UNIVERSITY OF CALIFORNIA, SAN DIEGO

Teaching Child-initiated Social Interactions to Preverbal Children with Autism: Effects on Social Initiations, Treatment Response Profiles and Vocal Communication

A dissertation submitted in partial satisfaction of the requirements for the degree

Doctor of Philosophy

in

Psychology

by

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2011

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2011

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ACKNOWLEDGEMENTS

I would like to thank Laura Schreibman for her support and guidance through the completion of this project. Her encouragement and confidence in me allowed me to take on this study and see it through. I would also like to acknowledge Aubyn Stahmer for never being too busy to offer suggestions and advice. I would like to thank my undergraduate research assistants without whom I could not have completed this project. I would like to thank the graduate students and staff of the Autism Intervention Research Laboratory who contributed their time and opinions as well as their moral support throughout this project. Finally, I would like to offer my heartfelt thanks to the children and families who committed to the project wholeheartedly. It was a pleasure working with all of you.

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ABSTRACT OF THE DISSERTATION

Teaching Child-initiated Social Interactions to Preverbal Children with Autism: Effects on Social Initiations, Treatment Response Profiles and Vocal Communication

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Doctor of Philosophy in Psychology

University of California, San Diego, 2011

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Engaging in spontaneous social behaviors towards others is critical to initiating and maintaining reciprocal social interactions (e.g., Garner & Estep, 2001; Oke & Schreibman, 1990). The literature has identified marked deficits in child-initiated social behaviors in young children with autism (e.g., Koegel, Koegel, Frea, & Fredeen, 2001; Mundy & Burnette, 2005). Researchers believe that interventions effectively targeting these early social communication behaviors in this population may minimize obstacles to subsequent language learning and social interaction skills (e.g., Rogers & Dawson, 2010; Yoder, Warren, & Hull, 1995).

Thus far, there is very little research on specific behavioral training of social initiations to young, preverbal children with autism or on the effect this early training has on response to treatment. The aim of this research project was to systematically evaluate a social initiation training (SIT) program for children with autism and examine the effect of SIT on the efficacy of another behavioral treatment, PRT. This study targeted children

who, based on an assessment of specific behavior characteristics, were not expected to increase social initiation behaviors during PRT (Sherer & Schreibman, 2005). A single-subject multiple baseline design across subjects was used to examine treatment efficacy and to evaluate individual differences in treatment response. During baseline sessions children received PRT only. During the treatment component of the study, children's sessions included both SIT and PRT.

This study replicated earlier findings that children who do not exhibit the PRT "responder" profile do not increase social initiations in response to PRT alone. As hypothesized, with the addition of an SIT program, all four participants evidenced gains in social initiations. All four children displayed gains in vocal communication during treatment (PRT + SIT) that were greater than gains in baseline (PRT). The three participants who did not display approach behaviors consistent with PRT "responders" profile prior to treatment, met the criteria following treatment. These results support the notion that at least one of the behaviors in the PRT "responder" profile, approach, can change in response to therapeutic intervention. Implications for the importance of social initiation training with young preverbal children are discussed.

INTRODUCTION

Impairment in social interactions is a defining characteristic of autism (American Psychiatric Association [APA], 2000). Children and adults with autism demonstrate delays, deficits or atypical characteristics in the frequency, type and quality of social interactions (McConnell, 2002). Numerous studies suggest that even individuals with autism who exhibit favorable prognostic indicators and response to intervention display pervasive deficits in social behaviors that persist throughout life (Freeman, 1997; Szatmari, Bartolucci, Bremner, Bond, & Rich, 1989; Venter & Schopler, 1992; Akshoomoff, Stahmer, Corsello, & Maher, 2010).

In the past, children were typically diagnosed with autism around age 4 and one of the most common diagnostic indicators was a delay in the development of speech (Siegel, Pliner, Eschler, & Elliot, 1988). Recent research on early social markers in autism, as well as increased awareness (on the part of both the general public and health care providers) have resulted in an increase in diagnosis in toddler age children. Today, it is more common for clinicians to provide a provisional diagnosis at 24 months (Lord, 1995) or in some cases as early as 18 months of age (e.g., Filipek, et al., 2000). Early indicators used to diagnose young children include deficits in early nonverbal social behaviors, such as social smiling, social orienting, and joint attention.

Given the ability of researchers and clinicians to identify autism risk at an early age, it is critical that researchers empirically validate new and existing treatments for use with children under 3 years old (U.S. Department of Health and Human Service, 2004). Experts agree that intensive, early intervention is critical to maximizing outcomes in children with autism (e.g., Rogers & Vismara, 2008; Birnbrauer & Leach, 1993; Bondy & Frost, 1995; Ozonoff & Cathcart, 1998; Sigman, 1997; Weiss, 1999). If these

interventions effectively target early social communication behaviors in children with autism, they may minimize obstacles to learning language and social interaction skills later on (e.g., Hwang & Hughes, 2000).

Neurodevelopmental disturbances in early social behavior are considered to exacerbate atypical social neurodevelopment by preventing children from engaging in the learning experiences that shape typical development. For example, a typically developing child that initiates a social game such as "pat-a-cake" with an adult has initiated an opportunity for learning about gestures, imitation, sharing emotions, eye contact, and expressive and receptive language. A child who has developed the social deficits seen in autism, however, is less likely to initiate the same interaction. Consequently, the child is less likely to benefit from these experiences and may thereby become further delayed in social development. Directly targeting the social behaviors that are disturbed during this critical time may positively impact the social environment and ongoing neurodevelopment in early childhood by providing children with the early social skills necessary to learn and benefit from the environment. Interventions that result in child initiation and engagement are likely to lead to better learning outcome and behaviors that lead to child-initiated learning should be identified as treatment goals.

Social Initiations

Child Outcome

Given that social dysfunction is quite possibly *the* pathognomic feature of autism, many researchers believe that social development should be a priority in intervention research (e.g., Mundy & Crowson, 1997; Weiss & Harris, 2001). Nonverbal social skills including joint attention, eye gaze, social orienting, and imitation have been linked to

speech development in this population (e.g., Dawson, et al., 2004; Loveland & Landry, 1986). Many researchers have proposed that nonverbal social skills may be predictive of overall developmental outcome (Mundy & Crowson, 1997; Mundy, Sigman, & Kasari, 1990). Therefore, interventions targeting early nonverbal social behaviors in autism may impact communication, language, and complex social skills development and, in turn, overall developmental outcome.

One specific category of social interaction, *child-initiated* social interaction, is critical to maintaining successful reciprocal social interaction (Weiss & Harris, 2001). This type of social behavior is also believed to predict children's long-term treatment outcome (Koegel, Koegel, & Brookman, 2003). Child-initiated social interaction relies on the child's ability to start an interaction in the absence of attention from or social engagement with a social partner (Koegel, Koegel, Shoshan, & McNerney, 1999; Warren, Yoder, & Leew, 2002). Examples of child-initiated social interactions include asking someone a question, gesturing to get someone's attention, asking someone to play or holding out a toy to someone. Child-initiated social interaction, or social initiations, one of the earliest forms of social communication, are markedly impaired in children with autism even after speech develops (Koegel, Koegel, & Carter, 2003).

Researchers have singled out the importance of social initiations in the social development of children with autism (e.g., Mundy & Burnette, 2005; Hwang & Hughes, 2000). Some researchers have argued that social initiation is necessary for children to learn from their environment, and can therefore be called "pivotal" (Koegel et al., 1999). Pivotal behaviors are behaviors central to wide areas of functioning, that when taught, produce collateral changes in other behaviors. If social initiations are pivotal, an increase

in social initiations should produce an increased ability to use learned skills in a functional, spontaneous way. For example, “help” is a word many children use to get assistance. A child who is able to say “help” but is unable to initiate with others may say “help” when there is no one present or only when prompted. However, a child who is able to initiate a social interaction is more likely to actively seek out another person, gain his/her attention and spontaneously use, “help” to request assistance. The skill, in this case saying “help”, is only functional when it is part of a social initiation. If social initiations are indeed pivotal, targeting social initiations in very young children with autism may be an efficient way to produce widespread change (Schreibman & Koegel, 1996).

Koegel and colleagues (1999) undertook an exploratory investigation using archival data to identify behavioral characteristics related to treatment outcome. The researchers examined the outcomes of children with similar language and adaptive abilities who had received an evidence-based behavioral treatment, Pivotal Response Training (PRT). From videotape, they assessed the behaviors of these same children approximately 7 years earlier, prior to intervention. They found that children with good long-term outcomes (e.g., age appropriate academics, friendships with typically developing peers and involvement in community activities) exhibited more social initiations prior to intervention than those with poor long-term outcomes (e.g., restricted educational settings, no friendships with typically developing peers and disruptive problem behaviors). These data indicate that social initiations, specifically, may be an important predictor of long-term treatment outcome in children with autism. Thus, a clinical intervention designed to specifically target social initiation behaviors may yield

important gains in global long-term outcomes in these children.

Another benefit of teaching social initiations is a potential reduction in maladaptive behaviors. Many children with deficits in social communication skills develop alternative, maladaptive means to communicate with others and to get his/her needs met (Bregman, Zager & Gerdtz, 2005). For example, a child that is not able to request attention appropriately by approaching an adult and saying "hi", may climb on furniture. In this example, if the child receives attention from the adult for this dangerous maladaptive behavior (i.e. climbing on furniture leads to adult attention), the behavior becomes functionally equivalent to a more appropriate skill, such as saying "hi". Research on maladaptive behavior, however, has shown that when a child learns a functionally equivalent and adaptive behavior, there is often a reduction in maladaptive behaviors (Hart & Banda, 2010). One such intervention, Functional Communication Training (FCT; Durand & Carr, 1992) is a behavioral intervention that assesses the function of maladaptive behaviors and specifically teaches an alternative skill. In a study by Durand and Carr (1992), children who engaged in attention-seeking problem behaviors including aggression, opposition, tantrums and property destruction, were trained using FCT to gain adult attention using verbal bids (e.g., "Am I doing good work?"). Children were successful in acquiring the verbal bids and there was reduction in the problem behaviors that maintained over time and across settings. Interventions designed to teach social initiations to nonverbal children may result in decreases in maladaptive behaviors. If teaching social initiations decrease maladaptive behavior, this supports to social validity of the intervention.

In summary, growing attention has been directed at the relation between early

social communication skills and subsequent development. Research is needed to further analyze the nature of the relationship between social initiations and child outcomes from evidence-based treatments.

Individual Response Profiles

The most effective treatments for children with autism have been based on a behavioral model (Schreibman, 2005). Both structured interventions such as discrete trial training (DTT; Maurice, Green, & Luce, 1996) and more naturalistic interventions such as incidental teaching (McGee, Morrier & Daly, 1999), milieu teaching (Hancock and Kaiser, 2002) and Pivotal Response Training (PRT; Koegel, O'Dell, & Koegel, 1987) are commonly used to produce positive changes in young children with autism. Additionally, augmentative communication systems, such as the Picture Exchange Communication System (PECS; Frost & Bondy, 2002), have successfully taught nonverbal children with autism some communication skills.

One of the naturalistic behavior interventions, PRT, uses techniques designed to facilitate generalization, increase spontaneity, reduce prompt dependency, and increase motivation. PRT involves specific strategies including providing clear and appropriate cues, allowing for child choice, taking turns, interspersing maintenance tasks with acquisition tasks, requiring response to multiple cues simultaneously, reinforcing attempts, and providing contingent reinforcement directly related to the child's response. This therapeutic technique has been shown to improve a variety of language functions including speech imitation (Koegel, Camerata, Valdez-Menchaca, & Koegel, 1998; Laski, Charlop and Schreibman, 1988), labeling (Koegel et al., 1998), question asking (Koegel et al., 1998), spontaneous speech (Laski, et al., 1988), and conversational

communication (Koegel, et al. 1998). PRT has also been adapted to teach play skills (e.g., Thorp, Stahmer, & Schreibman, 1995), peer social interactions (e.g., Pierce & Schreibman, 1997), and joint attention (e.g., Rocha, Schreibman & Stahmer, 2007). Although there is considerable evidence that PRT is an effective behavior intervention for preschool age children, individual differences are evident and not all children make the expected gains.

Although empirical evidence supports the effectiveness of behavioral treatments such as PECS, PRT and DTT, subsets of children for whom these treatments are *not* effective have been reported for each type of treatment. Indeed, there is consensus among researchers that no single treatment approach is efficacious for all children and thus there is no "one-size-fits-all" treatment for this population (National Research Council, 2001; Schreibman, 2005). Researchers have only recently begun to examine the characteristics of these poor responders in an attempt to better individualize treatment protocol and improve outcomes. The ultimate goal of this line of research is to prospectively tailor treatments to specific children to maximize treatment outcome. This is necessary for clinicians to provide the most effective treatment methods during this critical early intervention period.

In one such study, Sherer and Schreibman (2005) developed and validated behavioral profiles to assess which children would respond well to PRT. They first took a retrospective look at outcome data for 3- to 5-year-old children who had received PRT and identified the three best responders and the three worst responders. Using pre-treatment behavioral data for these children, they identified a specific behavioral profile that predicted a positive response: high toy contact, approach, and verbal stereotypy and

low avoidance and nonverbal stereotypy. They found that the opposite profile (i.e. low toy contact, approach and verbal stereotypy and high avoidance and nonverbal stereotypy) predicted a poor response to treatment.

To validate the PRT response profiles, Sherer and Schreibman (2005) used the profiles to predict treatment responsiveness in a new cohort of children. As hypothesized, children in the cohort who met the "responder" profile made substantial improvements in PRT as evidenced by considerable increases in their language, communication, play and social interaction levels. Children who met the "nonresponder" profile showed little, if any, improvement in these areas. Although social initiations were not directly targeted in treatment, children identified as "responders" showed a modest increase in social initiations during PRT. However, children in the same study identified as "nonresponders" did not show increases in social initiations during PRT. In a follow-up study further examining these profiles, children who exhibited a majority, but not all of, the behavioral characteristics of "nonresponders" participated in PRT treatment (Schreibman, Stahmer, Bartlett & Dufek, 2009). The social initiations of these "low responders," like the social initiations of "nonresponders," did not increase after treatment even though these children did exhibit modest improvement in communication behaviors. In addition, children with behavior profiles matching "nonresponders" showed a positive change after DTT, a more structured behavior intervention. Thus, the behavioral characteristics in the PRT response profile are child characteristics that specifically predict responsiveness to PRT, not responsiveness to all behavior interventions.

Although social initiations were not specifically measured as a predictor of

treatment response in these studies, one of the behaviors in Sherer and Schreibman's (2005) profile, the child approaching an adult, appears to be closely related to social initiations. Approach is defined as moving within arms reach of or looking at an adult. A child walking up to an adult is one example of an approach behavior. Many social initiations are also considered approach behaviors. For example, a child coming towards an adult and taking his/her hand to lead them to something that is out of reach is a social initiation and would also be considered approach. Thus, it is possible that social initiations, like approach, predict a positive response to PRT. Specifically, developing a social initiation intervention may result in positive changes in behavioral profiles and in turn, increase the effectiveness of subsequent behavioral treatment. More generally, an improved understanding of how to target the behavior characteristics that predict differential outcomes may enable clinicians to make treatment decisions that maximize response to intervention for a specific child.

Teaching Social Initiations

When designing interventions to increase social initiations in children with autism, researchers have typically focused on children with well-established verbal abilities (Donaldson, Olswang, & Coggins, 2002; Koegel, Carter, & Koegel, 2003; Nikopoulos & Keenan, 2004). In one such study, Koegel and colleagues (1999) taught children with limited social initiations to initiate verbally. Examples of initiations trained included, "What's that?" "Where is it?" and "Look, Mommy!" Following treatment, children exhibited an increase in social initiations, improved social and community functioning and higher adaptive behavior scores (Vineland Adaptive Behavior Scales; Sparrow, Balla, & Cichetti, 1984). Positive changes in social initiations were related to

improvements in social and adaptive functioning, further supporting the assertion that remediating deficits in social initiations has a positive effect on outcome. All of the participants in this investigation had a language age of at least two years at the time of training.

Given the pronounced language delay in children with autism, and the early age of diagnosis and therefore age at which intervention should begin, initiations that involve asking questions or making verbal statements may not be realistic targets for early intervention. However, given the posited importance of both early intervention and social initiations, it is likely that an early intervention targeting social communication skills that develop before speech, such as gestures, communicative sounds and eye contact, would produce positive outcomes and may facilitate response to treatments such as PRT. Thus far, there are no empirical data on specifically training social initiations to young, preverbal children with autism, or the effect of this early training on treatment outcome.

Although many behavioral interventions (e.g., DTT, PRT) include components aimed at remediating deficits in social interaction skills, most do not specifically train social initiations. Rather, these treatments focus on social behaviors cued by another person. However, one well established behavioral intervention, the Picture Exchange Communication System (PECS), specifically targets child-initiated behavior. PECS is an augmentative communication system that teaches children to exchange picture icons to make requests (e.g., “I want ball,”) and social comments (e.g., “I see cat,”). During the early stages of PECS training, there is both a communicative partner (the person the child is communicating with) and a physical prompter (a person that prompts the child to

communicate with the communicative partner by physically prompting the exchange of the PECS picture). Gradually, the presence of the prompter is reduced until the child is able to spontaneously initiate to the communicative partner. Thus, unlike PRT or DTT, the addition of the second prompter in PECS training allows specific training of initiations without cues from the person with whom the child is communicating. Consequently, children can learn to initiate communication with an adult who is not attending and this may translate to initiations with adults or peers who are not immediately present.

PECS is one option for teaching children without functional speech to initiate social interactions, but it relies heavily on the use of pictures. Social deficits in gestures and eye contact, some of the earliest indicators of autism, are not addressed when using PECS. In addition, some parents are hesitant to begin with a pictorial system at a very young age as they would rather focus on spoken language. A social initiation intervention that teaches children to use gestures, eye contact and vocalizations would offer an alternative method of teaching child-initiated social interactions and to date has not been explored. Data from studies evaluating PECS provide evidence that young preverbal children with autism can learn child-initiated social interactions (Charlop-Christy, Carpenter, Le, LeBlanc, & Kellet, 2002). However, this skill has not been taught in isolation. Additionally, the effect of teaching nonverbal social initiations on the development of other social and communicative skills has not been tested as PECS focuses primarily on augmentative communication.

Based on the literature on teaching communication strategies to preverbal children with autism and other disabilities (e.g., Frost & Bondy, 2002; Reichle, York, & Sigafoos,

1991), four specific behaviors are important and realistic targets for a social initiation training. The first behavior, tapping, is a functional and appropriate nonverbal gesture used by typically developing children to initiate interaction. Tapping is common gesture (e.g., as opposed to American Sign Language) understood and reinforced by a large number of people. This increases the likelihood that tapping will generalize to other settings. Second, hand leading is another appropriate nonverbal gesture and a functional way to communicate specific needs. One advantage of hand leading is the ability to communicate about something in another location. For example, if a child wants food, the child can lead the adult by the hand to the refrigerator. Third, vocalizations are important in assisting children with gaining another's attention. There is evidence to suggest that the acquisition of verbalization will be facilitated by the acquisition of tapping (Reichle, 1991). The final behavior, eye contact, is a nonverbal social communication skill widely accepted in the literature as an important social communication skill and an important target for behavioral treatment (McGee & Morrier, 2003).

Current Investigation

Social initiations show considerable promise for increasing learning opportunities and treatment responsiveness in children with autism. Thus, there is a need for a systematic evaluation of a social initiation training program for preschool-aged children who have not yet developed functional speech. The specific aims of this study were to: (1) assess the predictive validity of current behavioral profiles regarding acquisition of social initiations during PRT alone, (2) evaluate a social initiation training for young preverbal children with autism (SIT), (3) assess how learning social initiations changes

behavioral profiles, (4) assess how SIT impacts child progress in PRT, (5) assess how SIT effects the use of maladaptive initiations, and (6) assess the generalization and maintenance of social initiations learned during SIT.

METHODS

Participants

Four children diagnosed with Autistic Disorder participated in this investigation (see Table 1). Participants met the following inclusion criteria: (a) an independent diagnosis of autism by a psychologist with expertise in the diagnosis of Autistic Disorder, but not associated with this project; (b) met criteria for Autistic Disorder as set forth in the DSM-IV (APA, 2000) using the *Autism Diagnostic Observation Schedule* (ADOS-G; Lord, Rutter, DiLavore, & Risi, 1999) and the *Autism Diagnostic Interview-Revised* (ADI-R; Lord, Rutter, & Le Couteur, 1994); (c) between 2 and 4 years of age; (d) preverbal (i.e. no functional words); and (e) had a nonverbal age equivalent of 10 months or higher on the *Mullen Scales of Early Learning* (MSEL; Mullen, 1995). The participants ranged in age from 28 to 42 months at intake with nonverbal mental ages ranging from 10 to 16 months on the MSEL (visual reception subscale). All of the children also exhibited deficits in initiating socially communicative behavior during social initiation probes (described below) at intake and according to parent report of the child's behavior on the *Home Behavior Questionnaire* (HBQ; described below) at intake. In addition, participants did not exhibit the behaviors consistent with the "responder" PRT profile (Sherer & Schreibman, 2005) during the *Structured Laboratory Observation* (SLO; described below). Finally, children with seizures, sensory or physical impairment (e.g., blindness or deafness) were not included in this study. Participants were recruited from a database at the Autism Intervention Research Laboratory at the University of California, San Diego.

Matthew was the oldest participant at 40 months with a nonverbal mental age of 12 months on the MSEL. He had an expressive language-age equivalent of 7 months and a

receptive language-age equivalent of 14 months on the MSEL (see Table 2). He received a score of 34.5 on the *Childhood Autism Rating Scale* (CARS; Schopler, Reichler, and Renner, 1988) which is in the mild to moderate range of autism.

At intake, Matthew was the only participant who had received training in nonverbal initiations in the form of two different augmentative communication systems: Picture Exchange Communication System (PECS) and American Sign Language (ASL). Matthew received training in both augmentative systems in a special education preschool classroom. During intake assessments, Matthew did not initiate communicative exchanges using PECS in the laboratory when picture icons were made available. In addition, according to parent report, he did not initiate communication with PECS at home. Matthew did not use any sign language at any point during intake. Thus, there was no evidence to suggest that these forms of nonverbal initiation training had resulted in generalized ability to initiate social interactions. According to parent report, he made sounds, handed objects to others and led others by the hand to communicate his needs. He also engaged in maladaptive behaviors to communicate including hitting and pushing. During the social initiation probes at intake, Matthew initiated by hand leading; however, he still exhibited a deficit in the quantity and quality of social initiations compared to typically developing children of the same development level and therefore qualified to participate. He was the only participant that exhibited some spontaneous social initiations during pre-treatment assessments.

Brandon was 29 months at pre-treatment with a nonverbal mental age of 16 months on the MSEL. His expressive language-age equivalent was 2 months and his receptive language-age equivalent was 3 months on the MSEL. On the CARS, he received a score

of 45 which is in the severe range of autism. During the intake social initiation probes and at home (according to parent report), Brandon did not use eye-contact, appropriate sounds, language or gestures to make requests. His mother reported that at home he cried but did not approach her when he needed help with an object and pushed her toward the kitchen when he wanted food.

Nathan was 28 months with a nonverbal mental age of 15 months on the MSEL. His expressive language-age equivalent was 8 months and his receptive language-age equivalent was 5 months on the MSEL (see Table 3). He received a 42.5 on the CARS which is in the severe range of autism. Nathan was not able to communicate using appropriate sounds, language or gestures during the social initiation probes at intake. According to his mother, he brought her objects and whined when he needed help at home.

Ethan was 30 months with a nonverbal mental age of 10 months on the MSEL. At intake he had an expressive language-age equivalent of 5 months and a receptive language-age equivalent of 8 months on the MSEL. He scored 29.5 on the CARS which is the highest score a child can get and still be in the non-autistic range (score range 15-29.5). Ethan did not have any words or gestures and used eye contact and whining to communicate during the social initiation probes at intake. His mother reported that he brought her objects and stared at her when he needed help at home. She also reported that he would lead her by the hand when he wanted to watch a movie.

Design

A single subject, multiple baseline design was conducted across participants. This design has the advantage of controlling for developmental maturation and exposure to the

treatment (Kazdin, 1982). A probe element was used to assess child social initiation behaviors at regular intervals during baseline and intervention phases in a controlled generalization setting (instead of continuous assessment during treatment sessions). These probes are referred to as generalization probes (GP) and were used as a dependent measure to determine the impact of the introduction of an additional therapeutic treatment (Social Initiation Training; SIT) during the intervention phase. Each child participated in a baseline phase for 2-8 weeks followed by 8 weeks of the intervention phase. Individual participants were randomly assigned to one of three baseline conditions (2-, 4- or 8-week; see Figure 1). For each participant, data were obtained during pre-treatment, baseline, treatment, post-treatment, and after a one-month follow-up period.

Setting

All treatment sessions were conducted in the UCSD Autism Intervention Research Laboratory. Baseline and treatment sessions were held in two 6 x 8-ft carpeted rooms furnished with small tables, two small chairs, session materials (described below), and a one-way mirror through which all of the sessions were video recorded using a digital video camera. Each room also had two white shelves mounted 5-ft above the floor in two different corners of the room. A large living room style room with two sofas, a table and two shelves mounted 5-ft above the floor was used as a generalization setting (see Generalization, Post-treatment and Follow-up Probes: Laboratory generalization probes). The home environment of each child was also used as a generalization setting (see Generalization, Post-treatment and Follow-up Probes: Home generalization probes).

