong *wh*-question, irrelevant response, inappropriate response, and other. A rote/scripted response was defined as a fast and automatic response that occurred before the leading statement had finished. No response was defined as no verbalization of any kind in response to the leading statement. Responses had to occur within 3 s of the leading statement as based on previous literature that defines an awkward pause in conversation as 3 s or longer (Fox Tree 2002; Golman-Eisler 1968). Wrong *wh*-question was defined as the child asking a question but using the wrong *wh*-question (e.g., asking a *what* question when a *where* question was the appropriate response). Irrelevant responses were questions or comments made that were off-topic or unrelated given the leading statement presented. Inappropriate responses included comments such as "I don't want to talk about it" and "tell me, tell me, tell me!" Other responses were defined as minimal statements such as "oh" and "yeah."

Reliability and Fidelity of Implementation

Two observers independently coded the dependent measures from videotapes. One coder was naïve to the hypothesis and purpose of the study in order to control for

experimenter bias. The probes were coded in random order to control for observer drift. Inter-rater reliability was calculated for 30 % of the probes and probes were randomly selected from all phases of the experimental design. Reliability for identifying leading statements was found to be 96 % (range 88–100 %). For coding of the categorical components of the dependent measure, whether the correct *wh*-question was used, whether the question was on-topic, and whether the question appropriately requested social information, kappa was calculated to control for chance agreement and was found to be $k = 1$.

Similarly, two observers coded for fidelity of implementation. The observers coded 2 randomly selected intervention probes for each participant. The treatment procedures scored for an effective intervention included (1) providing a visual aid explaining the difference between *who*, *what*, and *where*, (2) implementing a self-management intervention using a check-box self-management sheet, and (3) reminding the participant to check off the boxes during the intervention probe as necessary. If the clinician correctly implemented a procedural element, the coders marked a plus sign. If the clinician did not correctly implement the procedural element, the coders marked a minus sign. A fidelity of implementation percentage for each tape was calculated, and an average was taken. The fidelity of implementation across clips was 100 %. Kappa was calculated to control for chance agreement between the coders and was found to be $k = 1$.

Results

Maria

Figure 1 shows Maria's responses during all phases of the study for *what*, *where*, and *who* questions combined. During baseline, Maria asked a *wh*-question appropriately between 9 and 14 % of opportunities. With the onset of intervention, Maria quickly improved to asking an appropriate *wh*-question between 70 and 100 % of opportunities. In the additional probes with new conversational partners and during long-term follow-up, Maria asked an appropriate *wh*-question between 75 and 100 % of opportunities. Cohen's d for Maria's responding between baseline and intervention was large ($d = 29.62$).

Sarah

Figure 1 also shows Sarah's responding during all phases of the study for *what*, *where*, and *who* questions combined. During baseline, her use of appropriate *wh*-questions was variable, but on average she answered appropriately only around 50 % of the time. With intervention, a sudden change occurred where she began to ask questions

appropriately at a higher and more stable level, between 76 and 100 % of opportunities. When she had a conversation with a familiar adult who was not involved with the intervention, she asked questions entirely appropriately. At long-term follow-up, Sarah's gains maintained and she was asking questions appropriately in the 90–100 % range. Cohen's d for Sarah's responding between baseline and intervention was also large ($d = 2.29$; Cohen 1988).

Additional Analysis of Responses

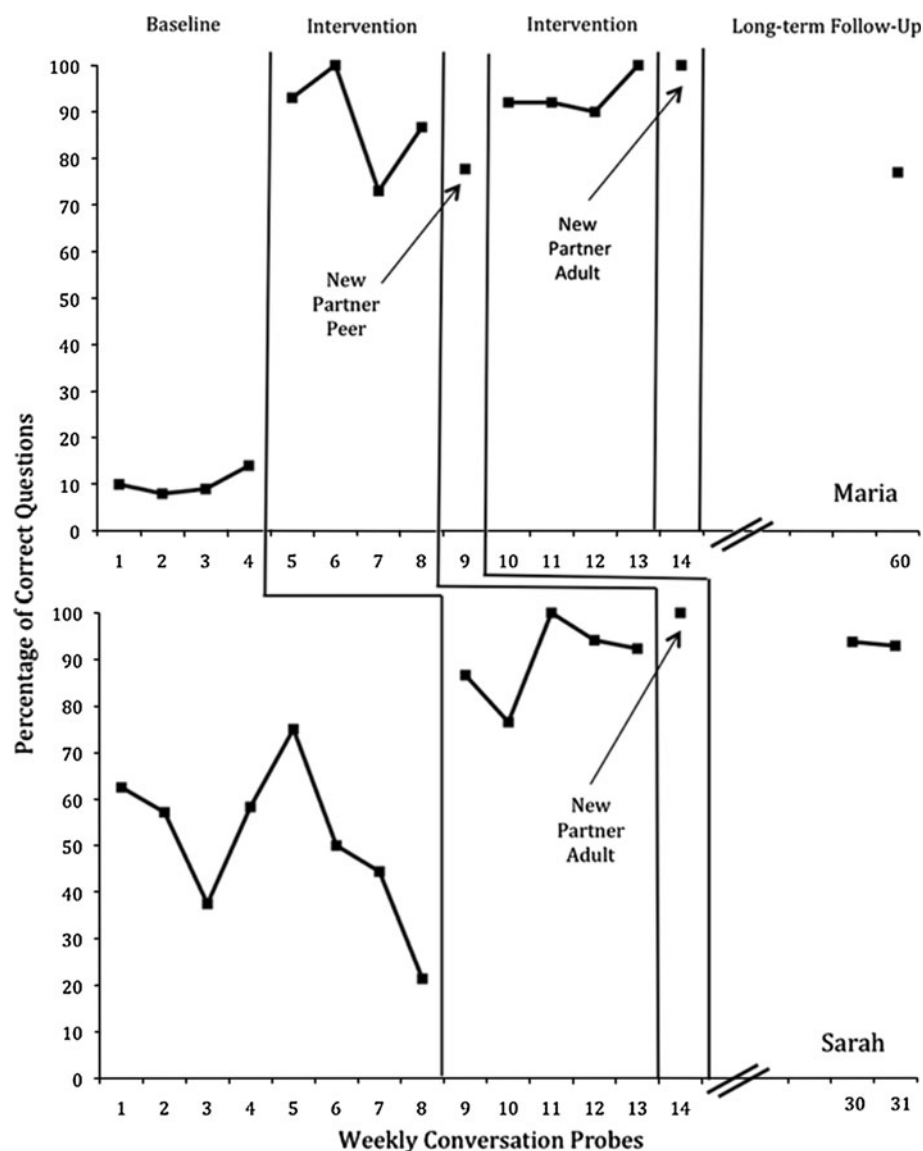
Table 2 shows the data for Maria and Sarah regarding the percentage of correct responses and response errors for each *wh*-question type during baseline, intervention, and post-intervention follow-up. The data indicate that at baseline, Maria gave few correct responses, and only for opportunities for *what* questions. At baseline, Maria responded correctly to *who*, *where*, and *what* questions, for 0, 0, and 10 % of opportunities, respectively. For 87 % of opportunities for *what* questions, Maria responded in a rote/scripted manner such that she would quickly, rotely, and automatically ask, "what is it?" For 3 % of opportunities for *what* questions, she provided no response. During the intervention phase, Maria's correct responding greatly increased for all three question types. She responded correctly for 86 % of opportunities for *who* questions, 92 % of opportunities for *where* questions, and 98 % of opportunities for *what* questions. Her *what* questions were not provided in a rote/scripted manner, and she made the distinction between the three question types, choosing which one to use accurately for a large percentage of the time. During the post-intervention conversation probe with a new conversational partner, Maria made no errors.

For Sarah, her errors at baseline were split across all of the error types except for rote/scripted responding. During intervention, Sarah responded correctly for a large percentage of the time, showing the ability to distinguish between the three question types. She responded correctly for 88 % of opportunities for *who* questions, 96 % of opportunities for *where* questions, and 90 % of opportunities for *what* questions during intervention. During the probe with a new conversational partner, she demonstrated 100 % correct usage of all question types.

Discussion

The data indicate that a self-management intervention package, which included concurrent teaching of three social *wh*-questions in the context of conversation, resulted in increased levels of correct question use for both participants. Self-management during conversation also produced a sudden increase in appropriate question-asking.