Materials

A variety of materials were used to reinforce target behaviors during baseline and treatment sessions, and during generalization, post-treatment and follow-up probes. Materials included developmentally-appropriate toys (e.g., trains), common household objects (e.g., cotton balls) and snacks (e.g., chips). To identify each participant's preferred items during laboratory sessions, an informal preference assessment, adapted from DeLeon and Iwata's (1996) multiple stimuli without replacement reinforcer assessment procedure, was used. This assessment was conducted in the laboratory prior to each assessment period and once a week during baseline and treatment sessions. During the assessment, a preference hierarchy was established for each child and the top 10-15 reinforcement items were chosen to be used for training sessions and probes that week. During the SIT sessions and GPs, reinforcement items were put in clear plastic child-proof bags and containers. Child-proof plastic containers that were used during the SIT sessions were different than those used during the probes in the laboratory and the children's homes to ensure generalization across materials had occurred. All baseline sessions, treatment sessions, and GPs in the laboratory used reinforcement items exclusively from the laboratory. For GPs in the home, parents were instructed to choose items in the home that were currently highly preferred by the child as reinforcement items. During PRT sessions, reinforcement items were put in an open plastic toy basket.

Therapist Training

All PRT and SIT sessions were conducted by the experimenter and approximately 20 trained undergraduate research assistants (RAs). Each RA received a copy of the manual *How to teach pivotal behaviors to children with autism: a training manual* (Koegel, Schreibman, Good, Cerniglia, Murphy & Koegel, 1989). During the initial

therapist training, RAs were trained to implement both types of therapy through didactic presentation and observation of other trained therapists for at least 10 hours. Research assistants then met in pairs and practiced implementing therapy on each other in a role playing activity (RAs took turns taking on the role of either the child or therapist). Finally, RAs were gradually introduced into the therapy sessions (e.g., 5 minutes of the session, then 10 minutes of the session) with study participants and were given feedback from the experimenter or another trained therapist.

Assessments

Intake Assessments

Two standardized diagnostic assessments and one standardized cognitive assessment were administered by the experimenter or another graduate level researcher in the Autism Intervention Research Laboratory prior to treatment to determine eligibility for participation. A standardized behavior rating scale was administered by the experimenter to assess the child's symptom severity.

Diagnosis. To establish study eligibility, the *Autism Diagnostic Interview-Revised* (ADI-R; Lord, Rutter, & Le Couteur, 1994) was administered to one parent of each participant. This is a standardized interview that provides a diagnostic algorithm for the DSM-IV (APA, 2000) definition of autism. Diagnostic impression was also assessed using the *Autism Diagnostic Observation Schedule* (ADOS-G;Lord, Rutter, DiLavore, & Risi, 1999). This measure is a direct observation of the child's behavior in response to specific play activities designed to elicit behavior consistent with the DSM-IV Autistic Disorder diagnostic criteria. This assessment has been shown to have high reliability and discriminate validity. In addition to meeting diagnostic criteria on the above diagnostic

assessments, a licensed clinical psychologist who it the sponsor of the project, Dr. Laura Schreibman, used her clinical judgment to determine participants' eligibility.

Cognitive Abilities. The *Mullen Scales of Early Learning* (MSEL; Mullen, 1995) was administered to assess the cognitive abilities of each child. This standardized assessment was designed as a comprehensive measure of cognitive functioning for infants and preschool children. The age equivalent for the visual reception subscale was used to determine if the child met the participation criteria of a nonverbal mental age of at least 10 months.

Symptom Severity. The experimenter interviewed the parent of each child and completed the *Childhood Autism Rating Scale* (CARS; Schopler, Reichler, & Renner, 1988). The CARS is a 15-item behavioral rating scale developed to differentiate between children with autism and those with other developmental disorders to assess the child's severity of autism. Each CARS item is coded between 1 and 4 and the sum of these scores yield a total score.

Additional Assessment

Each of the following standardized and behavioral assessments of linguistic and behavioral functioning were administered at pre-treatment, post-treatment and follow-up.

Language Abilities. One parent of each participant completed a parent report language measure, the *MacArthur Communicative Development Inventory* (CDI; Fenson, et al., 1993). The CDI is a standardized measure sensitive to communication changes in very young children (as young as 8 months). This assessment measures both receptive and expressive language. This measure yields age-equivalents for words understood, words produced and total gestures.

Adaptive Behavior. The *Vineland Adaptive Behavior Scales* (VABS; Sparrow, Balla, & Cichetti, 1984) is a standardized measure of adaptive communication, socialization and daily living skills. The VABS was administered to a parent of each participant in a structured interview. This measure yields an age equivalent and standard score in relation to normative skills in everyday life settings and daily living situations.

Social Initiations. One parent of each participant completed a *Home Behavior Questionnaire* (HBQ) developed by the experimenter to assess change in the use of social initiations in the home environment (see Appendix A). Parents were asked if they observed initiations for specific functions (i.e. help, food, toys, travel, play, and affection) in a yes/no format. If the parent reported that the child used a social initiation for a specific function (i.e. answered yes) he/she was asked to describe the initiations used in a short answer format. If the parent reported that the child did not engage in social initiations for a function (i.e. answered no), he/she was asked to describe any alternative behaviors observed for that function. Finally, parents were asked to estimate how often they observed social initiations for each function using a 5-point rating scale ranging from *frequently* (2 or more times a day) to *never* (0 times per week).

Joint Attention. The *Joint Attention Assessment* (JAA; adapted from Loveland & Landry, 1986) was used to measure each participant's ability to respond to joint attention initiations. The child and an assessor played with toys on the carpet in an unstructured laboratory setting for approximately 30 min. One parent remained in the room and was asked not to interact with the child throughout the assessment. Approximately every 30 sec, a joint attention bid was directed to the child by the assessor (e.g., established eye contact with the child and shifted his/her gaze to an object out of the child's reach). Joint

attention bids included initiating with objects (e.g., show), pointing and gaze shifting; each with and without verbalizations (e.g., “Look at the toy!”). During the assessment, a trained RA recorded if the child responded correctly. The child’s response was recorded as correct if the child responded to the bid (e.g., followed the gaze shift and looked towards the object). The number of correct responses divided by the total number of joint attention bids was used to yield percent of correct responding for each participant at each time point.

The *Early Social Communicative Scales* (ESCS; Siebert & Hogan, 1982) is a semi-structured assessment instrument designed to test a child’s ability to use different types of joint attention for requesting and sharing. During this assessment, the child and assessor sat across from each other at a child-sized table. Four colorful posters were posted on the walls. The assessor had a box of toys including a hat, sunglasses, a ball, balloons, bubbles and various wind-up toys. Each toy was introduced to the child one at a time, activated if necessary, and placed on the table beyond the child’s reach. After the child made three attempts to obtain the item, he was given the item. The child’s turn taking skills were also assessed with the hat, sunglasses and ball. Finally, we measured the child’s ability to respond to joint attention by pointing and orienting to each of the different posters on the walls.

The ESCS was video recorded and later coded by RAs who were trained to code this measure using Noldus® Video-Pro software. Behavioral measures yielded the following: rate per minute of initiating behaviors (i.e. joint attention, behavioral requests and social interaction), percent of opportunities of responding behaviors (i.e. joint attention and behavioral requests) and total frequency of responding to social interaction.

Behavioral Coding

All behavioral data were coded from video by trained RAs who were blind to the research questions addressed by the investigation. RAs were required to establish reliability with the experimenter before they began to code. Behavioral data for each child participant were coded for social initiations, vocal communication and PRT response profile using the behavioral definitions (summarized below and available in Appendices B through D).

PRT Response Profile

The *Structured Laboratory Observation* (SLO; e.g., Whalen & Schreibman, 2003) was used to establish if children exhibited behaviors consistent with the "responder" PRT profile (Sherer & Schreibman, 2005) prior to treatment. This measure was repeated during post-treatment to assess if there were any changes in these response predictive behaviors. This assessment took place in 14-ft 8-in x 13-ft (4.47 m x 3.96 m) carpeted living-room style setting with two couches, a coffee table and a child size table and chairs. This observation required one parent participant. The assessment was divided into three 5-min segments: 1) Attending condition: The child was allowed to play independently with toys while the parent observed; 2) Language condition: The parent tried to elicit language from the child; 3) Play condition: The parent encouraged the child to play appropriately with 3-4 toys. Behaviors were coded in continuous 30-sec intervals. The SLO was coded in its entirety for the presence of the five profile behaviors: toy contact, approach behavior, avoidance behavior, nonverbal stereotypy and verbal stereotypy (see Appendix D). In order the qualify for the study, at intake, child participants could not have more than three of the following PRT "responder" behavior

characteristics: moderate to high interest in toys, tolerance of another person in close proximity to them (low avoidance, high approach), moderate to high rates of verbal stereotypy and low to moderate rates of nonverbal stereotypy. These same behaviors were analyzed during the SLO at post treatment.

Vocal Communication

Measures of verbal language during PRT were used to assess the effectiveness, or PRT responsiveness, for each child when SIT was added the each child's treatment. The vocal communication behaviors of each child were coded from video recordings of PRT sessions during baseline and treatment. One randomly selected session each week was coded during the middle 10-min of a 20-min session. The middle of the session was coded in order to eliminate warm-up and fatigue effects. Noldus® Video-Pro software was used to analyze the behaviors. The frequency of vocalizations was recorded and each vocalization was then categorized by complexity (communicative sound, one-word phrase) and type (spontaneous, cued, imitated; see Appendix D).

Generalization, Post-treatment and Follow-up Probes

Generalization probes were used to assess the generalization of participants' therapeutic changes to untrained environments and adults and to assess the maintenance of skills over time. GPs occurred once a week during baseline and treatment and additional probes were conducted during post-treatment and follow-up periods. During each 15-min probe, no training took place and prompting was not used. Adults present during the probe were instructed to respond as they usually do to child-initiated social communication (e.g., if the child approaches and smiles at them, they could smile back and say, "hi"). These instructions were intended to allow adults to provide the same

reinforcement for social initiations that was likely occurring in the child's natural environment. When adults were instructed not to reinforce social initiations during probes in the pilot stages of the study, the newly acquired social behaviors were quickly extinguished and thus did not accurately represent changes in these behaviors during treatment. GPs were coded for seven types of social initiations (tapping, hand leading, vocalizations, eye contact, sign language, combined social initiations, maladaptive social initiations; see Appendix B).

Laboratory generalization probes. GPs in the laboratory took place during intake assessments to determine study eligibility. They were also repeated after every 4 hours of PRT or SIT sessions throughout baseline and treatment, and twice during both post-treatment and follow-up. GPs took place in a living-room style setting (see SLO setting above). Previous research found that social interactions with familiar adults are less impaired than interactions with unfamiliar adults and peers (Hauck, Fein, Waterhouse, & Feinstein, 1995). Thus, both an unfamiliar adult and the parent participant were present. Throughout the assessment, the unfamiliar adult sat on the couch pretending to have a phone conversation that was scripted. The parent sat on the couch and read a book or looked at a magazine. Both adults were available for the child to initiate interaction. During the first 5-min, none of the child's preferred items were in the room, and an initiation with an adult could only result in person to person engagement with the unfamiliar adult or parent. After 5-min, an adult briefly entered the room and placed preferred items on shelves out of the child's reach and on a coffee table in transparent plastic containers that the child could not open. If the child initiated a request for an item (e.g., the child handed the adult a container with a ball inside and said, "bah" with eye

contact) the adult provided access to the item. Then, that item was returned to a container or shelf after 30 sec (a stop watch was used) by the unfamiliar adult, at which point the child could initiate again to regain access. This allowed for a consistently high number of opportunities for the child to initiate during the brief period.

Home generalization probes. A GP in the home was used to further assess the extent of the generalization of therapeutic training. An RA videotaped a 15-min observation in the home after every 4 hours of intervention during baseline and treatment and twice during both post-treatment and follow-up. Probes usually took place in the main living area of the family's home. The RA and parent that were the only adults present. Before the GP began, the parent participant was asked to choose three of the child's highly preferred objects and place them in clear plastic child proof containers or on shelves if they were available. The parent was then instructed to engage in a daily activity that did not directly involve the child (e.g., chores, reading, talking on the phone). During the first 5 min, no reinforcement items were in the room. Then, the parent or RA brought the preferred items into the room and the assessment continued for 10 additional minutes.

Fidelity of Implementation

Fidelity of implementation (FI) was coded and calculated for 10% of all SIT sessions and 10% of all PRT sessions. This measure was used to ensure the accurate implementation of both training components and thus the integrity of the independent variable. This measure was also used to protect against unintended experimenter bias. Fidelity of implementation was coded from videotape by trained undergraduate RAs (see Appendices C and D). For the PRT sessions, FI measures yielded 97.4% for Attention, 97.4% for Clarity, 100% for Appropriateness, 76.9% for Maintenance and Acquisition,

100% for Child Choice, 89.7% for Contingent Consequences, 100% for Direct Reinforcement, 89.7% for Reinforcement of Attempts and 89.7% for Turn Taking. Fidelity measures for SIT sessions yielded 96.1% for Environment, 84.3% for Attention, 94.1% for Attempts, 88.2% for Time Delay, 98% for Prompts, 90.2% for Contingent, and 100% for Phase.

Procedure

All treatment sessions (PRT and SIT) were conducted by approximately 20 trained RAs (at least 5 per child) and the experimenter. The materials and the setting used during baseline were the same as those used throughout treatment.

Baseline

Children participated in baseline sessions for the first 2, 4 or 8 weeks of the study. During baseline, each child received 4 hours of PRT per week (12, 20-min sessions), divided over three days.

Pivotal Response Training. PRT is a naturalistic treatment technique that was designed to address deficits in children with autism by targeting the child's motivation. Strategies used in PRT are described in a published manual *How to teach pivotal behaviors to children with autism: a training manual* (Koegel, et al., 1989) and include the following: gaining child attention, providing a clear and appropriate cue, interspersing maintenance and acquisition tasks, providing child choice, reinforcing good attempts, providing contingent reinforcement and providing reinforcement directly related to child behavior. PRT has been shown to improve social communication skills in children with autism including language, play and social skills (e.g., Rogers & Vismara, 2008).

Intervention

During the treatment phase, children continued to participate in sessions 4 hours a week for 8 weeks; however, sessions were divided evenly between PRT (2 hours) and SIT (2 hours). PRT sessions during treatment were the same as PRT sessions during baseline.

Social Initiation Training. SIT is a therapeutic technique that was developed by the experimenter to teach social communication strategies to preverbal children with autism who do not meet PRT responder criteria for two or more behaviors in the non-responder profile (and thus are not expected to learn to spontaneously initiate social communication strategies from PRT alone; Sherer & Schreibman, 2005). Two adults participated in each SIT session: one adult was available for child initiations, called the communicative partner (CP) and the other adult assisted the child to initiate correctly, called the physical prompter (PP). The child's preferred items were placed in view of the child inside a transparent plastic bag with a zipper closure, in a transparent childproof plastic container or on a shelf that was out of the child's reach. Both the CP and the PP were engaged in other activities (e.g., talking to each other, reading or writing) and instructed not to look at, talk to or interact with the child in between teaching opportunities. Therefore, the child did not have access to either social attention or preferred items until he engaged in the targeted behaviors.

During the session, if the child made any attempt to gain attention or access to preferred items with any maladaptive behavior (e.g., whining) or without engaging the CP (e.g., trying to bite through the plastic bag to get the food inside), the PP used physical guidance (e.g., gently guided the child with a hand-over-hand prompt to pick up the bag, bring it to the adult and tap on the CP's leg) or expectant waiting (e.g., look at

child and wait until the child established eye contact) to teach the child to initiate communication (e.g., requesting help) with the CP. Over trials, the PP gradually faded prompts until the child was able to spontaneously initiate social communication with the CP using the targeted skill (see Phases 1-4 below). When the child initiated with the CP, whether spontaneous or prompted, the CP provided reinforcement that was appropriate for the function of the behavior for up to 1 min. For example, if the child looked at the CP and whined and it appeared that the child wanted attention, the PP guided the child to tap the CP. Then, the CP stopped what she was doing, said, "Please" to indicate that the tap was interpreted as a request, and provided attention (e.g., turned towards the child, smiled and made positive statements). The word "please" was used because it was universally appropriate for all of the potential functions of the initiation (to gain attention or access to object and to get help). The CP used linguistic mapping by pairing each initiation with a verbalization but the child was not required to imitate the verbalization until phase 4 (see description below). After the reinforcement was provided, the CP once again made preferred items and attention inaccessible to the child (e.g., put toy back on the shelf, removed attention by disengaging from the child and returning to another activity). Opportunities to initiate with the CP continued until the 20-min session ended.

Each child learned 4 levels of appropriate behaviors to initiate a social exchange across 4 phases. Training in each phase utilized backward chaining and prompt fading.

Phase1: The child is taught to initiate an interaction by approaching the adult with or without objects and tapping the adult.

Phase 2: The child is taught to communicate by leading the adult by the hand to something that is out of reach and tapping the adult.

Phase 3: The child is taught to initiate by coordinating eye contact with the social communication strategies from Phases 1 and 2.

Phase 4: The child is trained to coordinate a vocalization and eye contact with the social initiation behaviors from Phases 1 and 2.

After each SIT phase, 2-3 SIT sessions were used to teach the child to travel a short distance (e.g., 4 feet) to the CP and to persist in the initiation with the CP if he/she did not immediately respond. This distance and persistence training is adapted from *The Picture Exchange Communication System (PECS) Training Manual* (Frost & Bondy, 2002). Distance and persistence are important skills in order for social initiations to generalize to the natural environment (Frost & Bondy, 1995) and thus were included in all 4 phases of SIT after the mastery criterion for each skill was met and before starting the next training phase.

During Phase 1 of SIT, each child learned to approach and tap another person to initiate an interaction. When the function of the initiation was to request access to a preferred item in a container, the child was taught to pick up the container and bring it to the CP. When the preferred item was one that the child needed adult assistance with (e.g., train cars that child needed assistance connecting), the child was prompted to bring the item to the adult. Data on approaching and tapping were collected by trained RAs observing through a one-way mirror during each session. The mastery criterion for Phase 1 was that the child demonstrated approach and tapping behaviors spontaneously five or more times per session across two sessions.

During Phase 2, children were taught to take the CP by the hand, lead them to the shelf holding the preferred item, and tap the CP. In order to maintain initiating behaviors

from Phase 1, opportunities to engage in approaching and tapping behaviors were interspersed throughout the training session. Each child had to spontaneously engage in hand leading 5 or more times per session across two sessions to master Phase 2.

In the next phase of training, Phase 3, children were trained to communicate by coordinating eye contact with the initiating behaviors learned during Phases 1 and 2. Expectant waiting was used by the CP (the adult looked at the child and waits until she can establish eye contact with the child) followed by immediate reinforcement. The mastery criterion was coordinating spontaneous eye contact with tapping and hand leading five or more times per session across two sessions.

In the final phase of SIT, Phase 4, children were taught to coordinate vocalization and eye contact with approaching with or without objects, tapping and hand leading. Vocalizations were targeted by modeling the vocalization "please", providing additional verbal prompts and delaying reinforcement until the child made an attempt to imitate. If children were not able to produce the consonant or vowel sounds in "please" to approximate it, another adaptive vocalization was selected that the child could produce (e.g., "mmm" for more). Verbal prompts were gradually faded until the child was vocalizing spontaneously (no verbal or gestural model needed).

Social Validation Measures

Observer Ratings

To determine the social importance of the changes in child behavior, and thus the social validity of the intervention children received during the study, a short questionnaire (see Appendix E) completed by 60 undergraduate students at the University of California, San Diego who were naïve to the purpose of the study. Each observer was

assigned to one of two groups and watched 8 different 6-minute video clips of children during social initiation probes in the laboratory. One group observed two study participants at pre-treatment and two study participants at post-treatment. The other group observed the same children at opposite points in treatment so that each observer saw each child only once. In addition to video recordings of study participants, observers watched clips of four typically developing children ranging in age from 2 to 4 years old in the same setting. All video clips were presented to raters in a random order. Observers were informed that they were viewing videos of children and parents and that each child may or may not have developmental delay. After viewing each video clip, observers were asked to respond to four questions about the child's interest in adults, appropriate use of initiations, requests and language using a 9-point Likert scale (1 being "not at all" and 9 being "very much"). They were also asked to rate the child's behavior to that of typical preschoolers (1-9; 1 being "not at all typical" and 9 being "very typical". For each naïve observer who provided ratings, the scores assigned to each of the five questions were averaged to yield a single score for each participant. Ratings were used to measure the change in from pre-treatment to post-treatment and to provide a rating comparison of typically developing children of the same age.

Measures of Expectation and Satisfaction

Another aspect of social validity is the extent to which the parents find that participation in the study was helpful and responsible for improving his/her child's behavior. Assessments of expectations (pre-treatment; see Appendix F) and satisfaction (post-treatment; see Appendix G) (adapted from Forehand, Wells, & Griest, 1980) were completed by the parents of each participant. These self-report measures, developed as

part of an ongoing NIMH research study in the Autism Intervention Research Laboratory, were designed to measure parent expectations and satisfaction with the experimental intervention. Some questions required one or two written sentences and others involved using a 7-point Likert scale. These questionnaires were used to establish the social validity of both intervention used and to inform the experimenter of the parent's perception of how the therapeutic interventions may be improved.

Parent Expectation. Questions on the consumer expectation questionnaire measured parent outlook before any therapeutic intervention, PRT or SIT had taken place (see Appendix F). Questions assessed parent expectations for a satisfactory outcome (7-point Likert scale), changes in child behavior (short answer), and gains (short answer) as a result of the therapeutic intervention provided during the study.

Parent Satisfaction. Questions on the consumer satisfaction questionnaire measured parent's beliefs about PRT and SIT following both treatments (see Appendix G). Questions using a 7-point Likert scale assessed if parents believed that each intervention received was related the child improvement and if parents would recommend the interventions to another parent of a child with autism. Parents were also asked to share what part of the program was most helpful to them in a short answer format. These were all questions relevant to the feasibility of an intervention specifically targeting social initiations in a community setting.

Observational and Recording Procedures

Coding definitions for the observational measures of social initiations and vocal communication are available in Appendix B.

Each GP (laboratory and home) was videotaped and coded for social initiations

including tapping, hand leading, vocalizations, sign language, eye contact, and combined social initiations. The frequency of each of these behaviors was coded by 60-sec intervals to assess inter-rater reliability across coders.

To assess changes in vocal communication during PRT, the middle 10-min of each PRT session was coded for vocal communication behavior and each vocal communication was categorized by type (spontaneous, cued or imitated) and complexity (communicative sound or one-word phrase).

To determine the PRT response profiles of each child during pre and post-treatment, the SLOs were assessed using occurrence/non-occurrence data in 30-sec intervals. The behaviors coded were toy contact, approach, avoidance, vocal stereotypy and non-vocal stereotypy (see Appendix B).

Interobserver agreement

Interobserver agreement, or reliability, was calculated on behavioral coding for social initiations, maladaptive behaviors and vocal communication behaviors (see Table 14). Interobserver agreement was calculated across all participants and for each behavior separately. Reliability calculations were performed using Cohen's kappa statistic, which corrects agreement due to chance (Bakeman & Gottman, 1997; Bartko & Carpenter, 1976). Interobserver agreement was calculated for 31% of GPs for tapping, hand leading, vocalizations, eye contact and sign language, 36% of GPs for maladaptive initiations, and 30% of 10-min PRT session samples for communicative sounds, one word phrases, cued vocal communication, imitated vocal communication and spontaneous vocal communication. Kappa coefficients were calculated for each coded behavior yielding .97 for tapping, 1 for hand leading, .96 for vocalizations, .94 for sign language, .94 for eye

contact, .77 for maladaptive social initiations, .67 for communicative sounds, .44 for one word phrases, .70 for cued vocal communication, .87 for imitated vocal communication and .66 for spontaneous vocal communication.

Interobserver agreement for the fidelity of PRT implementation was calculated by evaluating the consistency between each coder on each therapist behavior across subjects. Reliability was defined as agreement between both coders on the criterion for each behavior being met (i.e. "pass") or not met (i.e. "no pass"). For example, if 2 coders watched the same video sample and both recorded a "pass" in the category of Direct Reinforcement then those coders are considered in agreement and therefore are reliable. Reliability was coded for 34% of PRT fidelity samples and was 100% for attention, 100% for Clarity, 100% for Appropriateness, 92% for Maintenance/Acquisition, 100% for Multiple Cues, 100% for Contingent, 100% for Direct Reinforcement, 54% for Reinforcement of Attempts and 69% for Turn Taking.

SIT implementation was coded using a 3-point scale for each category. The interobserver agreement criterion was identical scores or scores within 1 point of each other for 6 of the 7 SIT components. Reliability was calculated for 41% of SIT FI assessments and the reliability calculation was 100% for all components of SIT.

Data analysis

The therapeutic effectiveness of SIT was determined by changes in performance during GPs. Analysis of the behavioral observation data was conducted using fine-grain visual analysis of changes across conditions as is customary when a multiple baseline design is employed (Gliner, Morgan & Harmon, 2000). In this analysis, an emphasis was placed on the consistency of behavioral change across subjects, such that the data of each

and every subject must evidence behavioral change in the same manner for an effect of condition to be inferred. Child standardized assessments were examined individually and across participants.

Analysis of the social validity measure was conducted using matched-pairs t-test to compare the ratings of children with autism to those of typically developing children and to evaluate change in the behaviors of participating children from pre-treatment to post-treatment.

RESULTS

Social Initiations

Overall, the social initiation data reveal that SIT was an effective therapeutic intervention for all four children. All four participants exhibited gains in the frequency of child-initiated social behaviors with the onset of SIT. In addition, they all showed some maintenance of an increase in social initiation behaviors once the treatment was removed. Changes in maladaptive social initiations were less clear, and varied by child. Details about the changes in social initiation behavior are presented below.

Laboratory Generalization Probes

Tapping. During baseline GPs in the laboratory, no tapping was observed in any of the four participants (see Figures 2 and 4). With the onset of treatment, all four children exhibited a substantial increase in tapping behavior. Brandon and Nathan had the most dramatic and stable increase. Matthew's tapping increased but the change was more pronounced. Finally, Ethan's increase was substantial but variable (Matthew $M_{baseline}$= 0, SE=0; $M_{treatment}$=2.5, SE=0, Brandon $M_{baseline}$= 0, SE=0; $M_{treatment}$=10.1, SE=1.80, Nathan $M_{baseline}$= 0, SE=0; $M_{treatment}$=5.4, SE=1.78 and Ethan $M_{baseline}$= 0, SE=0; $M_{treatment}$2.5=, SE=1.05).

During post-treatment GPs in the laboratory, Matthew *(M*=3.5, SE=0.5) Brandon *(M*=16.5, SE=1.5), and Ethan (*M*=3.5, SE=1.5) continued to show a mean rate of tapping above baseline rates and even above the mean rate evidenced during the treatment phase (see Figure 4). The fourth child, Nathan showed tapping behavior at post-treatment that was above his baseline rate (*M*=2.5, SE=1.5) but below the level of tapping exhibited during treatment. During follow-up, all 4 participants showed a mean rate of tapping

above that of baseline and treatment (Matthew *M*=1.5, SE=0.5; Brandon *M*=7, SE=1; Nathan *M*=7.5, SE=2.5; Ethan *M*=7.5, SE=1.5) suggesting maintenance of behavior change.

Hand Leading. No hand leading was observed in three of the four participants (Brandon, Nathan and Ethan; *M*=0, SE=0) during baseline GPs and hand leading was observed at a low level for Matthew (*M*= 1.5, SE=1.5; see Figures 2 and 5). During treatment, Brandon and Ethan showed an increase in hand leading (Brandon *M*=2.13, SE=1.08; Ethan *M*=2, SE=1). Matthew showed a decrease in hand leading (*M*=0, SE=0) and for Nathan hand leading was not observed (*M*=0, SE=0). During post-treatment and follow-up probes Matthew, Nathan and Ethan (*M*=0, SE=0) did not exhibit hand leading. Brandon engaged in hand leading during both post-treatment (*M*=5, SE=1) and follow-up (*M*=4.5, SE=1.5).

Vocalizations. In GPs, all 4 children exhibited an increase in vocalizations during treatment (see Figures 2 and 6). The mean rate in which each child used vocalizations increased from baseline to treatment for Matthew ($M_{baseline}$=0, SE=0; $M_{treatment}$=1.63, SE=.99), Brandon ($M_{baseline}$=0, SE=0; $M_{treatment}$=1.9, SE=1.26), Nathan ($M_{baseline}$=0, SE=0; $M_{treatment}$=1.13, SE=.85) and Ethan ($M_{baseline}$=0, SE=0; $M_{treatment}$=.88, SE=.64). The mean frequency of vocalizations was greater during post-treatment probes than treatment probes for Matthew (*M*=8, SE=0), Brandon (*M*=4, SE=4) and Nathan (*M*=8, SE=0). Brandon's vocalizations increased further during follow-up (*M*=5.5, SE=4.5) while Matthew's decreased substantially (*M*=1, SE=1) and Nathan's decreased slightly (*M*=7.5, SE=2.5). Ethan did not engage in any vocalizations during post-treatment (*M*=0, SE=0), but did engage in vocalizations during follow-up (*M*=3.5, SE=1.5) at a greater mean

frequency than during treatment.

Eye Contact. During baseline, two participants, Matthew and Ethan, exhibited eye contact during their social initiations (Matthew *M*=1, SE=0; Ethan *M*=1.9, SE=.85; see Figures 3 and 7). Both participants showed an increase in eye contact during treatment (Matthew *M*=1.9, SE=.83; Ethan *M*=3, SE=1). Neither Brandon nor Ethan showed eye contact with initiations during baseline and showed low levels during treatment (Matthew $M_{baseline}$=0, SE=0; $M_{treatment}$=.5, SE=.50; Nathan $M_{baseline}$=0, SE=0; $M_{treatment}$=.5, SE=.27). During post-treatment, Matthew and Ethan exhibited a substantial increase in eye contact which was even greater than seen during treatment (Matthew *M*=9.5 , SE=0.5; Ethan *M*=7, SE=1). During follow-up, Matthew and Ethan showed a decrease in mean frequency of eye contact (Matthew *M*=2.5, SE=1.5; Ethan *M*=3.5, SE=0.5) but it was still above the mean rate during baseline and treatment. During post-treatment and follow-up, Brandon did not exhibit eye contact (*M*=0, SE=0). During post-treatment, Nathan exhibited an increase in eye contact that was maintained during follow-up ($M_{post\text{-}treatment}$=2.5, SE=.5; $M_{follow\text{-}up}$=2.5, SE=1.5).

Sign Language. Sign language, although not a behavior targeted during treatment, was measured for each participant (see Figures 3 and 8). Matthew was the only participant that used sign language during baseline (*M*=1, SE=1; Brandon *M*=0, SE=0; Nathan *M*=0, SE=0; and Ethan *M*=, SE=0). During treatment, Matthew's use of sign language increased (*M*=3.1, SE=1.2) and increased again during post-treatment (*M*= 6, SE=3). His use of sign language during follow-up was consistent with post treatment (*M*=6, SE=3).

Combined Social Initiations. All four participants exhibited an increase in

combined social initiations from baseline to treatment (Matthew $M_{baseline}$=2.5, SE=.5; $M_{treatment}$=2.5, SE=.54, Brandon $M_{baseline}$=0, SE=0; $M_{treatment}$=10, SE=1.71, Nathan $M_{baseline}$=0, SE=0; $M_{treatment}$=6.13, SE=1.77, Ethan $M_{baseline}$=0, SE=0; $M_{treatment}$=4.25, SE=.96; see Figure 9). Three of the participants showed a further increase in social initiations during post-treatment (Matthew *M*=17.5, SE=3.5; Brandon *M*=17, SE=1; Nathan *M*=8, SE=0) and one participant showed a slight decrease (Ethan *M*=3.5, SE=1.5). During follow-up, Nathan and Ethan both engaged in social initiations more than during baseline, treatment or post-treatment (Nathan *M*=9.5, SE=0.5; Ethan *M*=9.5, SE=1.5). Matthew showed a sharp decrease in the mean frequency of his initiations from post-treatment to follow-up (*M*=6, SE=3) but was still initiating at a mean rate above that of baseline. Brandon's average rate of combined social initiations went down during follow-up ($M_{post\text{-}treatment}$=17, SE=1; $M_{follow\text{-}up}$=12.5, SE=3.5) but maintained a rate higher than either baseline (*M*=0, SE=0) or treatment (*M*=10, SE=10).

Maladaptive Social Initiations. Two children, Nathan and Ethan, showed a decrease in maladaptive social initiations from baseline to treatment (Nathan $M_{baseline}$=30.3, SE=7.9; $M_{treatment}$=14.7, SE=3.9; Ethan $M_{baseline}$=4.2, SE=2; $M_{treatment}$=3.8, SE=1; see Figure 10). Matthew and Brandon both showed an increase in maladaptive social initiations from baseline to treatment (Matthew $M_{baseline}$=18.5, SE=18.5; $M_{treatment}$=38.3, SE=7.4; Brandon $M_{baseline}$=2.4, SE=2.4; $M_{treatment}$=2.9, SE=1.6).

PRT Response Profiles

Data were collected from video recordings of SLOs and coded for behavioral characteristics identified in the PRT response profile: toy contact, approach, avoidance, verbal stereotypy and nonverbal stereotypy. The mean percent of interval occurrence for

SLOs at each time point was compared to the PRT "responder" criteria; a range of means established in a previous study and shown to indicate a positive response to PRT (Sherer & Schreibman, 2005). The PRT response criteria included the following behaviors during the SLO: moderate to high interest in toys, tolerance of another person in close proximity to them (low avoidance, high approach), moderate to high rates of verbal stereotypy and low to moderate rates of nonverbal stereotypy.

The PRT response profiles for all four participants are detailed in Table 4. None of the child participants met the criteria for a PRT "responder" in all five behavioral categories during pre-treatment SLOs. Following treatment, two children, Matthew and Nathan showed an increase in the number of behavioral characteristics matching the profile. At pre-treatment, Matthew met the "responder" criteria in two behavior categories and at post-treatment he met the responder criteria in four categories. Nathan only met criteria for one category during pre-treatment and at post-treatment he met the criteria in three categories. Brandon showed a decrease in "responder" behaviors with three at pre-treatment and two at post-treatment. The number of "responder" categories for Ethan stayed the same.

From pre to post treatment, the specific behaviors matching the "responder" profile changed for each participant. During pre-treatment SLOs, Matthew was the only child that exhibited high enough levels of approach behavior that met the "responder" criterion for approach. During post-treatment, all four children showed levels of approach consistent with the PRT "responder" profile. During pre-treatment SLOs, both Brandon and Ethan exhibited low rates of avoidance, thus meeting the "responder" criterion for avoidance behavior. At post-treatment, Brandon and Ethan both showed an

increase in avoidance behavior and no longer met the criterion. Matthew's avoidance was too high during pre-treatment to meet the "responder" criterion but was low enough to meet the criterion post-treatment. Nathan's level of avoidance was too high to meet the "responder" criteria at both pre-and post-treatment.

During pre-treatment, none of the four children engaged in enough contact with toys to meet the "responder" criterion for toy contact. During post-treatment, two children, Matthew and Nathan did. All four children had verbal stereotypy at levels that met the "responder" criterion pre- and post-treatment. Brandon was the only child to have levels of nonverbal stereotypy low enough to meet the PRT "responder" criterion pre-treatment. All four of the children had too much nonverbal stereotypy to meet the criterion during post-treatment.

Vocal Communication: PRT Sessions

Vocal communication behaviors were analyzed using the Noldus Observer® Video-Pro software from video recordings of PRT sessions during baseline and treatment. The mean totals of all vocal communication during baseline, treatment, post-treatment and follow-up are presented in Figure 16.

Overall changes were observed in vocal communication behavior in all of the children. Details about changes in vocal communication behavior are presented below.

Communicative Sounds

The mean frequency in which children engaged in communicative sounds during baseline and treatment increased for three of the four participants (see Figure 11). Brandon showed the greatest increase in communicative sounds from baseline (M=27.5, SE=10.9) to treatment (M=45.1, SE=3.83). Nathan and Ethan also showed a positive

change in communicative sounds (Nathan $M_{baseline}$=19.5, SE=3.84; $M_{treatment}$=40.3, SE=7.37; Ethan $M_{baseline}$=10.3, SE=3.9; $M_{treatment}$=15.3, SE=1.76). Finally, Matthew showed a slight decrease in the mean frequency from baseline to treatment ($M_{baseline}$=28, SE=13; $M_{treatment}$=27.5, SE=3.49).

One-word Phrases

The change in the mean frequency of one-word phrases from baseline to treatment for each child was variable (see Figure 12). Brandon showed the greatest increase with a change from a mean of 0 (SE=0) during baseline to a mean rate of 15.4 (SE=8.4) during treatment. Ethan showed a small increase in one-word phrases from baseline (M=0, SE=0) to treatment (M=1.4, SE=.6). Matthew showed no change in one-word phrases ($M_{baseline}$=0, SE=0; $M_{treatment}$=0, SE=0). Lastly, Nathan showed a small decrease from baseline (M=1.8, SE=1.4) to treatment (M=.5, SE=.3).

Spontaneous Vocalization

Two of the four children showed an increase in spontaneous vocal communication from baseline to treatment (see Figure 13). The mean frequency of spontaneous vocal communication behaviors from baseline to treatment increased for Brandon ($M_{baseline}$=6, SE=5; $M_{treatment}$=7.7, SE=2.27) and Nathan ($M_{baseline}$=4, SE=1.78; $M_{treatment}$=4.6, SE=2.38), and decreased for Matthew ($M_{baseline}$=4.5, SE=.5; $M_{treatment}$=3, SE=2.62) and Ethan ($M_{baseline}$=1.4, SE=.7; $M_{treatment}$=1, SE=.33).

Cued Vocalization

An increase in cued vocal communication from baseline to treatment was observed in three of the four children (see Figure 14). Brandon ($M_{baseline}$=7.5, SE=6.5; $M_{treatment}$=43.3, SE=7.04), Nathan ($M_{baseline}$=16.3, SE=4.87; $M_{treatment}$=36.5, SE=6.72), and

Ethan ($M_{baseline}$=8.4, SE=4.1; $M_{treatment}$=13.3, SE=1.73) all showed an increase in the mean frequency of cued vocal communication while Matthew showed a small decrease ($M_{baseline}$=21.5, SE=12.5; $M_{treatment}$=19.8, SE=2.36).

Imitated Communication

Three of the four participants showed an increase in the mean total of imitated vocal communication from baseline to treatment (see Figure 15). An increase in imitated vocal communication was observed from baseline to treatment for Matthew ($M_{baseline}$=1.5, SE=1.5; $M_{treatment}$=3.8, SE=.6), Brandon ($M_{baseline}$=3, SE=3; $M_{treatment}$=7.3, SE=3.36) and Ethan ($M_{baseline}$=.5, SE=.27; $M_{treatment}$=2.5, SE=.91). This increase was not observed for Nathan ($M_{baseline}$=.8, SE=.75; $M_{treatment}$=.6, SE=.38).

Combined Vocal Communication

Three of the four children showed an increase in total vocal communication (communication sounds and one-word phrases; see Figure 16). The mean frequency of total vocal communication increased dramatically for Brandon ($M_{baseline}$=27.5, SE=10.85; $M_{treatment}$=60.5, SE=9.67) and Nathan ($M_{baseline}$=21.25, SE=5.27; $M_{treatment}$=41.8, SE=7.59) and substantially for Ethan ($M_{baseline}$=10.1, SE=3.9; $M_{treatment}$=16.9, SE=2.2). Matthew showed a slight decrease in his combined vocal communication from baseline (M=28, SE=13) to treatment (M=27.5, SE=3.49).

Generalization of Social Initiations: Home Environment

Overall, the data from GPs in the home environment support SIT as an effective therapeutic intervention that produces changes in social communication that generalize across settings. Gains in the frequency of social initiation behaviors were observed in all four children at the onset of treatment. All four participants generalized gains in the

mean frequency of social initiations from baseline to treatment to the home environment. According to parent report, children showed an increase in initiating social interaction for at least one function (e.g., help, attention, affection) and three of the four children engaged in tapping, hand leading and vocalization within these initiations at post-treatment. There were missing data for some children during post-treatment and follow-up in which case only one GP was used for these measures. When that occurred, the total frequency during that GP, rather than the mean frequency was reported.

Details about the changes in social initiation behavior are presented below.

Home Generalization Probes

Tapping. None of the children exhibited tapping during baseline probes and all four children exhibited tapping during treatment probes (see Figures 17 and 19). The mean frequency of tapping increased during treatment for Matthew ($M_{baseline}$=0, SE=0; $M_{treatment}$=2.8, SE=1.1), Brandon ($M_{baseline}$=0, SE=0; $M_{treatment}$=12.8, SE=2.2), Nathan ($M_{baseline}$=0, SE=0; $M_{treatment}$=3.5, SE=1.12), and Ethan ($M_{baseline}$=0, SE=0; $M_{treatment}$=1.8, SE=1.28). Ethan showed further increases in tapping from treatment to post-treatment (Ethan M=5, SE=2) and post-treatment to follow-up (6, no SE). Brandon showed a decrease in tapping from treatment to post-treatment (M=8.5, SE=8.5) followed by an increase from post-treatment to follow-up (12, no SE). Nathan showed a decrease in tapping from treatment to post-treatment (0, no SE) followed by an increase in tapping during follow-up (M=6, SE=1). Matthew showed a decrease in tapping behavior during post-treatment and then again during follow-up ($M_{post\text{-}treatment}$=.5, SE=.5; $M_{follow\text{-}up}$=0, SE=0).

Hand Leading. Only one of the four children showed an increase in hand leading

from baseline to treatment (see Figures 17 and 20). The mean frequency of hand leading increased slightly for Brandon ($M_{baseline}$=0, SE=0; $M_{treatment}$=.1, SE=.13), and did not change for Nathan ($M_{baseline}$=0, SE=0; $M_{treatment}$=0, SE=0), Ethan ($M_{baseline}$=.5, SE=.5; $M_{treatment}$=.5, SE=.3) or Matthew ($M_{baseline}$=0, SE=0; $M_{treatment}$=0, SE=0). Brandon did not exhibit any hand leading during post-treatment (M=0, SE=0) but did show had leading during follow-up (1, no SE). None of the other three children showed hand leading in the home environment during post-treatment or follow-up (Matthew $M_{post\text{-}treatment}$=0, SE=0; $M_{follow\text{-}up}$=0, SE=0; Nathan *post-treatment* 0, no SE; $M_{follow\text{-}up}$=0, Ethan $M_{post\text{-}treatment}$=0, SE=0; *follow-up* 0, no SE).

Vocalization. All four children showed an increase in vocalizations during social initiations from baseline to treatment and from baseline to follow-up (see Figures 17 and 21). The mean frequency of vocalizations that each child engaged in increased for Matthew ($M_{baseline}$=0, SE=0; $M_{treatment}$=.4, SE=.18), Brandon ($M_{baseline}$=0, SE=0; $M_{treatment}$=2.4, SE=1.45), Nathan ($M_{baseline}$=0, SE=0; $M_{treatment}$=.5, SE=.38) and Ethan ($M_{baseline}$=0, SE=0; $M_{treatment}$=1.1, SE=.74). During post-treatment, Matthew showed a slight increase in the mean frequency of vocalizations (M=.5, SE=.5) while Nathan showed an increase that was more substantial (9, no SE). Both Brandon and Ethan showed a decrease in vocalizations from treatment to post-treatment (Brandon M=0, no SE; Ethan M=0, SE=0) but they both engaged in vocalizations during follow-up (Brandon 1, no SE; Ethan 5, no SE). Matthew exhibited his highest level of vocalizations during follow-up (M=2, SE=1). Nathan exhibited a decrease from post-treatment to follow-up but maintained a frequency well above baseline (Nathan 4.5, SE=3.5).

Eye Contact. Three of the four children showed an increase in eye contact during

social initiations from baseline to treatment (see Figures 18 and 23). The mean frequency of eye contact that each child engaged in increased for Brandon ($M_{baseline}$=0, SE=0; $M_{treatment}$=1.6, SE=1.6), Matthew ($M_{baseline}$=0, SE=0; $M_{treatment}$=3, SE=.87), and Ethan ($M_{baseline}$=4.6, SE=.9; $M_{treatment}$=5.1, SE=1.5), but did not increase for Nathan ($M_{baseline}$=2.5, SE=1.65; $M_{treatment}$=2.1, SE=.93). Ethan showed an increase in the mean frequency of or eye contact from treatment to post-treatment (M=6, SE=3), and maintained the same level at follow-up (6, no SE). Nathan's eye contact increased from treatment to post-treatment (7, no SE) with a slight decrease during follow-up ($M_{follow-up}$=6.5, SE=.5). The other two children, Matthew and Brandon showed a decrease in eye contact and did not engage in any during post-treatment (Matthew M =0, SE=0; Brandon M=0, SE=0). Matthew's eye contact increased during follow-up (M =2, SE=1) but Brandon's did not (M=0, SE=0).

Sign Language. Two of the four children showed an increase in sign language from baseline to treatment (see Figures 18 and 22). The mean frequency of sign language that each child engaged in increased for Matthew ($M_{baseline}$=0, SE=0; $M_{treatment}$=1.4, SE=.73), but did not increase for Brandon ($M_{baseline}$=0, SE=0; $M_{treatment}$=0, SE=0), Nathan ($M_{baseline}$=0, SE=0; $M_{treatment}$=0, SE=0) or Ethan ($M_{baseline}$=0, SE=0; $M_{treatment}$=0, SE=0). Matthew's sign language decreased from treatment to post-treatment (M=0, SE=0) and then increased again during follow-up (M=2, SE=2). None of the other 3 children showed sign language behaviors during post-treatment or follow-up (Brandon $M_{post-treatment}$=0, SE=0; *follow-up* 0, no SE; Nathan *post-treatment* 0, no SE; $M_{follow-up}$=0, Ethan $M_{post-treatment}$=0, SE=0; *follow-up*=0, no SE).

Combined Social Initiations. All four of the children increased the mean

frequency of combined social initiations in the home from baseline to treatment (Matthew $M_{baseline}$=0, SE=0; $M_{treatment}$=4, SE=1.24; Brandon $M_{baseline}$=0, SE=0; $M_{treatment}$=11.8, SE=2.82; Nathan $M_{baseline}$=0, SE=0; $M_{treatment}$=4.8, SE=1.31; Ethan $M_{baseline}$=.5, SE=.5; $M_{treatment}$=3.8, SE=1.36; see Figure 24). They all continued to show combined social initiations at post-treatment and follow-up at a rate higher than baseline (Matthew $M_{post-treatment}$=1, SE=1; $M_{follow-up}$=3, SE=1; Brandon $M_{post-treatment}$=8.5, SE=8.5; $M_{follow-up}$=16, no SE; Nathan $M_{post-treatment}$=9, no SE; $M_{follow-up}$=9, SE=0; Ethan $M_{post-treatment}$=6, SE=3; $M_{follow-up}$=7, no SE).

Home Behavior Questionnaire

Parent responses on the HBQ at pre- and post-treatment indicated whether children were initiating in the home setting for the following functions: help, food, toys, travel, play and affection. All four of the participants' parents indicated that his/her child engaged in initiations for at least two functions during pre-treatment (see Table 5). During post-treatment, parents indicated that his/her child engaged in initiations for at least three functions. Observations of gains in initiations for food were the most consistent across participants (Matthew, Brandon and Ethan). Gains were also seen in initiations for travel (Matthew and Brandon), toys (Brandon) and play (Nathan). Decreases in initiations were seen for help (Ethan), toys (Ethan), travel (Ethan) and play (Brandon and Ethan). According to the HBQ, during pre-treatment, Brandon and Nathan did not engage in tapping, hand leading or vocalizations (see Table 6). Ethan engaged in hand leading and Matthew engaged in tapping and hand leading. At post-treatment, Brandon, Matthew and Nathan engaged in tapping, hand leading and vocalizations and Ethan engaged in tapping and vocalizations.

Social Validation

Observer Rating Scale

For each naïve observer (undergraduate student) who provided ratings, the scores assigned to each of the five questions using 9-point Likert scales were averaged to yield a single score for each participant. Observers rated the videos of typically developing children with a mean score of 5.45 with a range of 4.2-6.1 (*SD*=.85; see Table 7). Three of the four participants received higher ratings on average following treatment. Brandon received significantly higher ratings at post-treatment (M = 6.22, SD = 1.26) than at pre-treatment (M = 2.17, SD = .78), $t(1, 30) = -14.84$, $p < .000$. Change in mean ratings from pre- to post-treatment were also significant Ethan ($M_{\text{pre-treatment}}$ =2.58, SD =1.08; $M_{\text{post-treatment}}$ =5.51, SD =1.08), $t(1, 30) = 7.84$, $p < .000$ and Nathan ($M_{\text{pre-treatment}}$ =1.78 , SD =1.05; $M_{\text{post-treatment}}$ = 6.27, SD =1.19), $t(1, 30) = -20.011$, $p < .000$. Matthew was the only participant that did not receive significantly higher ratings at post-treatment (M =4.08, SD =.67) than at pre-treatment (M =4.89, SD =.79), $t(1, 30) = -1.895$, $p < .068$. He also had the highest average rating at pre-treatment with a rating most similar to that of the typically developing children.

Parent Expectation

According to the consumer expectation questionnaire when parents rated their expectations for a satisfactory outcome from the treatment using a 7-point Likert scale (1 being “very optimistic” and 7 being “very pessimistic”), parents of three of the children were very optimistic (Nathan 7, Ethan 7, Brandon 6) and parents of one of the children was in between very pessimistic and very optimistic (Matthew 4; see Table 8). When asked what changes they foresaw after treatment, their responses included the following:

gaining verbal communication skills (Matthew), communicating more using verbal and nonverbal communication (Brandon), be able to talk and socialize (Nathan) and have more communication however that may be (Ethan).