Fig. 1 Percentage of correct questions for both participants for all three question types



The participants made large gains during the short length of the intervention and importantly, these gains were maintained long-term. Additionally, the participants were able to exhibit appropriate question-asking during probes with new conversational partners who were uninformed in treatment and without the presence of external reinforcers. Overall, the results suggest that at least some children with autism can be taught to use and discriminate between different *wh*-question structures in the context of conversation to acquire social information from the conversational partner. This study provides an initial step towards improving reciprocal social conversation in children with autism. While the present study did not include all questions that might be asked, it suggests that further research in this area with more questions might be quite profitable.

Interestingly, the data suggest the possibility of a motivational component. Due to the difficulty of social

conversation for children with autism, it may be challenging to motivate them to perform at their full ability level. Once intervention was implemented, Sarah showed an immediate increase in the number of appropriate questions asked for all three types of questions, indicating that altered stimulus properties may have been a factor for her lack of responding. Maria's data are also consistent with a motivational hypothesis in that she also showed a sudden increase in correct responding almost immediately once intervention was implemented and discriminated between all three question types. The fact that the participants' gains maintained after intervention ended and that their appropriate question use occurred with an individual not involved in intervention, suggests that gaining social information may have become a natural reinforcer and intrinsic motivation for social conversation may have increased. This would be an interesting area for future

Table 2 Percentage of response errors and correct responses by question type for Maria and Sarah

Wh-question	Response type						
	Rote/scripted (%)	No response (%)	Wrong Wh-question (%)	Irrelevant (%)	Inappropriate (%)	Other (%)	Correct (%)
Baseline							
Who	0	0	100	0	0	0	0
Where	0	0	100	0	0	0	0
What	87	3	0	0	0	0	10
Intervention							
Who	0	0	12	0	2	0	86
Where	0	0	8	0	0	0	92
What	0	3	2	0	0	0	98
Long-term follow-up							
Who	0	0	0	0	0	0	100
Where	0	0	0	0	0	0	100
What	0	0	0	0	0	0	100
Percentage of errors and correct responses by question type for Sarah							
Baseline							
Who	0	10	14	34	4	24	14
Where	0	6	0	21	6	3	64
What	0	4	13	5	5	9	64
Intervention							
Who	0	0	0	12	0	0	88
Where	0	0	0	4	0	0	96
What	0	0	4	6	0	0	90
Long-term follow-up							
Who	0	0	0	0	0	0	100
Where	0	0	0	0	0	0	100
What	0	0	0	0	0	0	100

This table displays an analysis of Maria’s and Sarah’s correct and incorrect responses. Percentages were calculated out of the overall number of leading statements for each target *wh*-question during the indicated phase of the study. Incorrect responses were further analyzed by type of response error

research. Increasing motivation for asking questions may also be linked to increased persistence, a concept that has been suggested to be another critical component of maintaining conversation and warrants additional research in the context of naturalistic social conversation (Wetherby and Prizant 1993).

The findings in this study have theoretical implications for the role of motivation in social communication. It has been discussed that children with autism may exhibit learned helplessness in a variety of domains (Seligman 1972; Koegel and Egel 1979). They may not be motivated to engage with others due to past failures in social interactions and lack of confidence in conversation skills. In turn, increasing motivation is likely to have a large impact on the acquisition and use of social skills. Recruiting motivational strategies and intervention techniques for children with autism has not only been shown to increase

verbal initiations (Koegel et al. 1998; Koegel et al. 2010), but also increase engagement in academic work (Koegel et al. 1994; Koegel et al. 2010), and reduce family stress (Koegel et al. 1996). Furthermore, increasing motivation serves as a pivotal area and can lead to widespread collateral gains (Koegel and Koegel 2006). In relation to the current study, increasing motivation facilitated rapid changes in acquisition and use of an essential social communicative skill. Without motivation, children with autism are unlikely to spontaneously engage in social interaction with their peers (Bauminger and Kasari 2000). The results of this study suggest that the children may have more ability to ask questions than was previously expected; however, they are in need of motivation in order to ask them.

A major strength of this study is that it used a versatile, easy to implement intervention that can be used by

clinicians, teachers, and parents to teach question asking skills. The positive results of this study inspire future research on using motivational self-management procedures to target several concurrent spontaneous questions (i.e., without a clear leading statement as a prompt), and expanding on the complexity of the question taught to build on the partner's utterances. The dynamic nature of reciprocal conversation requires the participants to have at hand a wealth of appropriate questions to ask at the correct times, thus these are important skills. In summary, this study serves as a foundation for future research regarding how to teach social conversation and ultimately help to ameliorate the core social deficit in children with autism.

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