Parent Satisfaction

On the consumer satisfaction questionnaire, when parents rated if the skills being taught in the program were relevant to his/her child's improvement using a 7-point Likert scale (1 being "not at all" and 7 being "a great deal"), parents rated either 6 or 7 for PRT and for SIT (see Table 9). When parents rated if they would recommend the program to another parent of a child with autism using a 7-point Likert scale (1 being "strongly oppose" and 7 being "strongly recommend"), three parents rated 7 for both PRT and SIT and one parent rated 7 for PRT and 6 for SIT (Brandon). When asked what part of the program was most helpful, parent responses were as follows: learning to get attention (Matthew), starting to ask for help, leading me to places, motivating him with toys, and attempting to imitate sounds (Brandon), social initiations (Nathan) and eye contact and PRT (Ethan).

Standardized Assessments

Overall, for the standardized assessments, there was no clear pattern of change for all participants from the pre-treatment to post-treatment period and from the post-treatment to follow-up period.

Language Assessment

The changes in age-equivalent scores across words understood, words produced and total gestures on the CDI were relatively small and inconsistent among the four child participants (see Tables 2 and 3).

Adaptive Behavior Assessment

Between pre-treatment and post-treatment time points, Matthew's VABS communication age-equivalent score increased, his daily living skills score slightly decreased and his socialization score was stable (see Tables 2 and 3). Between post-treatment and follow-up time points, his communication and socialization age-equivalent scores decreased and his daily living skills scores increased. For Brandon, his communication age-equivalent score decreased and his daily living skills and socialization were stable between pre-treatment and post-treatment. Between post-treatment and follow-up, his communication and socialization scores increased and his daily living skills score did not change.

From pre-treatment to post-treatment periods, Nathan's communication and socialization age-equivalent scores decreased and his daily living skills score did not change. Between post-treatment and follow-up, all of his age equivalent scores were relatively consistent. Between pre-treatment and post-treatment time points Ethan did not show improvement on communication or daily living skills age-equivalent scores. Additionally, his socialization age-equivalent score was lower at post-treatment than it was at pre-treatment. Conversely, between post-treatment and follow-up, Ethan showed improvement in age-equivalent scores for all three adaptive behavior categories. According to this measure, while other children showed improvement in some areas, overall, Ethan showed the most substantial and consistent improvement in adaptive behavior from the pre-treatment period to that of follow-up.

Diagnosis and Symptom Severity

All four child participants had scores on the ADOS-G and ADI that were

consistent with a diagnosis of autism (see Tables 1). Three of the four participants, Matthew, Brandon and Nathan, scored in the autistic range (either mildly-moderately or severely) in symptom severity on the CARS and one participant, Ethan scored just below the autistic range.

Behavioral Assessments

Joint Attention Responding

Overall, changes in correct responding on the JAA were inconsistent (see Table 10). The most consistent pattern of change was the increase in correct responding between post-treatment and follow-up for three of the four children. Matthew showed a substantial decrease in correct responding to joint attention bids from pre- to post-treatment, Nathan and Ethan showed a slight decrease and Brandon showed no change. From post to follow-up, the percentage of correct responses increased for three of the participants to levels above pre- and post-treatment (Matthew, Brandon and Nathan). During follow-up, Ethan's percentage of correct responding was below that of both pre-treatment and post-treatment.

Joint Attention Initiating and Responding

Initiating behaviors on the ESCS, initiating joint attention (IJA), initiating behavioral requests (IBR) and initiating social interaction (ISI) are presented in Table 11. For Matthew, IJA, IBR and ISJ decreased from pre to post treatment. Between post-treatment and follow-up, IJA decreased, IBR increased and ISI stayed the same. For Brandon, IJA increased slightly and IBR and ISI decreased slightly from pre to post-treatment. From post-treatment to follow-up, gains were observed in IJA, IBR and ISI. Nathan showed an increase in IJA, a decrease in IBR and no change in ISI from pre- to

post-treatment. From post-treatment to follow-up, Nathan showed gains in IJA and IBR and no change in ISI. Finally, from pre- to post-treatment, Ethan showed an increase in IBR, and no change in IJA or ISI. From post-treatment to follow-up, a decrease in IJA, an increase in IBR and no change in ISI was observed.

Two responding behaviors on the *ESCS*, responding to joint attention (RJA) and responding to behavioral requests (RBR) are presented in Table 12. Only one child, Nathan, showed gains in RBR from pre-to post-treatment while Matthew, Brandon and Ethan, showed no change. From post-treatment to follow-up, Matthew, Brandon and Ethan showed a gain in RBR while Nathan showed a decrease. All four participants showed a gain in RBR from pre- to post-treatment. Two of the four children, Ethan and Brandon, showed an additional gain during follow-up. Nathan and Matthew evidenced a decrease in RBR at follow-up.

A final type of social responding, responding to social interaction (RSI) was evaluated (see Table 13). Matthew, Brandon and Nathan all responded to more social interactions during post-treatment than they had during pre-treatment. Ethan's frequency of RSI stayed the same. At follow-up, the same rate of RSI as post-treatment was observed for Ethan and Matthew. Brandon showed an increase in RSI and Nathan showed a decrease.

DISCUSSION

The present study systematically evaluated a therapeutic intervention aimed at increasing child-initiated social interactions in young children with autism marked delays in social communication skills. While other social initiation interventions exist (e.g., Koegel, Vernon & Koegel, 2009), this study evaluated one of the first interventions for toddler age children without functional speech. In the current study, all four of the participants exhibited gains in the frequency of social communication behaviors at the onset of SIT. Moreover, all of the participants exhibited increases in social initiations in generalization settings and maintained gains at a one-month follow-up. Together, these findings support SIT as an efficacious treatment for increasing social communication behaviors.

In addition to evaluating a new therapeutic intervention, this study sought to replicate an earlier finding that children who did not meet the "responder" profile for PRT did not exhibit gains in social initiations when they received PRT (Sherer & Schreibman, 2005). The finding that none of the participants showed an increase in social initiations during baseline supports the predictive validity of the PRT response profile. These data also contribute to the ever-growing body of research on using child characteristics to predict treatment response.

In addition to evaluating the predictive validity of the behavior profile on changes in social initiations during PRT, this study examined how increases in social initiations during treatment changed behavioral profiles. Although preliminary, data suggest that increases in social initiations during SIT are related to increases in one of the behaviors that predict a positive response to PRT, approach.

This study also explored how response to PRT, measured in the form of language gains, changed when each child received SIT. This was accomplished by analyzing vocal communication skills, the main behavioral target during PRT sessions, during baseline and treatment PRT sessions. Findings suggest that gains in social initiation skills during SIT had a positive effect on the therapeutic effectiveness of PRT. If predictive profiles suggest that a specific behavior characteristic is necessary for a child to benefit from an intervention such as PRT, the addition of an intervention to target that behavior characteristic to a child's treatment program (PRT + SIT), may be beneficial. Some researchers believe that systematically combining interventions is the most appropriate way to individualize intervention (e.g., Rogers & Vismara, 2008; Iovannone, Dunlap, Huber & Kincaid, 2003). However, some researchers argue that combining treatments may be detrimental to learning (e.g., Howard, Sparkman, Cohen, Green and Stanislaw, 2005). Results for this investigation suggest that systematically combining treatments based on child characteristics may be an effective approach.

Finally, there was a significant difference in naïve observers rating of children pre- and post-treatment for three of the four participants. Participants looked more similar to typically developing children following treatment. More specific aspects of these findings are discussed below.

Social Initiations

An increasing number of research studies demonstrate that a large number of children with autism who receive early behavioral intervention show substantial improvement (e.g., Vismara & Rogers, 2010). However, there is also a subset of children

who do not show these improvements. Further, there is a paucity of research examining the specific child behavioral characteristics related to positive outcomes. The present investigation specifically addressed the importance of early social interaction skills and the limited research on variability in outcome. One of the key questions addressed by this study concerned children who do not meet the PRT "responder" profile, suggesting they would not significantly benefit from participation in PRT, and their ability to develop social initiations during PRT. The findings from this study support the conclusion that no, PRT alone is *not* sufficient to bring about positive gains in social initiations for these very young, preverbal children. In fact, two social behaviors tapping and vocalizations, were not observed in any of the participants during the baseline condition of PRT only. Eye contact was observed in two of the participants during baseline, but a positive pattern of change in this behavior was not observed. One child showed gains in hand leading during baseline, but when the treatment phase began, he did not continue to show positive changes in this behavior even though he continued to receive PRT. The results from this study are consistent with the previous finding by Sherer and Schreibman (2005) that children who do not meet the "responder" profile do not increase social initiations during PRT.

Increasing information on which evidence-based treatments fail to remediate social deficits in children with specific behavior characteristics provides a foundation on which to develop and systematically evaluate treatments that may lead to improved outcomes in social initiations. The present study investigated the effectiveness of SIT for teaching children who were unlikely to learn social initiations behavior through PRT

alone. In support of the effectiveness of SIT, all four of the participants exhibited substantial gains in the frequency of social initiation behaviors during treatment. The clear gains observed in tapping, eye contact, vocalizations and combined social initiations strongly support the efficacy of SIT to teach children whose behavior does not meet the PRT "responder" profile to initiate social interaction. In addition, since data were collected in an untrained setting, with untrained adults, these findings support the generalized nature of these gains. In sum, these data support the efficacy of SIT in targeting social skills in children who did not show gains in social initiations during PRT.

Although the current findings offer strong evidence to support positive gains in tapping, eye contact, vocalizations and combined social initiations across all four participants, gains in hand leading are less clear. It is important to note that according to session data used to determine mastery of each phase, all four subjects learned to use hand leading during phase two of SIT and met the mastery criteria for that phase. However, as seen in the laboratory GPs, this type of initiation did not generalize to the untrained setting for two participants. One possible explanation is that the generalization of hand leading was not as well supported by the training environment. SIT sessions were conducted in very small treatment rooms and participants did not have to lead an adult more than a few feet. In contrast, the generalization setting in the laboratory was much larger and children often had to travel up to three times farther each way to lead an adult to a shelf. Since travelling the greater distance was not practiced during SIT sessions, this may have presented a barrier to the generalization of this skill. A second possible explanation is that the hand leading in the generalization settings required

greater behavioral output or more work for the child, and delay to reinforcement was greater. During GPs in the laboratory, some of the preferred items were placed on the coffee table in the center of the room. Participants brought preferred items to an adult, tapped the adult and the adult usually opened the container. In order to gain access to the preferred items on shelves, the child walked from the preferred item on the shelf to an adult, led the adult back to the shelf and tapped the adult. Thus, hand leading required a greater number of behaviors than the other initiations which usually led to a great delay to reinforcement (access to the item). The increased effort and delayed access to the preferred items may explain the lack of generalization of hand leading exhibited by two of the participants.

One type of initiation, sign language was not specifically taught during SIT but data were collected because Matthew used sign language to communicate at a very low frequency during baseline. Data on sign language provided an opportunity to assess collateral changes in one social behavior when other social behaviors were learned. Results indicate that Matthew's sign language increased during treatment. These data suggest that when new social communication skills are learned, a generalized increase in social initiations may occur. However, Matthew practiced sign language in the special education preschool classroom that he attended while he was in the study so this relationship is unclear. Future studies exploring the generalized effect of SIT on established social initiation behaviors are necessary to determine the extent of this relationship.

Although individual differences were observed in participants' changes in social

initiations, the overall increase in initiations is clear. All four participants evidenced more social initiations at the onset of treatment when SIT was introduced. These findings supported the effectiveness of SIT for increasing social initiation behavior in young preverbal children with autism who are unlikely to learn these behaviors through other interventions.

PRT Response Profiles

At intake, none of the children met the PRT "responder" profile across all five behavior categories (toy contact, approach, avoidance, verbal stereotypy, nonverbal stereotypy). After receiving treatment, while none of the children met the "responder" profile across all categories, the behavior profiles of all four participants changed. Two of the four children showed an increase in the number of behavior categories that matched the PRT response profile and thus became more similar to children who are expected to respond positively to PRT. In addition, all three children who did not show high levels of approach consistent with the "responder" profile at pre-treatment evidenced an increase in this behavior following SIT. To meet the "responder" criterion for high approach, children must move within arm's reach or look at an adult frequently during the SLO. This behavior is very similar to the behaviors trained in SIT. Therefore, it is not surprising that this particular behavioral category evidenced gains following SIT. High approach was the most consistent change from pre- to post-treatment with all four participants exhibiting high approach post-treatment. These data suggest that if a child does not meet the PRT "responder" profile, directly targeting a predictive behavior (in this case approach) may create a change in behavior

characteristics and, thus, increase responsiveness to PRT.

A shift in the PRT "responder" profile following behavior intervention was also observed by Schreibman and colleagues (2009). They observed that one child with autism went from meeting the behavior criteria for only one PRT "responder" behavior (avoidance) to meeting behavior criteria for all five behaviors following a structured behavior intervention, Discrete Trial Training. To date, these are the only two studies that systematically assess the impact of treatment on behavioral profiles. Together, the results of these studies highlight the potential benefits of identifying intervention strategies that target child characteristics predictive of treatment responsiveness. Future studies evaluating SIT and other intervention strategies for children who are not predicted to respond positively to evidence based treatment are needed.

Response to PRT

The therapeutic effectiveness of PRT is well established, especially when used to target language skills (Humphries, 2003; National Standards Report, 2009). However, in the small subset of children who do not meet the PRT "responder" profile, only limited gains in vocal communication are expected. In the present study, while increases in vocal communication skills were evident during baseline (PRT) and treatment (PRT+SIT) for three of the four children, gains in treatment were considerably larger than those of baseline. The majority of gains observed were in cued and imitated vocalizations but gains were also observed in spontaneous vocalizations. Not surprisingly, since participants had no functional words when they began treatment, most of the gains exhibited during baseline and treatment were in the form of communicative sounds rather

than one-word phrases.

With regard to specific participant responsiveness, Matthew, the participant with the most combined vocal communication during pre-treatment was also the child that did not exhibit gains in this behavior from baseline to treatment. Data suggest that Matthew exhibited a very slight decrease in communicative sounds and no change in one-word phrases. In addition, he exhibited a small increase in imitated vocal communication and a small decrease in spontaneous and cued. Interestingly, one behavior that set Matthew apart from the other participants was his use of the sign for "more" to communicate requests. While the use of sign language was tracked during SIT, it was not tracked during PRT. Vocal communication was the main behavioral target during PRT but informal observations from video recordings verify that Matthew used both vocalizations and sign language during PRT. While sign language is an alternative communication strategy that can lead to positive changes in speech development, this may not have been evident during the relatively short baseline and treatment period. Matthew's use of sign language is one proposed explanation why Matthew did not evidence the gains of other participants but the data available do not allow for any strong conclusions.

The greater positive gains during in communication behavior once SIT was introduced suggest that the addition of SIT improved responsiveness to PRT for three of the four participants. This finding is consistent with previous research in which social initiations were shown to be predictive of treatment response (Koegel et al., 2001). However, because the treatment children received had two components, SIT and PRT, it is unknown if SIT alone effected responsiveness to PRT.

Generalization and Maintenance of Behavior Change

Generalization of newly learned skills to non-treatment settings is an important factor in determining the meaningfulness of an effective intervention (Powers, 2005). One of the strengths of SIT, as evidenced by the data in this study, is participants' generalized social initiations. GPs in the home were used as a second measure of generalization assessing social initiations with an untrained setting, adult and materials. Generally, initiation behaviors in the home GPs were similar with those observed in the laboratory GPs. For example, during treatment, Brandon showed the greatest increase in the frequency of tapping in the laboratory and he also showed the greatest increase in tapping in the home. Consistent with laboratory GPs, all four participants displayed substantial improvements in tapping and vocalizations from baseline to treatment during home GPs. Additionally, the same two participants who exhibited hand leading during GPs in the laboratory exhibited hand leading during GPs in the home. One difference was that when hand leading was exhibited during home GPs, it was at a lower mean frequency than laboratory GPs. While probes in the home setting were important to accurately measure the generalization of newly acquired behaviors, the environments in the children's homes were less controlled than those in the laboratory. The environmental arrangement in the laboratory GPs provided consistent opportunities for hand leading with preferred objects on three different shelves during every probe; however, shelves were not always available in the home environment. Consequently, there is an alternative explanation for the lack of evidence to support generalized gains in hand leading during home GPs.

Data suggest that participants' improvements in social initiations are maintained over time, even after they are no longer directly targeted in treatment. The maintenance of positive changes in combined social initiations in both laboratory and home GPs following treatment suggests that SIT is an effective strategy for producing long-term changes. While the maintenance of behavior gains was substantiated in post-treatment and follow-up data for most participants, there were some inconsistent findings. During post-treatment GPs, Nathan did not exhibit any tapping and Ethan and Brandon did not exhibit vocalizations. Given that the participants displayed these behaviors during treatment and follow-up GPs, it still seems likely that the participants acquired and maintained the behaviors.

Results from the HBQ provide further evidence of changes in social initiations in the home environment. These data, collected by parent report, offer insight into the functions of initiations observed (help, food, toys, travel, play, affection) in addition to the topography and estimated frequency. There were two interesting findings about gains in initiations for specific functions. First, parents reported that three of the four participants used initiations to request food more frequently following treatment. Second, and unexpectedly, only one parent reported an increase in social initiations to request toys. Both food and toys were used during SIT so it seemed likely that gains in social initiations would be similar following treatment for both of these functions. One possible explanation is that toys are more readily accessible than food in most home environments for children this age. This suggests that there are missed opportunities to practice this important type of social initiation and further highlights the need for a parent

coaching component of SIT. For example, parents could be encouraged to put favorite toys out of reach to encourage their child to initiate a request for a desired toy. While suggestive, data for the function of initiations was highly subjective and behavior analytic methodology was not used so it should be interpreted with caution.

Parents also reported changes in the topography of social initiations used at home pre- and post-treatment. According to short answer responses on the HBQ, two of the participants engaged in some social initiations at pre-treatment (Matthew tapping and hand leading, Ethan hand leading). At post-treatment, four participants evidenced vocalizations and tapping and three participants evidenced hand leading.

On the pre-treatment HBQ, Ethan's mother reported that he engaged in hand leading and at post-treatment, she reported that he engaged in tapping and vocalizations. This finding is surprising since Ethan exhibited hand leading during GPs in the laboratory and at home at a lower frequency. Also surprising was his mother's report on changes in initiations used for different functions in the home. She reported an increase in initiations for food and a decrease in initiations for help, toys, travel and play. Since data on the function of initiations during the GPs was not collected, there is no observational data to support or dispute this finding. While Ethan's acquisition, generalization and maintenance of social initiations are clear from GPs, data from parent report suggest that not all of these positive changes were observed in the home environment.

Overall, the observations from home GPs and the HBQ corroborate the findings from the laboratory GPs that specifically targeting social initiation in a therapeutic intervention leads to positive gains. Data suggest that SIT may produce long-term

generalized changes in social initiations and that these changes can be maintained over time in the natural environment.

Maladaptive Social Initiations

Conclusions about the impact of the therapeutic intervention on maladaptive behaviors are limited by the individual differences in observations of these behaviors. One participant showed a substantial decrease in maladaptive behavior, two participants showed little change and one participant, Matthew, showed a substantial increase. The topography of the maladaptive behaviors varied across children. Behaviors observed included both mild behaviors such as pulling on an adults clothing or bringing a container to an adult for help and immediately walking away, to more disruptive behaviors such as hitting and throwing. One explanation for variation in behavior changes is that some maladaptive behaviors were more easily replaced by functionally equivalent behaviors learned during SIT than other. For example, pulling on an adults clothing may be easily replaced by hand leading learned in SIT. On the other hand, climbing on a parent to get attention may be harder to replace with tapping. Additional research is needed to further elucidate this functional relationship.

Since the only measure of maladaptive behaviors was laboratory GPs including parents, evidence of the maintenance of maladaptive behaviors after learning appropriate social initiations was closely linked to the responses parents provided to these initiations. As evidenced in the data, Matthew learned to tap an adult to initiate a social interaction and displayed this behavior consistently throughout probes. However, he also climbed on his mother's back, and when he did so, his mother often responded by providing social

attention. It is likely that the increase in Matthew's maladaptive social initiations was related to the ongoing reinforcement of back climbing and other inappropriate behaviors by his mother even though new more adaptive initiations were acquired.

One unexpected and common maladaptive behavior was bringing a container with a preferred object to an adult and then walking away before the adult had a chance to open it. All four children engaged in this behavior at some point during the treatment phase. Another unexpected observation was that children often engaged in stereotyped behavior during or after walking away. For example, Matthew would bring an item to his mother, tap her on the leg and walk away and throw his body into one of the couches; Ethan would put an item in his mother's lap, walk away, sit down and rock back and forth. Staying in proximity to an adult and waiting for an access to a preferred item was targeted during SIT and physical prompts were used prevent the child from walking away or to guide the child back to the adult to wait for a response. This behavior was surprisingly hard to modify and although it did appear to decrease during SIT sessions, this change did not always generalize to the untrained settings.

In future studies, it would be helpful to record different types of maladaptive initiations to see what patterns emerge. It would also be helpful to assess changes in maladaptive behaviors with a neutral adult who had no history of reinforcing these behaviors to better understand if teaching functionally equivalent initiations is sufficient to decrease maladaptive behaviors. Finally, incorporating parent coaching into PRT may be an effective way to reduce maladaptive behaviors across settings and adults.

Standardized Assessments

The language and adaptive behavior scores showed little or no change from pre to post-treatment. Even when positive changes were evident, there was no clear pattern of change across subjects. It is possible that the length of treatment (10-16 weeks) was too brief a period in which to see substantial changes in standardized assessments.

Social Validation

The results of the consumer satisfaction questionnaire indicate that parents of all four children felt that the skills being taught in SIT were very relevant to child improvement and would highly recommend the treatment to another parent of a child with autism. Furthermore, results indicate significant improvements in the normalcy and social communication ratings were detectable in three of the four children by naïve observers. These findings suggest that the treatment led to a socially relevant clinically significant behavior change.

In the observer ratings, one child, Matthew was rated substantially higher than the other participants at intake. One behavioral difference between Matthew's pre-treatment video clip and that of other children was that he was the only child that was observed attempting to get help from an adult when preferred items were inaccessible. The other three participants did not seek out help from an adult and instead were observed throwing containers on the floor, crying or attempting to pry the lid of the container using teeth. Matthew's behavior at post-treatment was also unique in that he was the only child to use sign language, which may have been interpreted by observers as an atypical communication behavior. Either one of these differences may explain why he was the only participant with a limited change in pre- to post-treatment ratings.

Overall, the social validity data are consistent with behavioral measures indicating that SIT effectively increases social initiations in young children with deficits in social communication. In addition, they support SIT as a socially relevant intervention that parents consider beneficial. These findings have important implications for the translation of this intervention from the laboratory to clinical settings.

Limitations and Future Research

Although this study has some important implications for the use of therapeutic interventions in the treatment of young children with autism, several limitations exist. First, although it seems likely that changes in approach from pre- to post-treatment were related to gains made during SIT, participants received two interventions and the influence of each cannot be teased apart. However, given that this study provided evidence that social initiations do not increase during PRT alone, and that they do increase during SIT, it seems likely that SIT is the change agent. Future studies examining the impact of SIT alone on the child characteristics that predict response to PRT would be beneficial. Despite the limitations in conclusions that can be drawn, this important finding highlights the potential benefits of using one intervention (in this case SIT) to change child characteristics and, in turn, change a child's responsiveness to an evidence-based treatment (such as PRT).

Given that there are five behaviors in the "responder" profile, the relative importance of each behavior is unknown. While the results of this study suggest that high levels of approach behavior may be related to treatment response as evidenced by changes in language during PRT, changes in other profile behaviors also occurred. Based

on this study alone, it is impossible to discern the relative contribution of one profile behavior over another to PRT responsiveness. In the study by Schreibman and colleagues (2009), the relative influence of two of the response predictive behaviors, high toy contact and low avoidance were explored and toy contact was found to be more predictive of a positive treatment response. In another study, Ingersoll, Schreibman & Stahmer (2001) found that children with low social avoidance made more positive gains than children with high social avoidance. More research designed to analyze the predictive strength of each behavior is needed.

As new interventions are developed and existing interventions are used with younger children, it may be necessary to identify new behaviors that predict treatment responsiveness. There is some preliminary evidence to suggest that the existing PRT response profile, developed with 3 to 5 year old children may not predictive in a younger-aged sample (Cunningham, 2007). It is unclear if the profile as a whole may not be as predictive for younger children or if some of the behaviors may maintain their predictive strength. More research is needed to analyze the predictive strength of each behavior characteristic and for what age.

While PRT and SIT are very different interventions, they are both intensive behavior interventions aimed at remediating deficits in children with autism. Thus, there is some overlap in the behavioral targets between the two interventions. Since vocalizations and eye contact were trained in both interventions a carryover effect may from one intervention to the other cannot be ruled out. Again, future studies examining the impact of SIT alone would be beneficial.

Finally, the small number of subjects inherent in a single-subject design limits the generalizability of these findings across other children with autism. Additional large scale group design studies including children with different child characteristics are needed to support the effectiveness of SIT and to further analyze the behavior characteristics in the PRT "responder" profile that predict treatment response.

In conclusion, this research offers a new and exciting treatment option for increasing social initiations in young children without functional speech. It also furthers our understanding of the complex relationship between predictive behavioral profiles and treatment response.

Table 1. Participant Characteristics at Intake

Child name	Matthew	Brandon	Nathan	Ethan
Sex	M	M	M	M
Diagnosis (ADOS and ADI)	Autism	Autism	Autism	Autism
Age at Intake	3-6	2-5	2-4	2-6
Mullen NV MA	1-0	1-4	1-3	0-10
Autism Severity (CARS)	34.5	45	42.5	29.5

Note: All names presented here are pseudonyms. Ages and age equivalents are shown in years-months. For the CARS, scores of 15-29.5 indicate the individual is “non-autistic”, scores of 30-37 indicate the individual is “mildly-moderately autistic,” and scores of 37.5-60 indicate individual is “severely autistic”.

Table 2. Standardized Assessments for Matthew and Brandon

	Matthew pre	Matthew post	Matthew follow-up	Brandon pre	Brandon post	Brandon follow-up
Age						
	3-6			2-5		
Cognition						
MSELVisual Reception	1-0			1-4		
Language						
CDI Words Understood	0-10	<0-8	<0-8	<0-8	<0-8	<0-8
CDI Words Produced	0-11	<0-8	0-9	0-8	0-8	0-8
CDI Total Gestures	1-2	1-0	1-0	0-9	<0-8	<0-8
MSEL Receptive Language	1-2			0-3		
MSEL Expressive Language	0-7			0-2		
Adaptive Behavior						
VABS ABC	1-4	1-0	1-0	0-11	1-0	1-2
VABS Communication	0-6	0-9	0-8	0-6	0-4	0-9
VABS Daily Living Skills	1-2	1-1	1-7	1-2	1-1	1-1
VABS Socialization	1-1	1-1	0-9	0-7	0-8	0-11

Note: Language and adaptive behavior scores are shown as age-equivalents in years-months.

Table 3. Standardized Assessments for Nathan and Ethan.

	Nathan pre	Nathan post	Nathan follow-up	Ethan pre	Ethan post	Ethan follow-up
Age						
	2-4			2-6		
Cognition						
MSELVisual Reception	1-3			0-10		
Language						
CDI Words Understood	<0.8	<0.8	<0.8	1-0	>1-4	>1-4
CDI Words Produced	0-8	1-0	0-9	1-2	1-3	1-1
CDI Total Gestures	0-11	0-10	0-9	1-0	0-11	1-1
MSEL Receptive Language	0-7			0-8		
MSEL Expressive Language	0-5			0-5		
Adaptive Behavior						
VABS ABC	1-3	1-1	1-0	1-2	1-2	1-7
VABS Communication	0-9	0-7	0-6	0-10	0-10	1-2
VABS Daily Living Skills	1-1	1-1	1-0	1-2	1-1	1-7
VABS Socialization	1-3	0-10	0-9	0-11	0-8	1-1

Table 4. Behavioral Characteristics Matching the PRT "Responder" Behavior Profile Pre- and Post- treatment

Child	Time	Moderate to High Toy Contact	High Approach	Low Avoidance	Moderate to High Verbal Stereotypy	Low to Moderate Nonverbal Stereotypy
Matthew	Pre		**x**		**x**	
	Post	**x**	**x**	**x**	**x**	
Brandon	Pre			**x**	**x**	**x**
	Post		**x**		**x**	
Nathan	Pre				**x**	
	Post	**x**	**x**		**x**	
Ethan	Pre			**x**	**x**	
	Post		**x**		**x**	

Table 5. Parent Responses to Home Behavior Assessment Pre- and Post-treatment

Child	*Time*	*Does your child come to you to ask for help when a toy or other object is broken or they don't know how to work something or can't turn it on?*	*Does your child come to you to ask for food?*	*Does your child come to you to ask for toys that are not readily accessible?*	*Does your child come to you to ask you to go somewhere?*	*Does your child come to you to ask for you to play with him/her?*	*Does your child come to you to ask you for affection?*
Matthew	Pre	Frequently	No	No	Rarely	Frequently	Frequently
	Post	Frequently	Frequently	No	Frequently	Frequently	Frequently
Brandon	Pre	Rarely	Regularly	No	Regularly	Sometimes	Sometimes
	Post	Sometimes	Frequently	Regularly	Frequently	No	Sometimes
Nathan	Pre	Regularly	No	No	No	No	Frequently
	Post	Regularly	No	No	No	Frequently	Frequently
Ethan	Pre	Sometimes	Regularly	Regularly	Regularly	Regularly	Frequently
	Post	Rarely	Frequently	Rarely	No	No	No Answer

Table 6. Types of Social Initiations Reported by Parents on Home Behavior Assessment Pre- and Post-treatment

	Pre Treatment			Post Treatment		
	Tapping	Hand Leading	Vocalization	Tapping	Hand Leading	Vocalization
Brandon				x	x	x
Matthew	x	x		x	x	x
Nathan				x	x	x
Ethan		x		x		x

Table 7. Mean Ratings on the Observer Rating Scale at Pre- and Post- treatment

Child	Pre *M (SD)*	Post *M (SD)*	*t*-statistic	*p*-value	significance
Matthew	4.89 (0.79)	4.08 (0.67)	-1.895	.068	
Brandon	2.17(0.78)	6.22 (1.26)	-14.84	.000	*
Nathan	1.78 (1.05)	6.27 (1.19)	-20.011	.000	*
Ethan	2.58 (1.08)	5.51 (1.08)	7.884	.000	*
Typical Participants	5.45 (0.85)				

Note: The range of possible scores on the observer rating scale is 1 through 9, with 1 being the “not at all typical” or “not at all” and 9 being “very typical” or “very much”.

Table 8. Parent Responses to Consumer Expectations Questionnaire

Child	*At this point, my expectation for a satisfactory outcome of this treatment is: (scale of 1-7, 1 being "very pessimistic" to 7 being "very optimistic")*	*What types of changes if any do you foresee?*	*What are you hoping to gain from this program?*
Matthew	4	He will get verbal communication skills. He will function better in social situations. He will manage to catch up his academic goals expected in age levels.	Start to talk or at least express himself in more detail.
Brandon	6	I hope he will start to communicate more, verbal and nonverbal communication.	I'm hoping he will be able to communicate better and ask me when he wants something.
Nathan	7	That he will be talking and able to perform basic tasks, as well as be able to socialize with other people.	That he will be talking and able to perform basic tasks, as well as be able to socialize with other people.
Ethan	7	Ethan to have more communication however that may be.	To teach Ethan to communicate and to teach us as parents how to communicate to Ethan on his level.

Table 9. Parent Responses to Consumer Satisfaction Questionnaire

Child	*Treatment*	*Do you feel the skills that your child is being taught in the program are relevant to his/her improvement? (scale of 1-7 , 1 being "not at all" and 7 being "a great deal")*	*Would you recommend this program to another parent of a child with autism? (scale of 1-7 , 1 being "strongly oppose" and 7 being "strongly recommend")*	*What part of this program was most helpful to you?*
Matthew	PRT	6	7	He learned more ways to get attention.
	SIT	7	7	
Brandon	PRT	6	7	SIT helped me a lot because he started to ask for help and lead me to the places he wanted to go. But also PRT helped me to motivate him more with toys and he started to make more sounds and tried to imitate.
	SIT	6	6	
Nathan	PRT	7	7	Social initiations
	SIT	7	7	
Ethan	PRT	7	7	Eye contact, PRT
	SIT	6	7	

Table 10. Percent of Correct Responses to Joint Attention Bids on the Joint Attention Assessment at Pre-treatment, Post-treatment and Follow-up.

	Pre	Post	Follow-up
Matthew	63	47	77
Brandon	40	40	73
Nathan	53	50	63
Ethan	40	37	23
Mean (SD)	49 (11.2)	43.5 (6.0)	59 (21.4)

Table 11. Rate Per Minute of Initiating Joint Attention, Behavioral Requests and Social Interaction on the Early Social Communication Scales at Pre-treatment, Post-treatment and Follow-up.

	Joint Attention			Behavioral Requests			Social Interaction		
	Pre	Post	Follow-up	Pre	Post	Follow-up	Pre	Post	Follow-up
Matthew	0.55	0.12	0.10	0.86	0.40	0.48	0.05	0.00	0.00
Brandon	.11	0.12	0.32	0.53	0.51	1.00	0.04	0.03	0.09
Nathan	0.00	0.10	0.24	0.77	0.21	0.33	0.00	0.00	0.00
Ethan	0.29	0.29	0.16	0.04	0.21	0.33	0.00	0.00	0.00

Table 12. Percent of Opportunity Responding to Joint Attention and Behavioral Requests on the Early Social Communication Scales at Pre-treatment, Post-treatment and Follow-up.

	Joint Attention			Behavioral Requests		
	Pre	Post	Follow-up	Pre	Post	Follow-up
Matthew	50	50	57	55	88	70
Brandon	0	0	13	20	30	52
Nathan	13	38	25	0	36	28
Ethan	13	13	38	0	12	14

Table 13. Total Frequency of Responding to Social Interaction on the Early Social Communication Scales at Pre-treatment, Post-treatment and Follow-up.

	Pre	Post	Follow-up
Matthew	0	2	2
Brandon	0	2	3
Nathan	4	7	4
Ethan	1	1	1

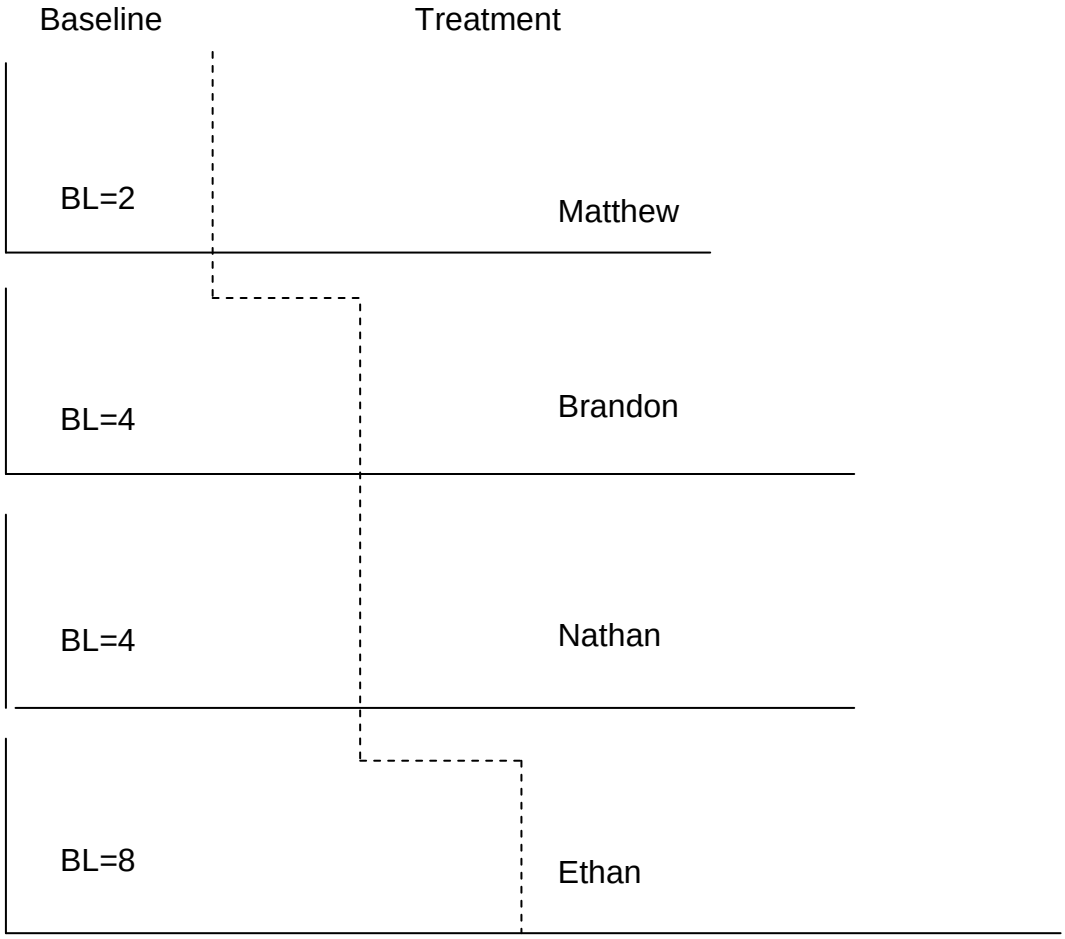

Figure 1. Multiple baseline design illustration for each participant. BL=number of baseline sessions for each participant.

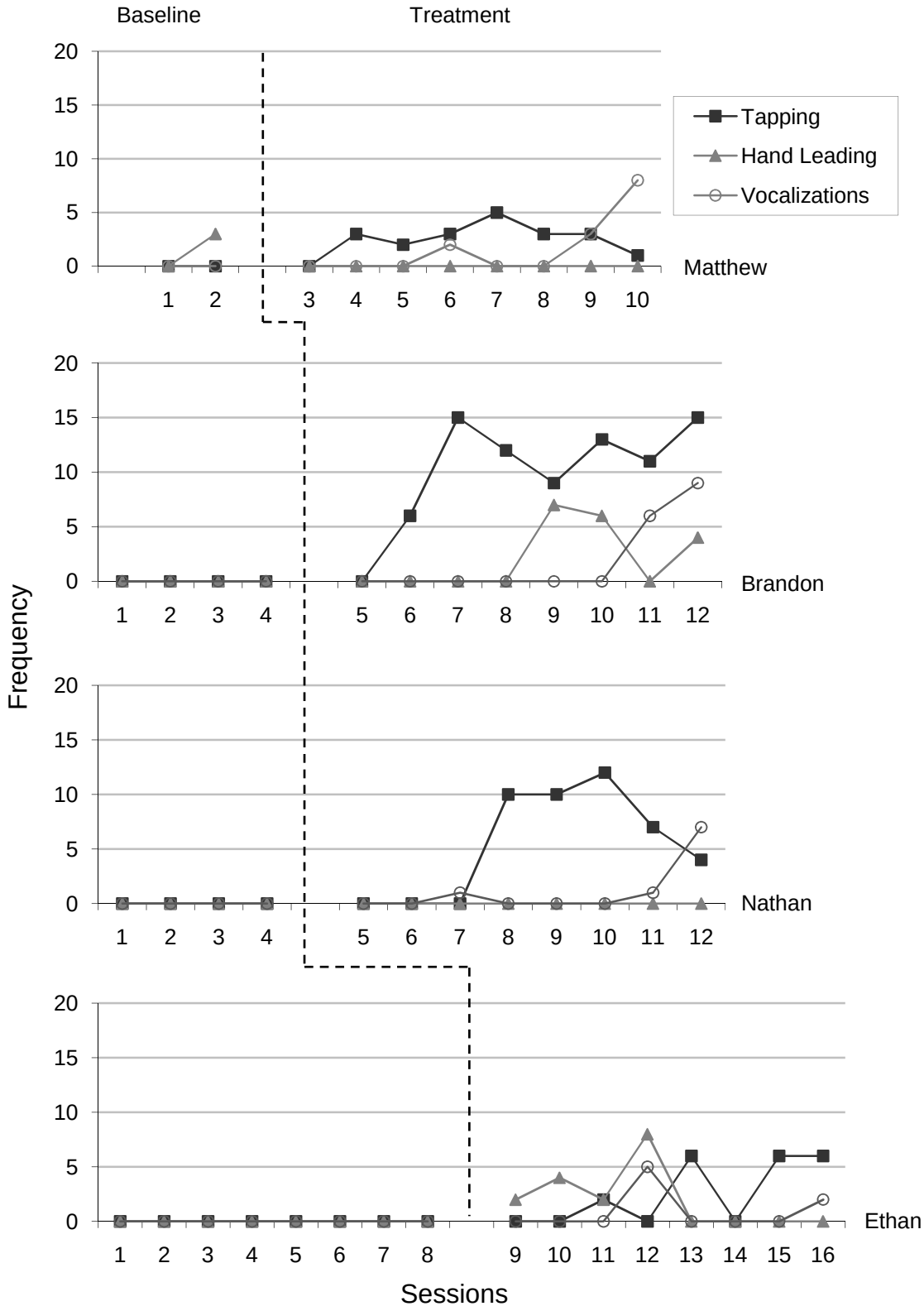

Figure 2. Tapping, hand leading and vocalizations during generalization probes in the laboratory during baseline and treatment.

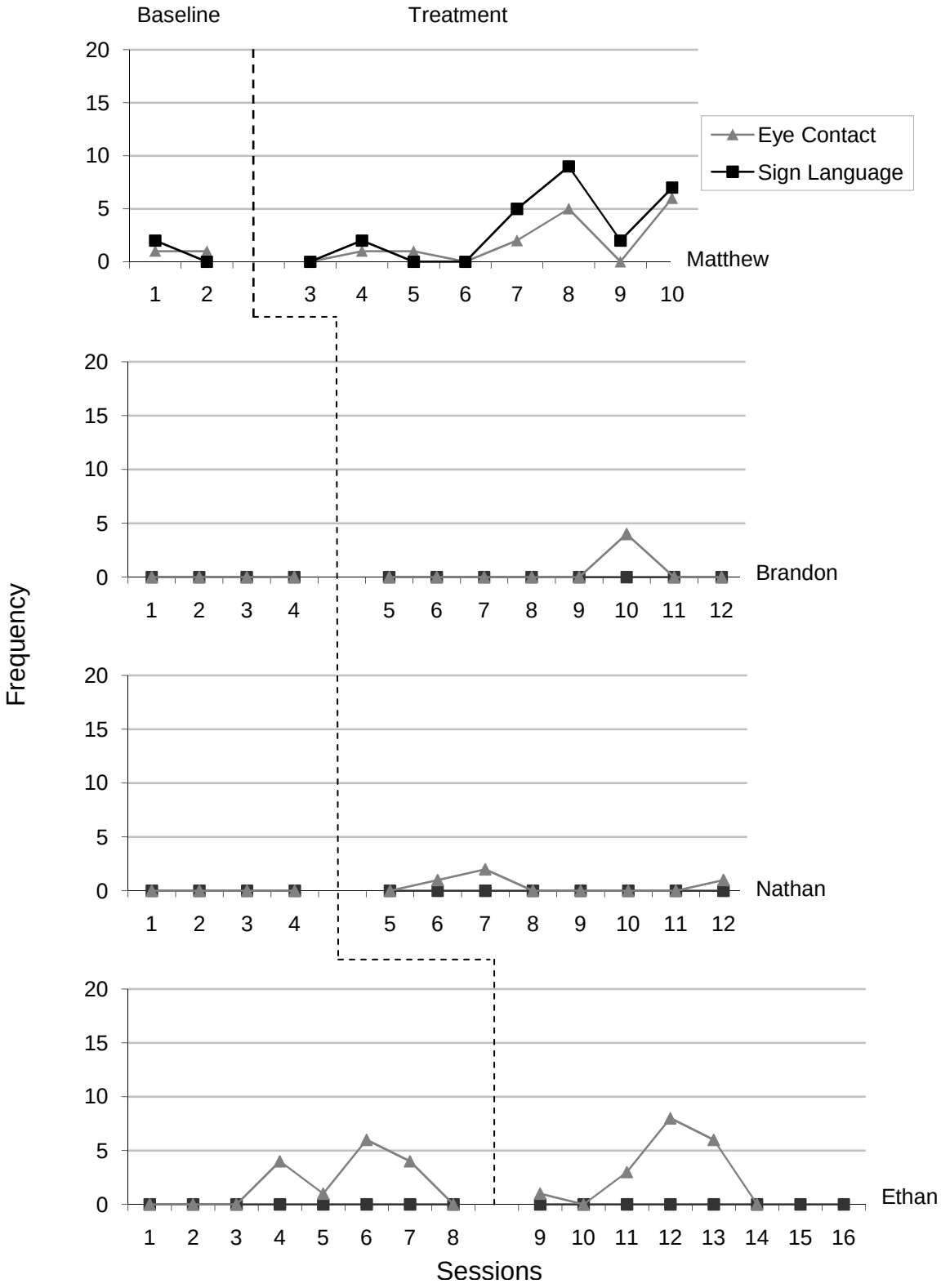

Figure 3. Eye contact and sign language during generalization probes in the laboratory during baseline and treatment.

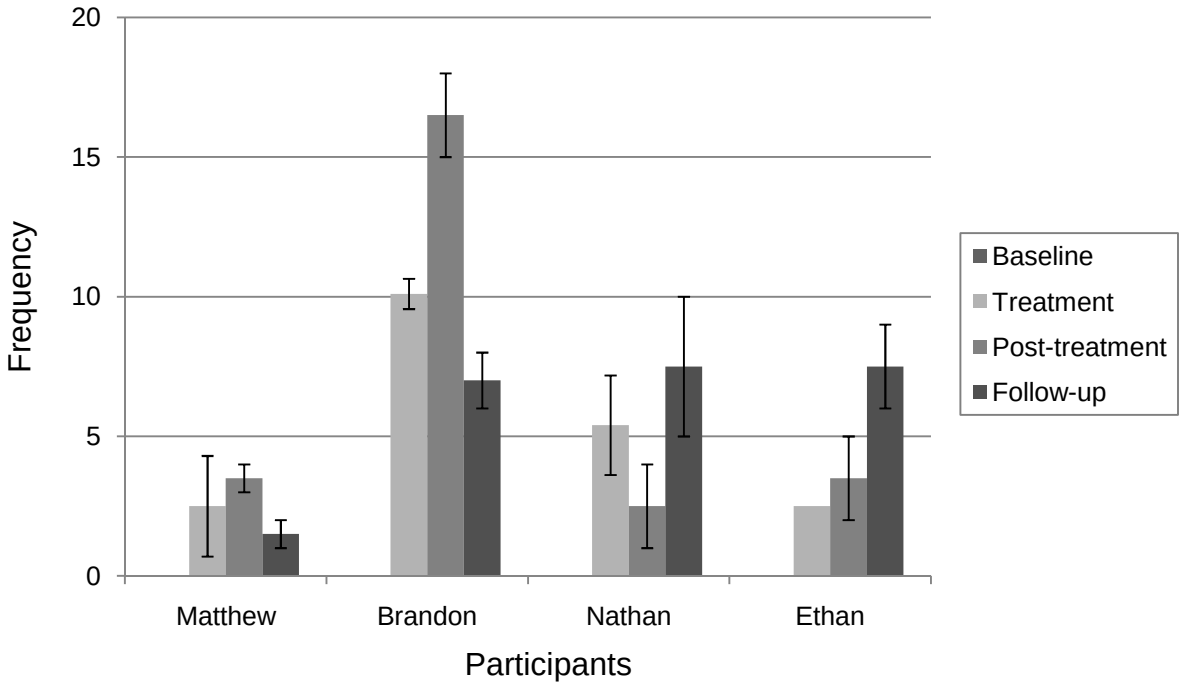

Figure 4. Mean total of tapping during generalization probes in the laboratory during baseline, treatment, post-treatment and follow-up. Error bars represent standard error.

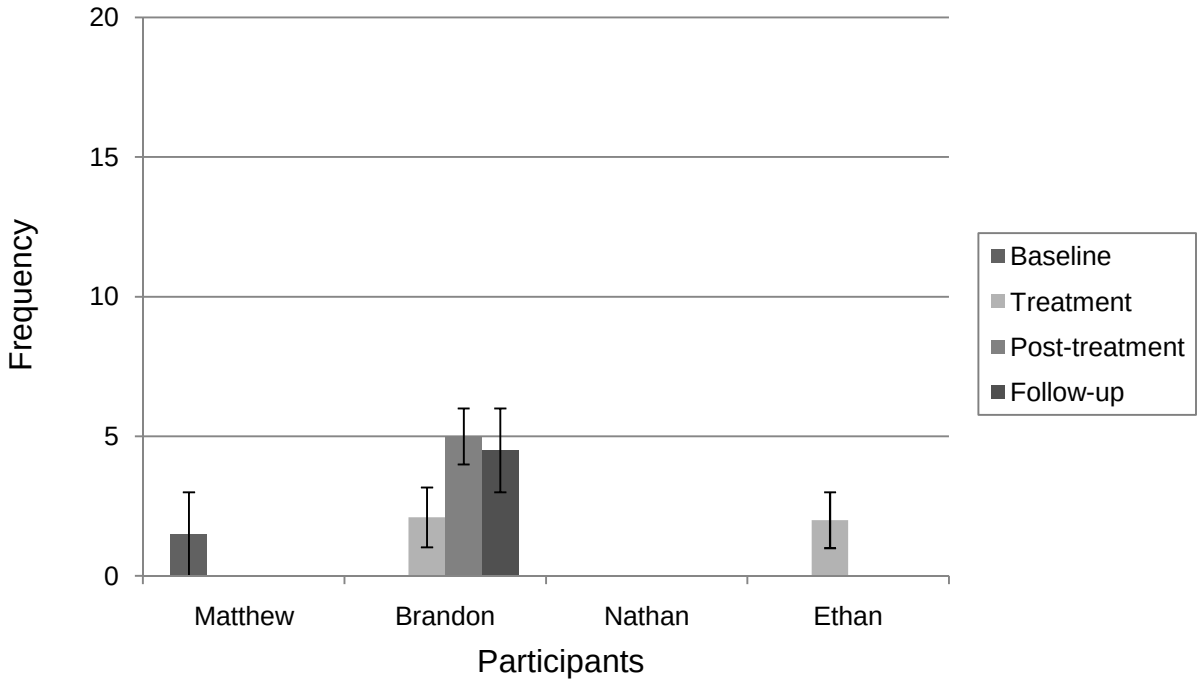

Figure 5. Mean total of hand leading during generalization probes in the laboratory during baseline, treatment, post-treatment and follow-up. Error bars represent standard error.

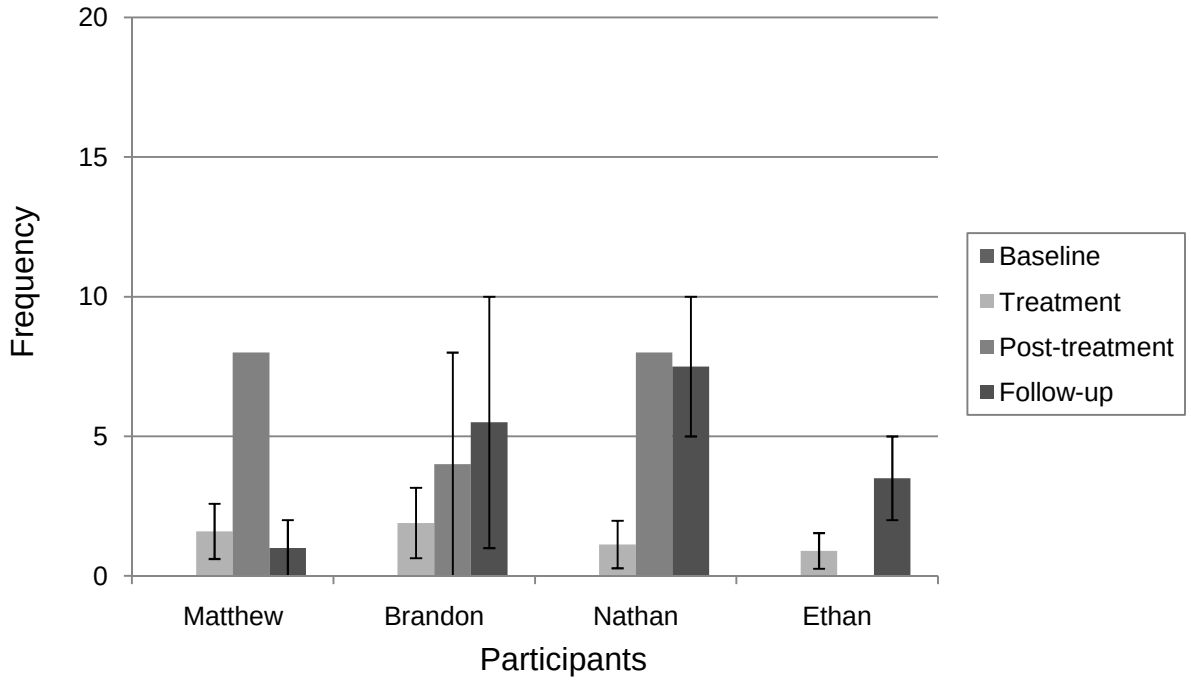

Figure 6. Mean total of vocalizations during generalization probes in the laboratory during baseline, treatment, post-treatment and follow-up. Error bars represent standard error.

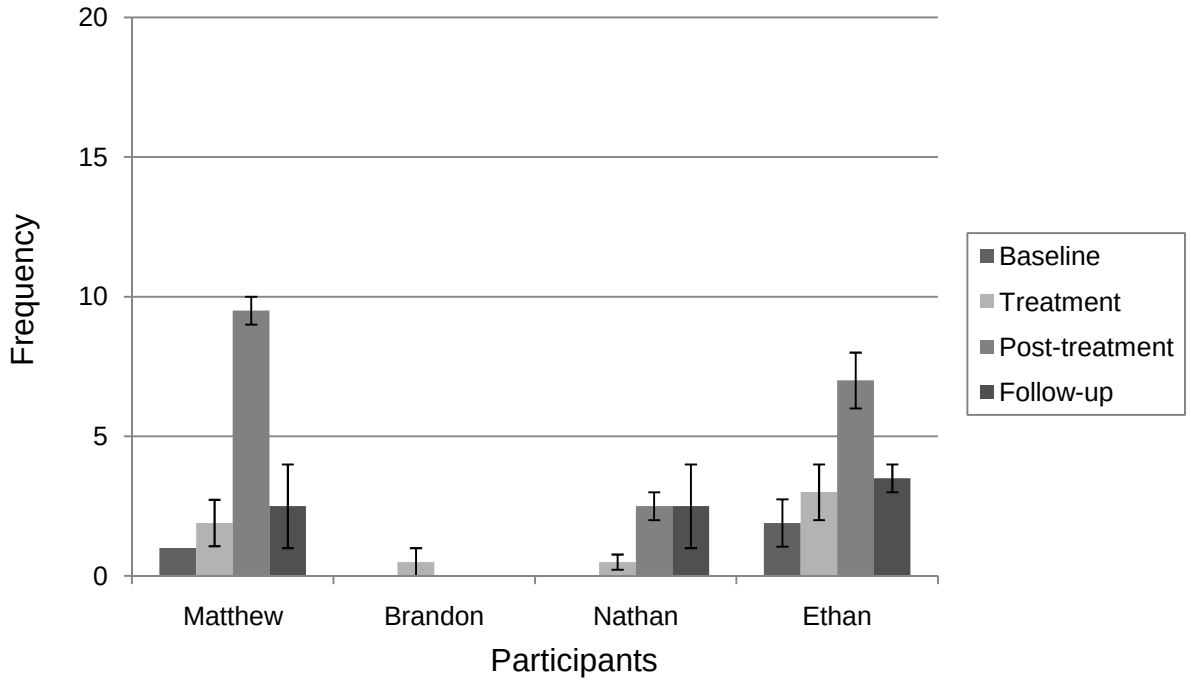

Figure 7. Mean total of eye contact during generalization probes in the laboratory during baseline, treatment, post-treatment and follow-up. Error bars represent standard error.

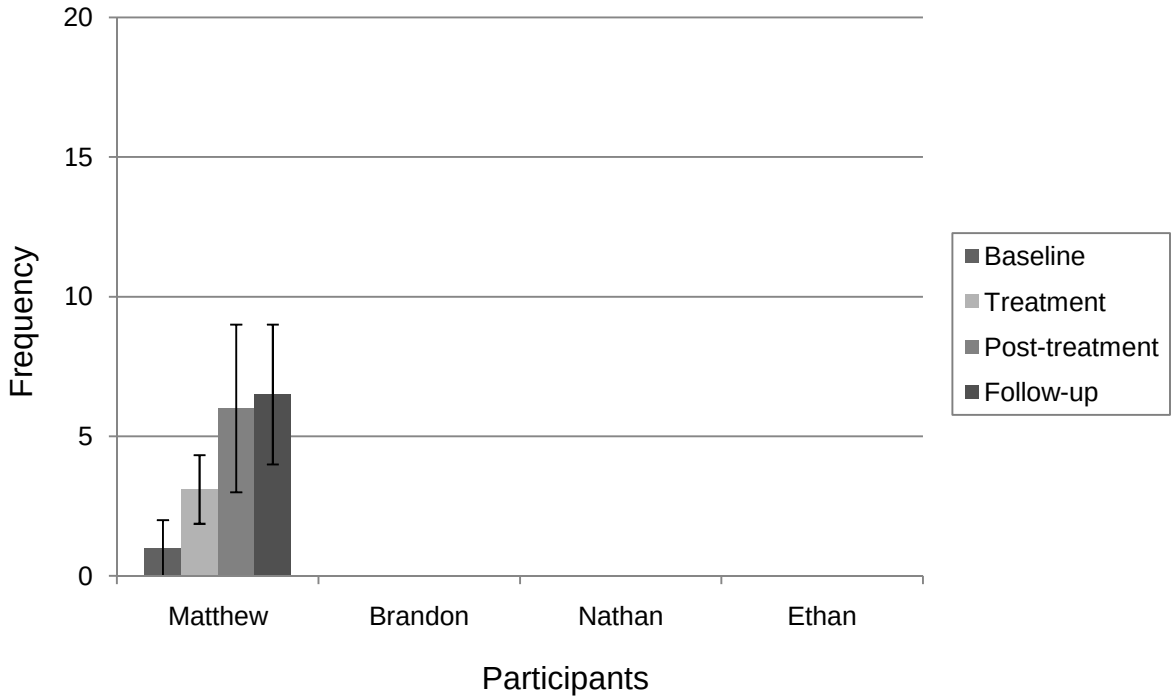

Figure 8. Mean total of sign language during generalization probes in the laboratory during baseline, treatment post-treatment and follow-up. Error bars represent standard error.

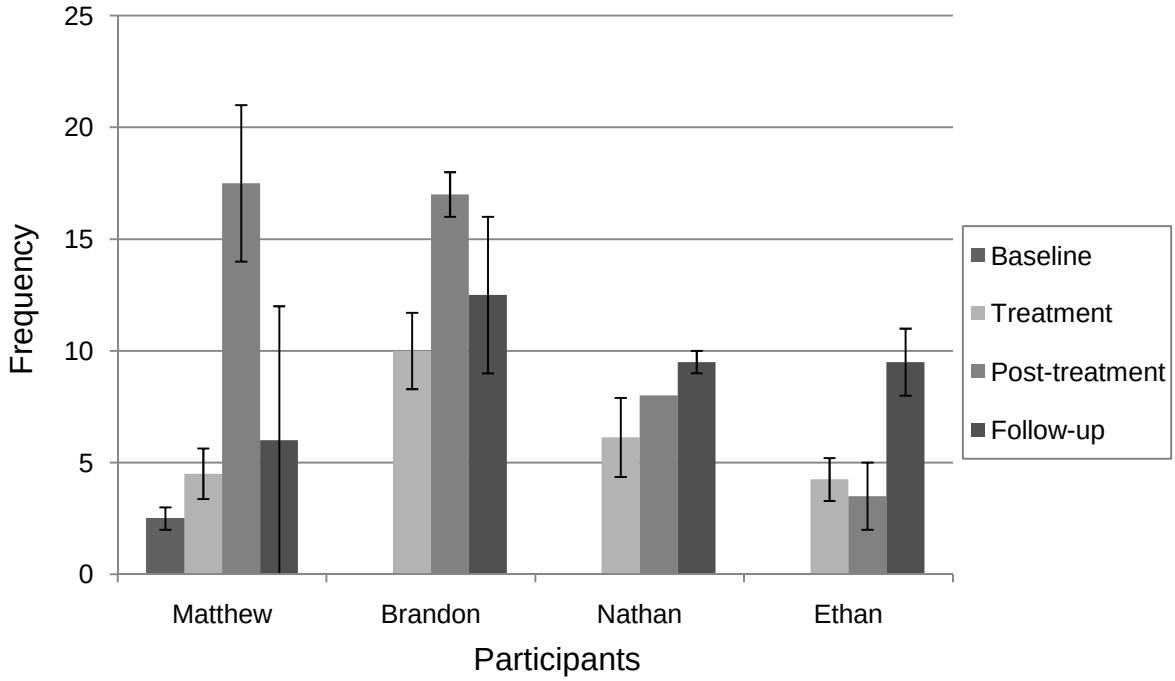

Figure 9. Mean total of combined social initiations in generalization probes in the laboratory during baseline, treatment, post-treatment, and follow-up. Error bars represent standard error.

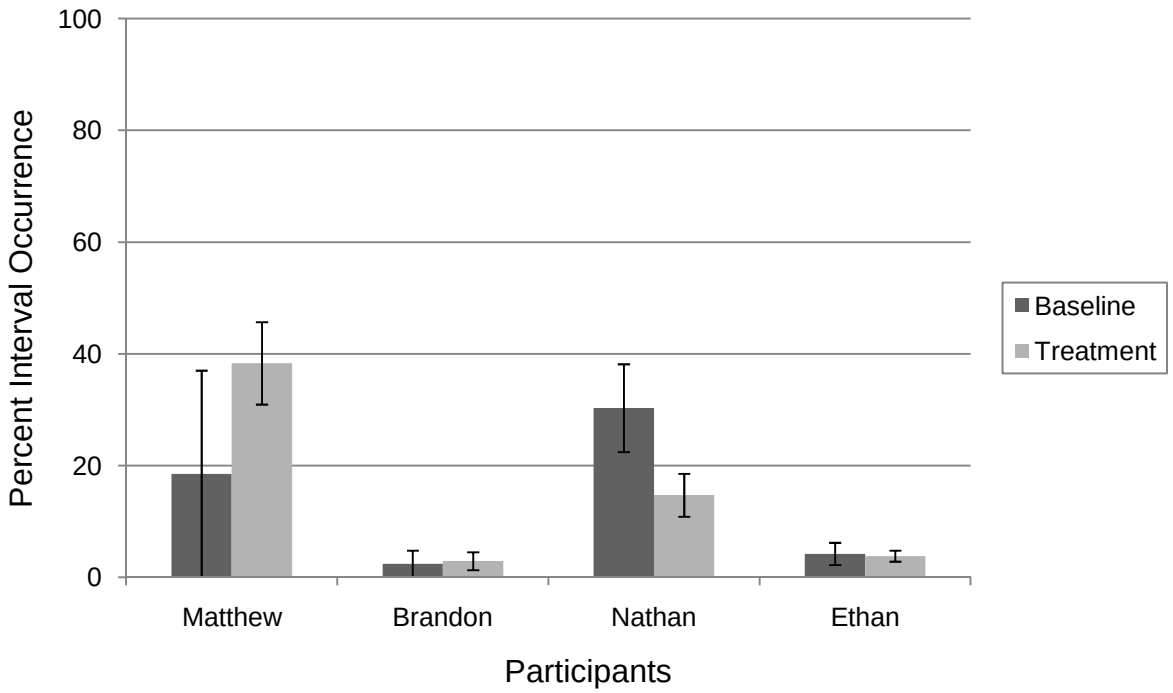

Figure 10. Mean percent interval occurrence of maladaptive social initiations during generalization probes in the laboratory during baseline and treatment. Error bars represent standard error.

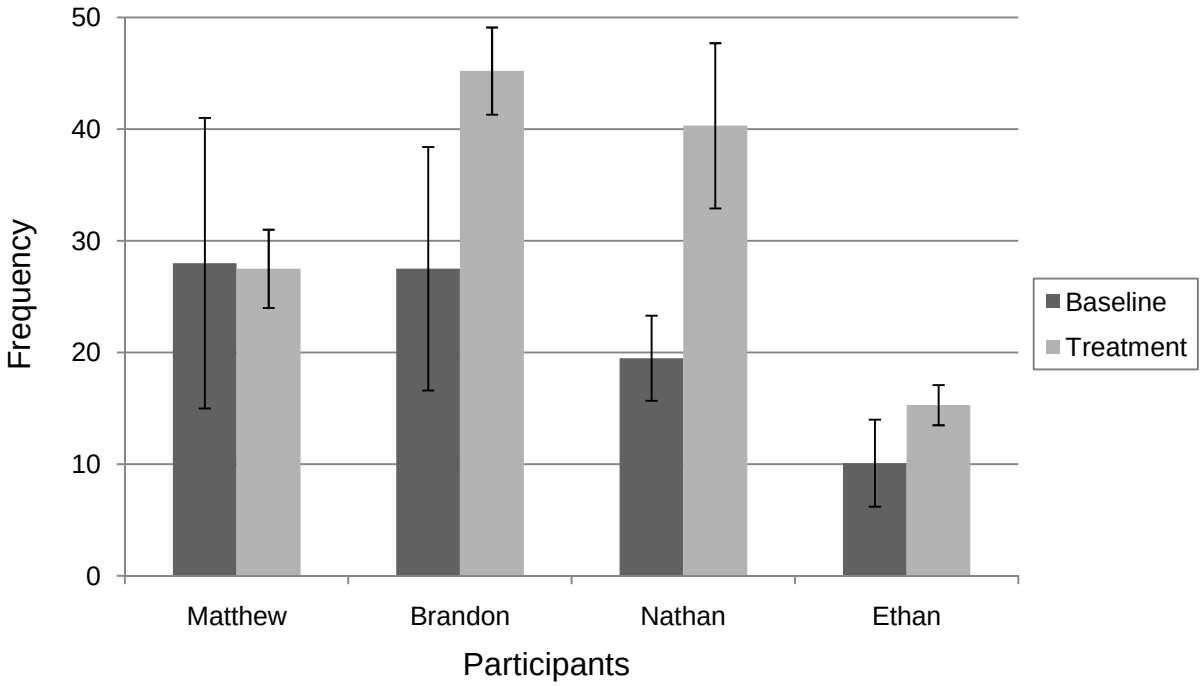

Figure 11. Mean total of communicative sounds during PRT sessions in the laboratory during baseline and treatment. Error bars represent standard error.

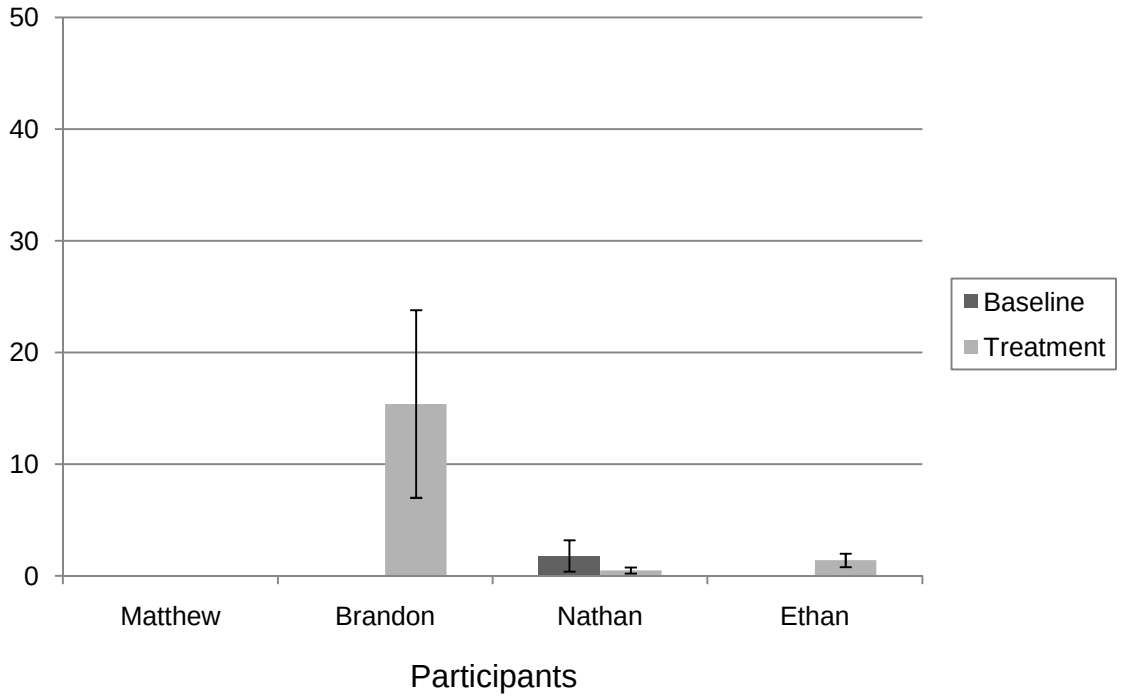

Figure 12. Mean total of one-word phrases during PRT sessions in the laboratory during baseline and treatment. Error bars represent standard error.

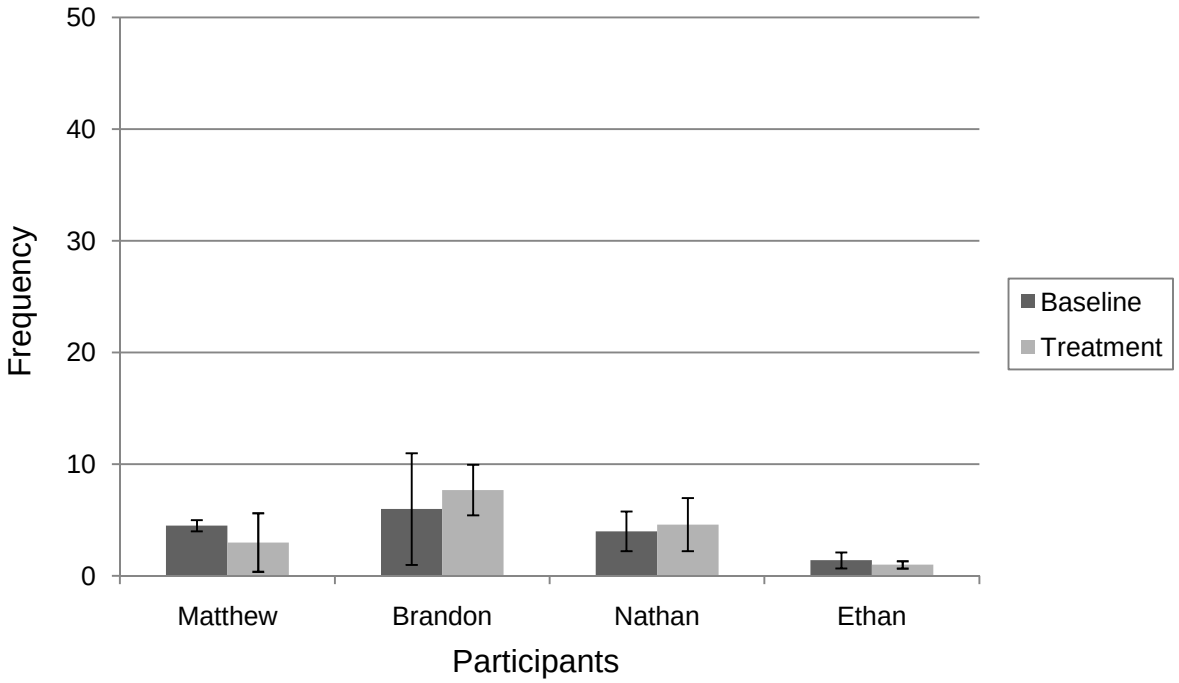

Figure 13. Mean total of spontaneous vocal communication (communicative sounds and one-word phrases) during PRT sessions in the laboratory during baseline and treatment. Error bars represent standard error.

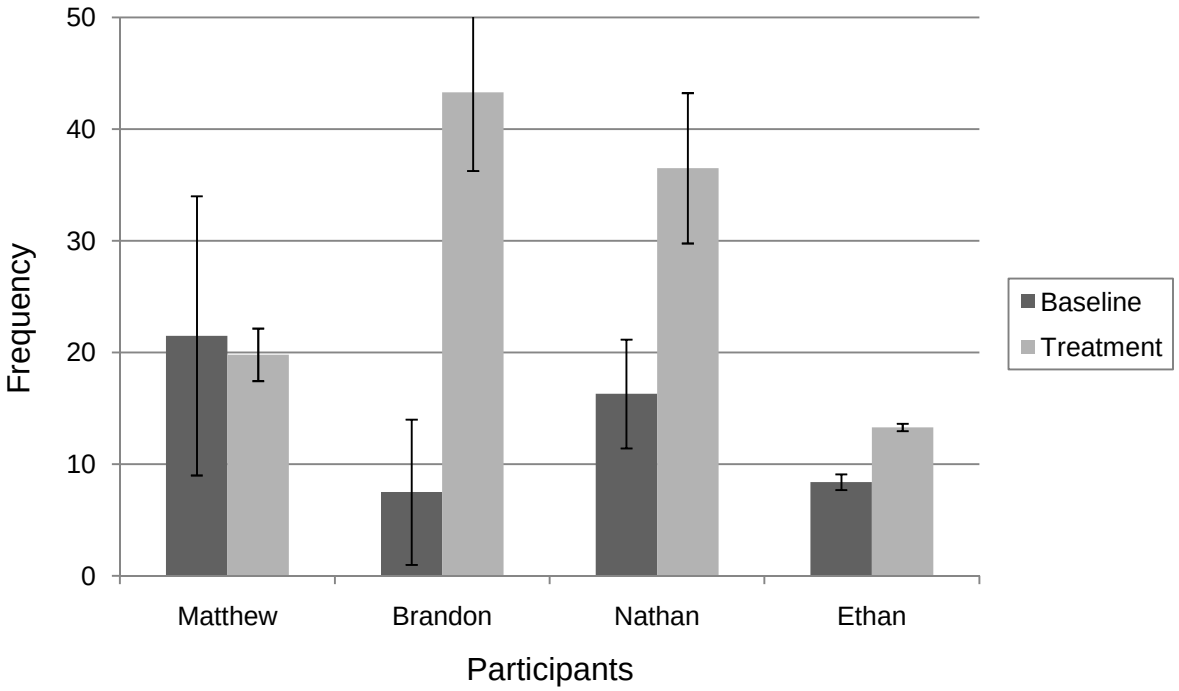

Figure 14. Mean total of cued vocal communication (communicative sounds and one-word phrases) during PRT sessions in the laboratory during baseline and treatment. Error bars represent standard error.

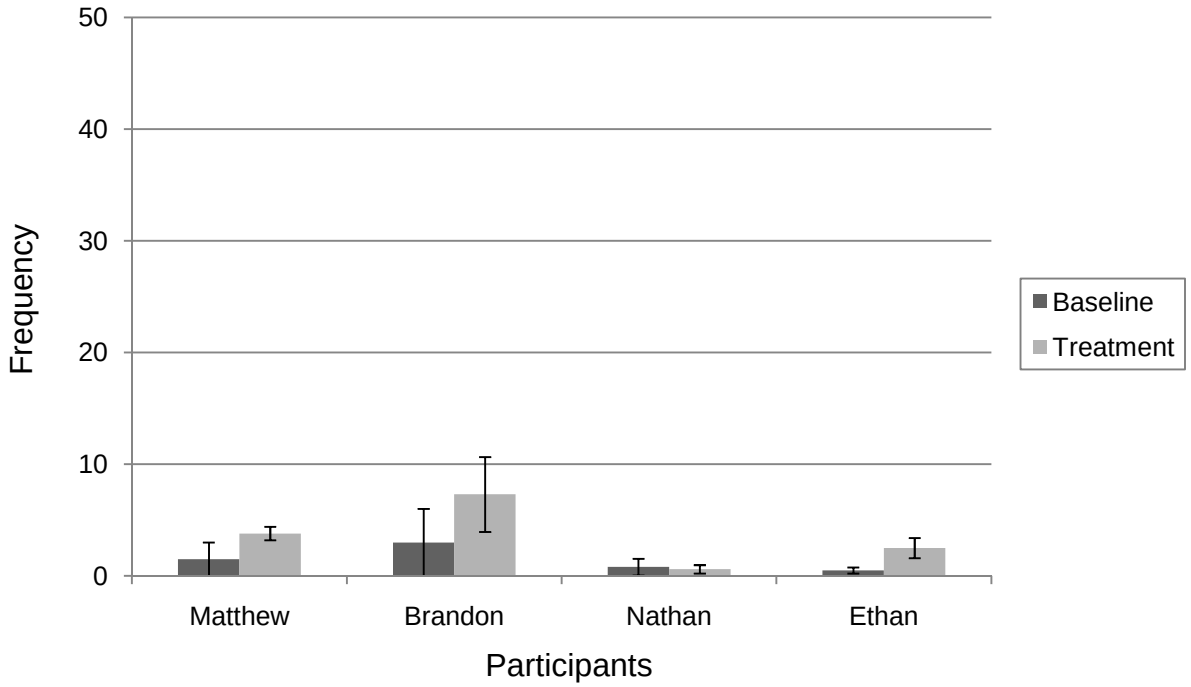

Figure 15. Mean total of imitated vocal communication (communicative sounds and one-word phrases) during PRT sessions in the laboratory during baseline and treatment. Error bars represent standard error.

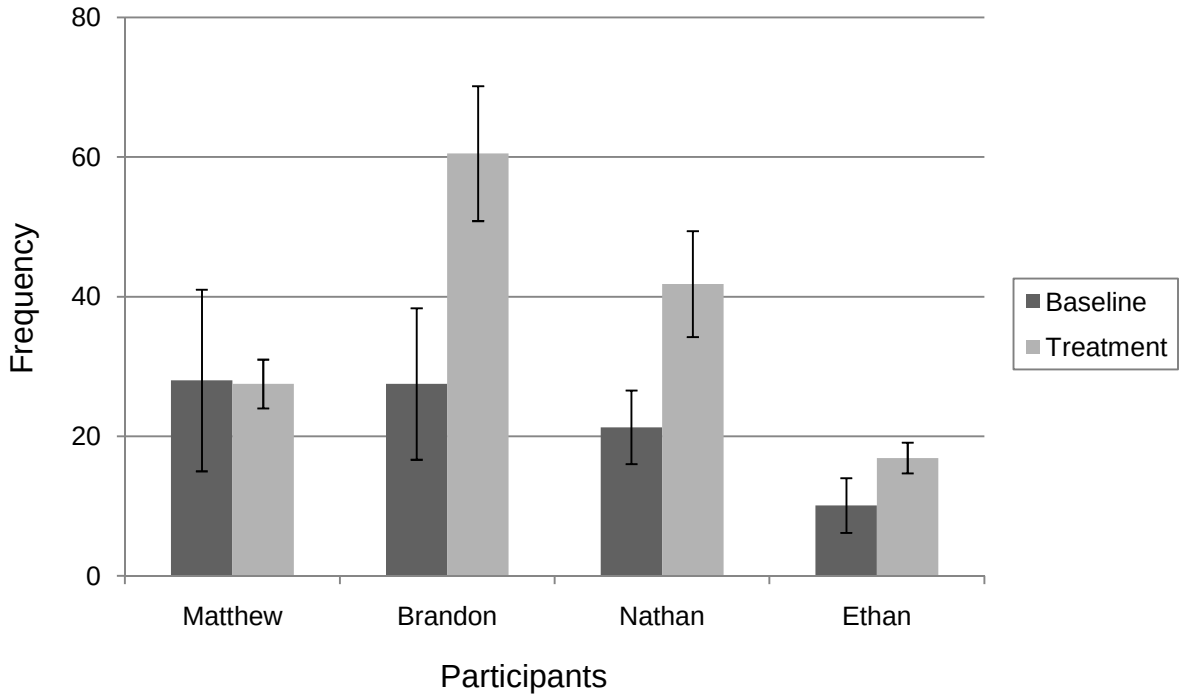

Figure 16. Mean total of combined vocal communication during PRT sessions in the laboratory during baseline and treatment. Error bars represent standard error.

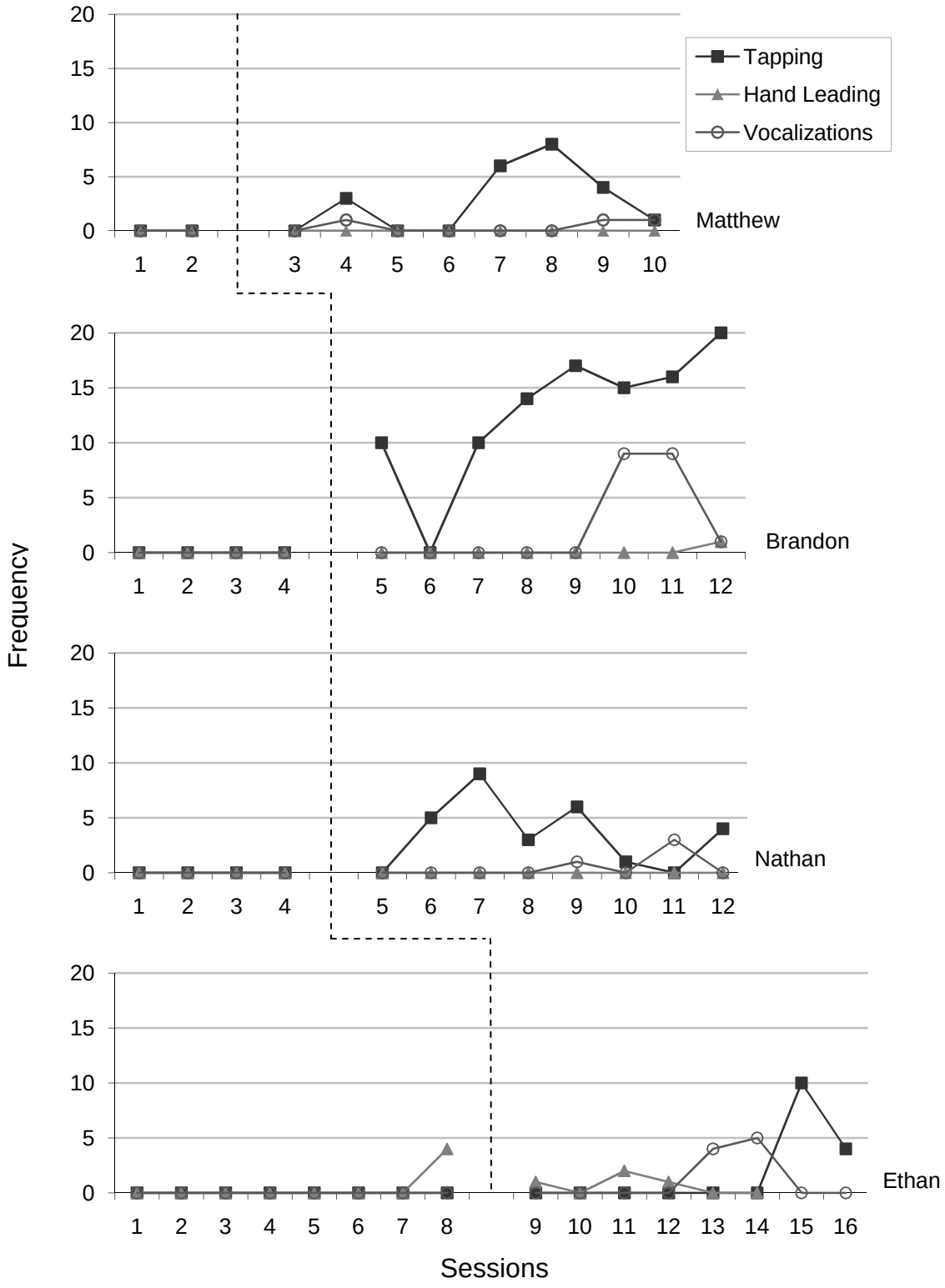

Figure 17. Tapping, hand leading and vocalizations during generalization probes in the home during baseline and treatment.

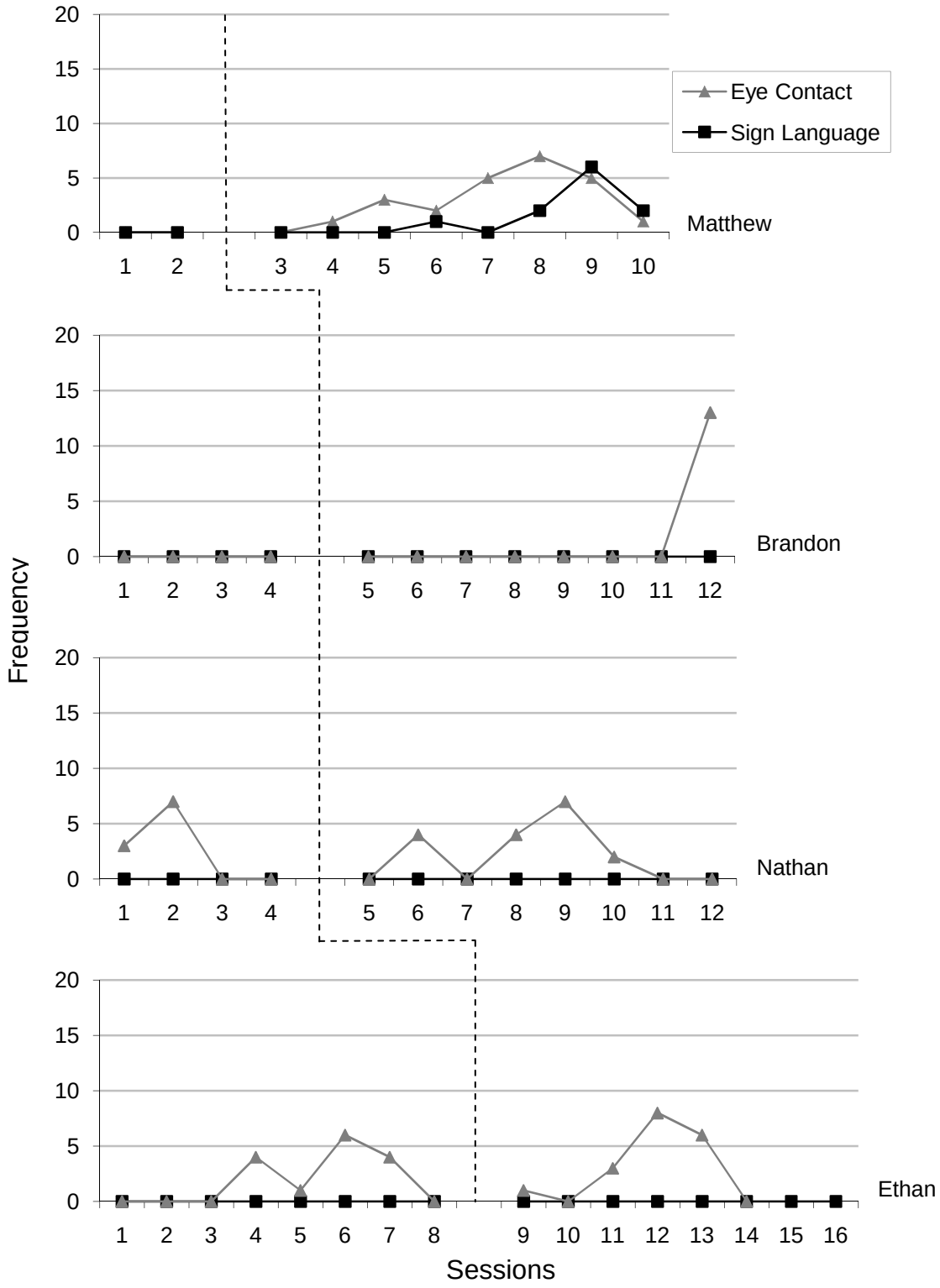

Figure 18: Eye contact and sign language during generalization probes in the home during baseline and treatment.

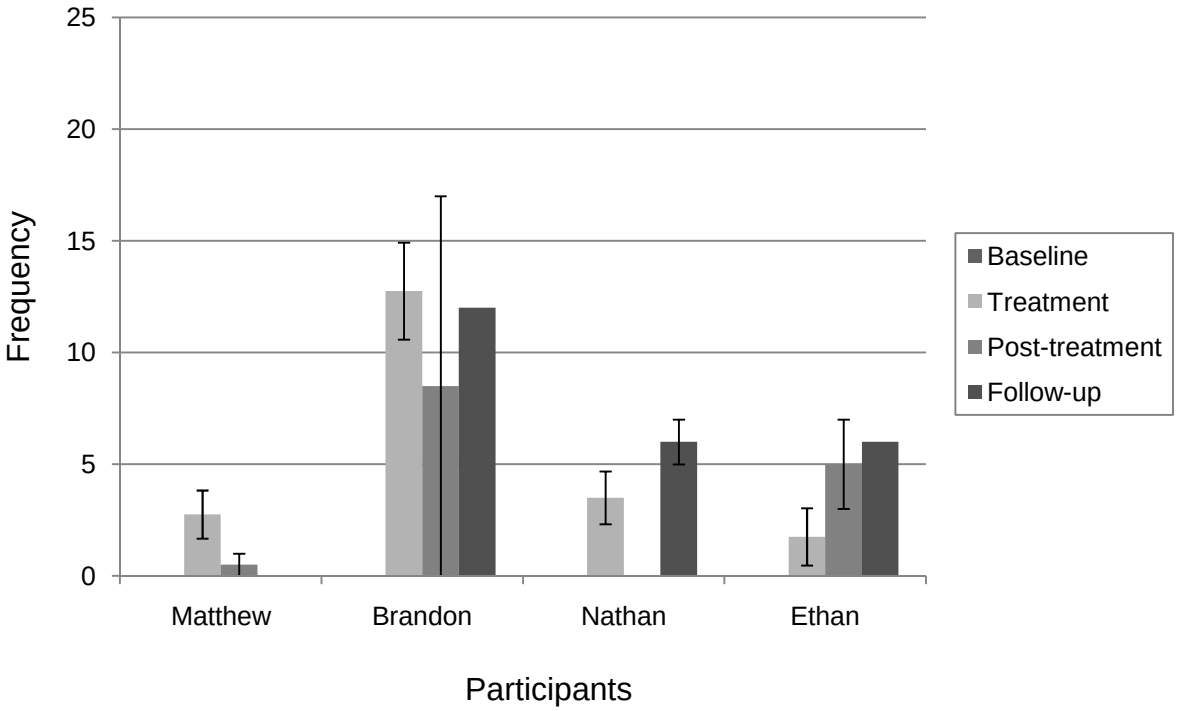

Figure 19. Mean total of tapping during the generalization probes in the home during baseline, treatment, post-treatment and follow-up. Error bars represent standard error. When totals are presented instead of mean totals, no error bars are shown.

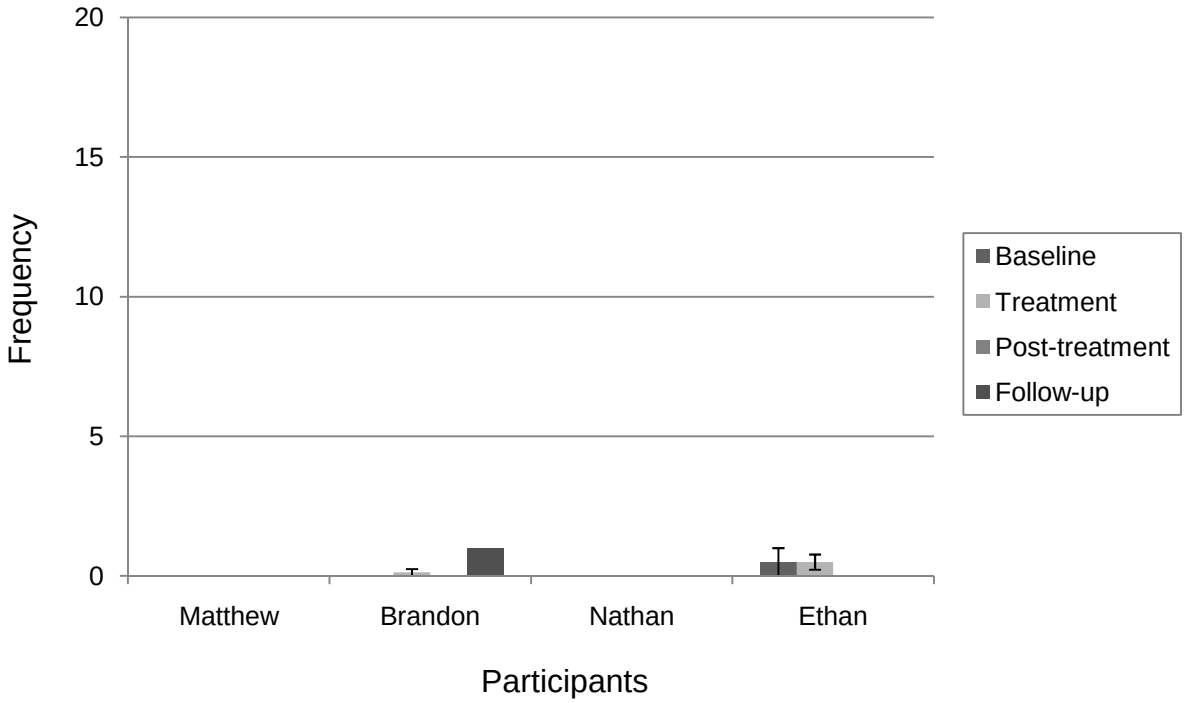

Figure 20. Mean total of hand leading during the generalization probes in the home during baseline, treatment, post-treatment and follow-up. Error bars represent standard error. When totals are presented instead of mean totals, no error bars are shown.

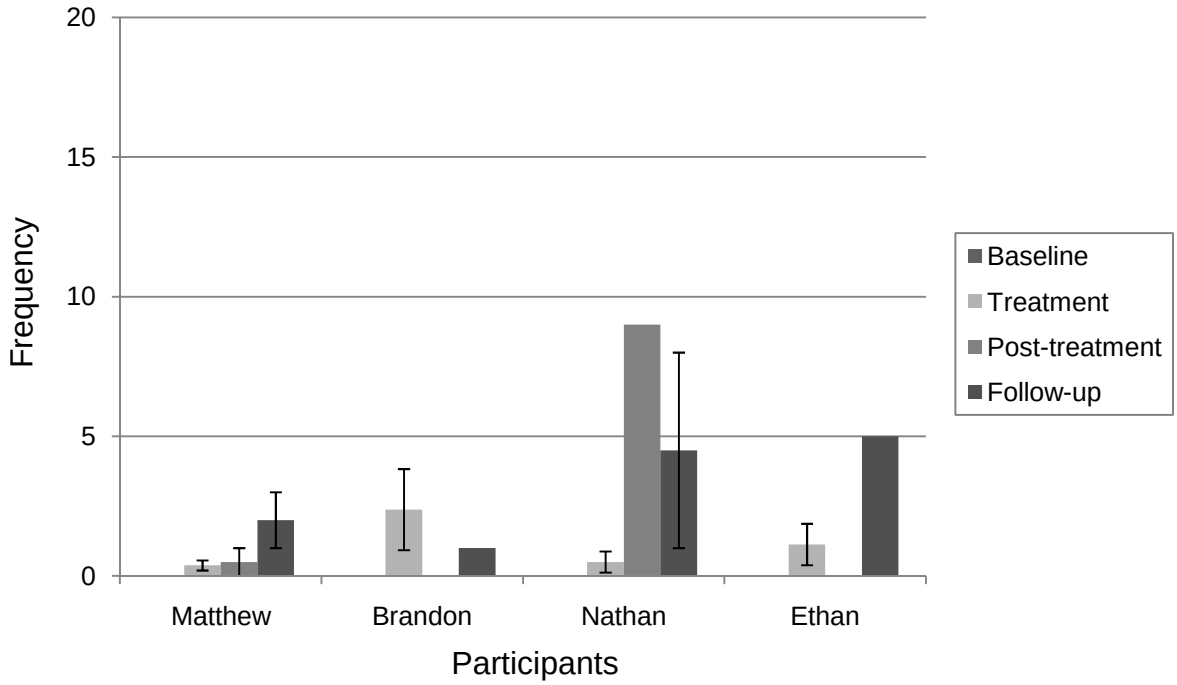

Figure 21. Mean total of vocalizations during the generalization probes in the home during baseline, treatment, post-treatment and follow-up. Error bars represent standard error. When totals are presented instead of mean totals, no error bars are shown.

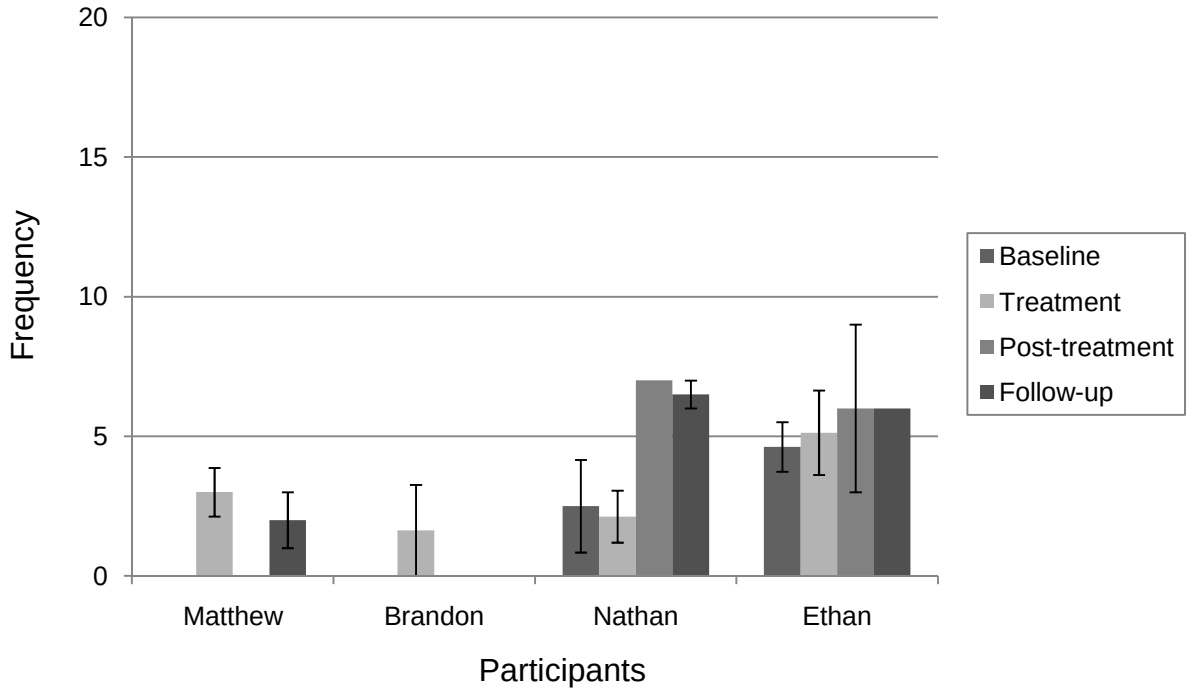

Figure 22. Mean total of eye contact during the generalization probes in the home during baseline, treatment, post-treatment and follow-up. Error bars represent standard error. When totals are presented instead of mean totals, no error bars are shown.

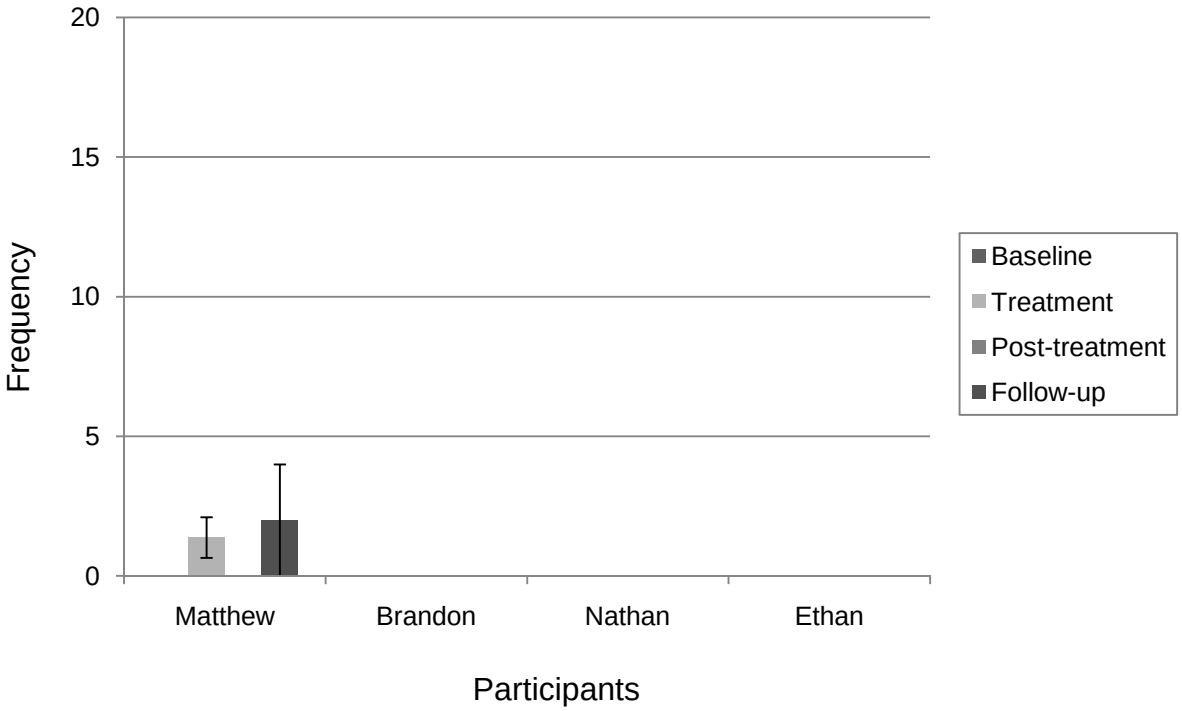

Figure 23. Mean total of sign language during the generalization probes in the home during baseline, treatment, post-treatment and follow-up. Error bars represent standard error.

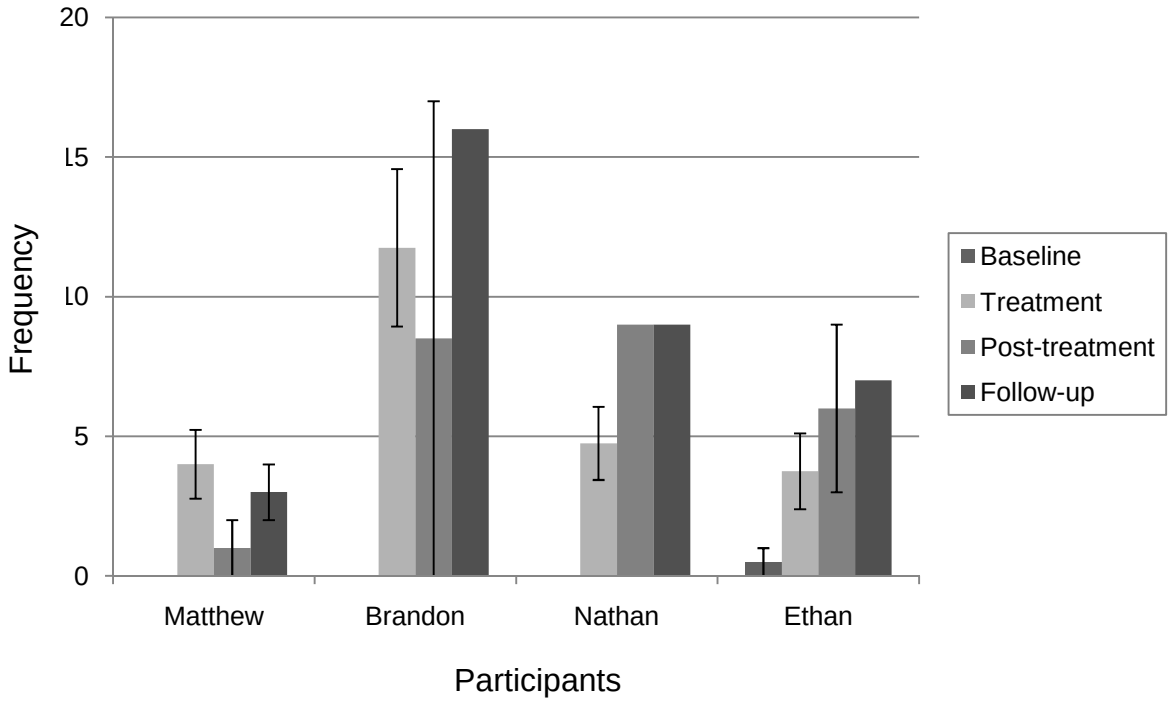

Figure 24. Mean total of combined social initiations (each initiation may include any combination of tapping, hand leading, vocalization, eye contact and sign language) in generalization probes in the home environment during baseline, treatment, post-treatment, and follow-up. Error bars represent standard error. When totals are presented instead of mean totals, no error bars are shown.

APPENDICES

Appendix A. Home Behavior Assessment

Home Behavior Questionnaire

Please answer the following questions about your child's behavior in the home environment. When answering each question use the guide below to estimate how often your child engages in each behavior.

FREQUENTLY: 2 or more times a day
REGULARLY: 1-2 times a day
SOMETIMES: 3-5 times a week
RARELY: 3 or less times a week
NEVER: 0 times a week

1. Does your child come to you to ask for help when a toy or other object is broken or they don't know how to work something or can't turn it on? (e.g., cry, whine, make a sound, say "help", hand you the toy, stare at you) (circle one) YES / NO

a. If NO, what does he/she do instead and where does he/she do it?

_____

_____

b. If YES, after approaching you, what does your child do to let you know that they need help?

_____

_____

c. If YES, how often does this occur? (circle one)

FREQUENTLY REGULARLY SOMETIMES RARELY NEVER

2. Does your child come to you to ask for food (e.g., juice, cookies) that is not readily accessible? (circle one) YES / NO

a. If NO, what do they does he/she do instead and where does he/she do it?

_____

_____

b. If YES, after approaching you, what does your child do to let you know that he/she wants food?

_____

_____

c. If YES, how often does this occur? (circle one)

FREQUENTLY REGULARLY SOMETIMES RARELY NEVER

3. Does your child come to you to ask for toys that are not readily accessible? (circle one) YES / NO

a. If NO, what does your child do instead and where does he/she do it?

_____

_____

b. If YES, after approaching you, what does your child do to let you know that he/she wants these toys?

_____

_____

c. If yes, how often does this occur? (circle one)

FREQUENTLY REGULARLY SOMETIMES RARELY NEVER

4. Does your child come to you to ask you to go somewhere? (e.g., leading you to the door or standing in front of the door and crying) (circle one) YES / NO

a. If NO, what does your child do instead and where does he/she do it?

_____

_____

b. If YES, after approaching you, how does your child do this?

_____

_____

c. If YES, how often does this occur? (circle one)

FREQUENTLY REGULARLY SOMETIMES RARELY NEVER

5. Does your child come to you to ask for you to play with him/her? (e.g., take your hand and lead you to toys or hand you a toy) (circle one) YES / NO

a. If NO, what does your child do to let you know that they want you to play with him/her and where does he/she do it?

_____

_____

b. If YES, after approaching you, how does your child do this?

_____

_____

c. If YES, how often does this occur? (circle one)

FREQUENTLY REGULARLY SOMETIMES RARELY NEVER

6. Does your child come to you to ask for affection (e.g. hugs and cuddling) when they are NOT upset or crying? (circle one) YES / NO

a. How does your child do this (e.g. takes your hand, sits on your lap)?

_____

_____

b. If YES, how often does this occur? (circle one)

FREQUENTLY REGULARLY SOMETIMES RARELY NEVER

7. If you are busy with an activity (e.g., making dinner or talking on the phone) and your child wants your attention, what does he/she do?

_____
_____
_____

a. Does he/she come close to you to do this behavior, or might it occur in another room or more than 10 feet away? Please describe.

_____
_____
_____
_____
_____

b. If yes, how often does this occur? (circle one)

FREQUENTLY REGULARLY SOMETIMES RARELY NEVER

Appendix B. Behavioral Definitions for Child Behaviors

Behavior	Operational Definition	Example
Social		
Tapping	Child moves hand and forearm in an up-and-down motion, making contact with a portion of the CP's body after the downward motion.	The child taps the adult's knee and the adult stops reading.
Hand Leading	Child clasps own hand around the hand, wrist, or forearm of communicative partner and pulls communicative partner in the direction of an object. Note: Placing an adults hand on a container without any other form of communication (e.g., eye contact, sign language) should be marked as maladaptive.	The child approaches the adult who is engaged in conversation with another adult and takes his/her hand and leads him/her to a toy on a shelf that is out of the child's reach.
Vocalizations	Child directs an appropriate vocalization toward the CP.	After the child leads the adult by the hand to a snack that is out of reach, he says "peas" an approximation of "please".
Eye Contact	Child makes direct eye contact with CP (does not include attempts to make eye contact).	While child is tapping the adult on the shoulder, he directs his gaze to the eyes of the adult.
Sign Language	Child directs sign language or a gesture toward the CP during a social initiation. Gestures include hand waving or pointing.	Child puts the container in the adult's lap, taps the adult's knee and uses the sign for "more".
Combined Social Initiations	Must include tapping or hand leading, with eye contact, sign language or vocalization. A social initiation begins when the child initiates with the communicative partner and ends when the child is given access to the preferred object or adult attention.	The child approaches an adult, takes his/her hand, leads them to a child-proof cabinet, and taps his/her leg while using eye contact.
Maladaptive Social Initiations	Child uses a maladaptive initiation behavior aimed at making a request, getting help, or gaining attention. This	Child walks up to the adult, puts a container with snack in it in the adults lap and turns and walks to the other side of the

	includes attempting to use adult's hand as a tool, whining, crying, throwing, grabbing, aggressiveness in the form of hitting, kicking, biting, or scratching, pulling on adult's clothing or bringing an item to an adult and walking away (> 2 feet) before gaining access to the reinforcer.	room.
Vocal Communication		
Vocal Communication	Child directs an appropriate vocalization towards an adult for the purpose of communication. (see sub-categories below)	
Communication Type	Spontaneous: Does not follow an adult model or question. Cued: Immediately follows an adult model, question or nonverbal action such as pointing at a toy, holding a toy in front of his/her face, or mouthing the target vocalization. Must be related to cue. Imitated: Immediately follows and imitates all or part of the adult verbalization.	Child reaches towards a ball and says "ba". Adult says "What do you want?" and child says "ba". Adult says "want ball" and the child says "ba".
Communication Complexity	Communicative sound: Cannot be identified as word(s) or an approximation of a word. One-word phrase: Can be identified as a word or an approximation of one.	Reaches towards adult and says "ba ba ba" to request a cracker. Looks at adult and says "tick tick" to request tickles.
PRT Response Profile		
Toy Contact	The child interacts with a toy in the room in a functional and appropriate way for 5 consecutive seconds or more. Even if the object manipulation occurs repetitively, the behavior should be scored if it is	• Tapping drumsticks on an object • Pushing buttons on a toy • Reading a book • Rolling a car on the floor

	consistent with the object's intended function(s).	
Approach	The child moves to at least within arms reach of the adult, or looks at the adult's face outside of arms reach (must be clear). Do not score more than one interval for each occurrence of approach (do not include the whole time walking).	• The child sits on the adults lap. • The child moves close to the adult to play with, retrieve or share a toy.
Avoidance	The child moves away from the adult, out of arm's reach or actively physically avoids contact. Do not score during intervals in which the child remains away from the adult or moves further away. Only score those intervals in which the child physically moves away.	• The child pulls part of his body away from the adult's touch. • The child resists looking at the adult's face by hiding or covering his/her face when the adult is trying to get eye contact. • The child covers his ears or eyes in response to the adult speaking.
Vocal Stereotypy	Vocal utterances that appear to serve no apparent function (e.g., request, comment, refusal) and are not parent-directed. May or may not be odd in intonation. May be repeated sounds, or non-contextual words.	• Child is saying "no, no, no" while rolling a car. • Child walks around the room often changing directions saying "gah gah gah".
Non-Vocal Stereotypy	Object or motor behaviors that are serve no apparent function or do not employ objects as they were intended.	• Child is flapping his hands. • Child positions his hands or objects in front of his face or over ears. • Child spins a ball repeatedly • Child repeatedly opens and closes the door on a car. • Child rocks and sways his body while looking in the mirror.

Appendix C. Behavioral Definitions for Fidelity of Implementation of PRT

Behavior	Operational Definition	Example
Attention	The child should be attending before the therapist presents an instruction, question or other cue. The child may be attending to the therapist or to the activity. Directions that are provided by the therapist for the specific purpose of gaining the child's attention should not be considered instructional cues. The child can be attending to the therapist or to the toy/activity; however the therapist must have control over the reinforcing component of the activity.	Therapist is holding a train near his/her face and the child is attending to the train and reaching towards it. The therapist presents the verbal cue "more".
Clarity	The therapist should present a clear cue, question or instruction that is developmentally appropriate for the child. It should be clear which response the therapist is targeting from the child and the child should have an opportunity to respond. A clear cue will be developmentally appropriate, at the same level or just above the child's current level of functioning.	The therapist uses a verbal cue of "ball" for a child who routinely uses single words to request desired items.
Appropriateness	The therapist should present a cue, question or instruction that is appropriate to the task. The cue should be related to the desired item.	The child wants to play with a car, and the therapist presents the verbal cue "car".
Maintenance and Acquisition tasks	The therapist should intersperse maintenance tasks and acquisition tasks when presenting cues. Maintenance tasks target skills the child has mastered. Acquisition tasks are skills that are currently being taught. Code based on the initial cue presented by the	The therapist intersperses two different cues while teaching a child to request more pegs for a pegboard; "more" (maintenance task) and "more pegs" (acquisition task).

	teacher regardless of the child's response. Maintenance and acquisition skills will change as the child learns new skills, so the therapist should review current maintenance and acquisition skills before each session. Child affect, in the form of heightened frustration, may be an indication the therapist is targeting too many acquisition tasks and too few maintenance tasks.	
Child Choice of Activity	The teacher should give the child choices and follow the child's lead. The teacher may offer choices to generate child interest in new activities or within activities. Low child engagement may be an indication the teacher is not following the child's choice of activity. The teacher is following the child's lead if the child is enjoying an activity and the teacher continues with that activity in a way the child prefers. If the teacher presented choices or followed the child's lead in a previous minute, and the child is still engaged in that toy/activity, the teacher is following the child's choice.	The therapist holds up a book and bubbles and asks the child "Book or bubbles?" The child says "book" and the therapist hands him the book.
Contingent Consequence	The teacher should present a consequence immediately following the child's behavior (within 3 sec). If the child responds correctly, the teacher should present a reinforcer (i.e. a tangible item, activity or praise). It should be clear which behavior is being reinforced. If the child responds incorrectly or fails to respond, the teacher should withhold reinforcement	The child says "more" and the therapist immediately hands him a pretzel.

	and should represent an appropriate cue. If the teacher makes an attempt to respond correctly, the teacher could either present a reinforcer or withhold reinforcement and represent an appropriate cue.	
Direct Reinforcement	The therapist should provide a reinforcing consequence directly related to the child's response and the activity	The child wants to play with a car, the therapist presents a cue "I want car", the child respond "I want car" and the child gets to play with the car.
Reinforcement of Attempts	The therapist should provide a reinforcing consequence following a majority of the child's goal-directed attempts. The therapist should reinforce child attempts to increase the overall amount of reinforcement, and therefore, increase child motivation. Child affect, in the form of increased frustration, and low child motivation may be an indication the therapist is not reinforcing the child's goal-directed attempts.	The therapist holds up a toy dog and the child says "dah". The therapist gives the child the toy.
Turn Taking	The therapist should take turns while playing with the child. A turn occurs when the therapist partakes in the activity by modeling play or verbally indicating a turn (e.g., "my turn," "I want to play," "Let me try"). Turns are used to regain teacher control of the activity or materials and to model appropriate play at a level the child can understand. The length of a turn will vary according to the child's patience and motivation; however, a turn should clearly interrupt the child's play and refocus the child's attention on the teacher's	The child is playing with a toy top and the therapist says "my turn" and takes the top and spins it.

	behavior. The child may maintain some access to the activity, but the teacher should have control of the most desired item to maintain the child's attention.

Appendix D. Behavioral Definitions for Fidelity of Implementation for SIT

Behavior	Operational Definition	Example
Environment	Child is in an environment in which access to preferred items is restricted.	Child is in a room and his favorite toys are on shelves, out of reach.
Attention	Adults in the room are engaged with each other (e.g., talking), in an activity (e.g., reading) or ignoring the child during the session.	One adult is reading a magazine and the other adult is reading a book. Neither adult is looking at or talking to the child.
Attempts	When the child shows interest in a preferred item or wants attention from an adult, strategies are used to ensure that the child successfully gains access to the item.	The child brings the preferred item in a container, to the adult, taps his leg and tries to walk away. The prompter gently guides the child to stay near the adult.
Time Delay	Once target behaviors are introduced, a time delay is used to encourage the child to initiate the target behavior(s) independently.	The child brings the container to an adult and the prompter waits to see if the child will initiate tapping independently before using a physical prompt.
Prompts	The adults use nonverbal prompting strategies (e.g., graduated guidance, shadowing) and verbal strategies (e.g., modeling) or the child engages in the target behaviors independently.	The prompter gradually fades prompting for tapping by touching the child's hand first, then elbow, then shoulder.
Contingent	The child receives access to preferred item(s) or attention if and only if they engage in an appropriate social initiation.	The child starts pulling on the adults clothing and the adult does not respond.
Phase	The behaviors targeted during the session are appropriate to the training phase.	During phase 1, the adults use prompting strategies to teach the child to bring objects to the adult and tap them.

Appendix E. Observer Rating Scale

Video Clip Questionnaire

You are going to watch short video clips of preschool-age children playing with an adult. Some of the children may or may not have developmental difficulties. Each video clip is 2 minutes long. After each 2-minute segment, please use the provided scales to indicate the degree to which the **child** you just watched exhibited the following behaviors. A score of 1 indicates that the child exhibited the behavior not at all. A score of 9 indicates that the child exhibited the behavior very much. A score of 5 indicates that the child exhibited the behavior in the middle between not at all and very much.

Thank you for your time.

To what extent does this child show interest in the adults?

1	2	3	4	5	6	7	8	9
Not at all								Very much

To what extent does this child initiate with others appropriately?

1	2	3	4	5	6	7	8	9
Not at all								Very much

To what extent does this child make requests appropriately?

1	2	3	4	5	6	7	8	9
Not at all								Very much

To what extent does this child use language appropriately?

1	2	3	4	5	6	7	8	9
Not at all								Very much

Compared to other preschoolers, how typical does this child's behavior look?

1	2	3	4	5	6	7	8	9
Not at all typical								Very typical

Appendix F. Consumer Expectation Questionnaire

Social Initiation Study
Consumer Expectation Questionnaire

Child Code_____
Date_____

The following questions are designed to help us find some answers pertinent to the treatment of children with autism. Although some questions may be difficult, please circle the answer to each one as best you can with regard to your child participating in this study. We appreciate any comments you have regarding any question.

All answers will be strictly confidential.

1. Do you have as much time as you would like for recreational and/or cultural activities?

   Never 1 2 3 4 5 6 7 Always

2. Do you have as much time as you would like for socializing with other people?

   Never 1 2 3 4 5 6 7 Always

3. Do you feel like you are able to have visitors to your home who are not familiar with your child?

   Never 1 2 3 4 5 6 7 Always

4. Do you feel that you can take your child out in public?

   Never 1 2 3 4 5 6 7 Always

5. Do you feel you have enough time to spend with your spouse or significant other?

   Never 1 2 3 4 5 6 7 Always

6. Do you feel you have enough time to spend with your other children?

   Never 1 2 3 4 5 6 7 Always

7. Does your child have a stressful effect on your family life?

   Not at all 1 2 3 4 5 6 7 Extreme Effect

8. On average, how much time do you spend working with (teaching) your child per day? _____ How many days per week?_____

9. How confident are you in managing current behavior problems in the **home** on your own?

Not Confident 1 2 3 4 5 6 7 Very Confident

10. How confident are you in managing current behavior problems in the **community** on your own?

Not Confident 1 2 3 4 5 6 7 Very Confident

11. Do you feel that you use many (or enough) rules to guide your child's behavior?

Yes_____ No_____

Please Explain:

_____
_____
_____
_____

12. Do you feel that you are able to sit down and teach your child to do something that s/he has never been able to do before? (Such as tying his/her shoes, assembling a puzzle, etc.)

Never 1 2 3 4 5 6 7 Always

13. Do you enjoy spending time alone with your child (just you and your child)?

Never 1 2 3 4 5 6 7 Always

14. What things do you enjoy doing with your child?

_____
_____
_____
_____

15. What things do you **like** about spending time with your child?

_____
_____
_____
_____

16. What things do you **dislike** about spending time with your child?

_____
_____
_____
_____

17. Here is a list of statements about your child. Please indicate the amount of your agreement or disagreement with each statement:

When my child grows up s/he will be able to:

	Strongly Disagree	**Mod-erately Disagree**	**Mildly Disagree**	**Un-decided**	**Mildly Agree**	**Mod-erately Agree**	**Strongly Agree**
Get dressed without help	1	2	3	4	5	6	7
Name parts of the body	1	2	3	4	5	6	7
Use money	1	2	3	4	5	6	7
Prepare a meal	1	2	3	4	5	6	7
Use the telephone	1	2	3	4	5	6	7
Read a book	1	2	3	4	5	6	7
Be married	1	2	3	4	5	6	7
Tell time	1	2	3	4	5	6	7
Mail a letter	1	2	3	4	5	6	7
Start up a conversation	1	2	3	4	5	6	7
Live independently	1	2	3	4	5	6	7
Tie his/her shoes	1	2	3	4	5	6	7

	Strongly Disagree	**Mod-erately Disagree**	**Mildly Disagree**	**Un-decided**	**Mildly Agree**	**Mod-erately Agree**	**Strongly Agree**
Answer a simple question	1	2	3	4	5	6	7
Name colors	1	2	3	4	5	6	7
Communicate effectively at an adult level	1	2	3	4	5	6	7
Respond to a simple command (eg. “Clap your hands”)	1	2	3	4	5	6	7
Drive a car	1	2	3	4	5	6	7
Go to college	1	2	3	4	5	6	7
Hold a job	1	2	3	4	5	6	7
Have friends	1	2	3	4	5	6	7
Take care of a pet	1	2	3	4	5	6	7
Write a letter	1	2	3	4	5	6	7
Say his/her name	1	2	3	4	5	6	7
Take a bus trip alone	1	2	3	4	5	6	7
Go to the store alone to buy something	1	2	3	4	5	6	7

18. What goals do you have for your child at age 25? Please write, as best you can, about where s/he will be living and what s/he will be doing. We realize it is impossible to predict such things, but please tell us what you **expect** that your child will be doing:

_____
_____
_____
_____
_____
_____
_____
_____

19. At this point my expectation for a satisfactory outcome of this treatment is:

Very Pessimistic 1 2 3 4 5 6 7 Very Optimistic

What types of change, if any, do you foresee? _____
_____
_____
_____
_____

20. What are you **hoping** to gain from this program?

_____
_____
_____
_____
_____

Appendix G. Consumer Satisfaction Questionnaire

Social Initiation Study
Consumer Satisfaction Questionnaire

Child Code_____
Date_____

These questions evaluate the treatment program you have received. It is important that you answer them as honestly as possible. We hope to continually improve our program based on your feedback. In an effort to maintain the confidentiality of this measure, we will not evaluate these questionnaires until the conclusion of the study.

A. Pivotal Response Training (PRT)

In this section, we would like to get an idea of how you feel about your child's progress in **only the PRT SESSIONS**. Please circle the response that is most accurate.

1. My child's ability to appropriately communicate with others is at this time

   Considerably Worse 1 2 3 4 5 6 7 Greatly Improved

2. My child's ability to appropriately initiate social interactions with others is at this time

   Considerably Worse 1 2 3 4 5 6 7 Greatly Improved

3. My child's ability to appropriately communicate that he/she needs help is at this time

   Considerably Worse 1 2 3 4 5 6 7 Greatly Improved

4. My child's ability to appropriately get my attention is at this time

   Considerably Worse 1 2 3 4 5 6 7 Greatly Improved

5. The behavior problem(s) I was originally concerned with before beginning treatment is(are) at this time

   Considerably Worse 1 2 3 4 5 6 7 Greatly Improved

6. My feelings at this time about my child's progress are that I am

Very Dissatisfied	1	2	3	4	5	6	7	Very Satisfied

7. To what degree has this treatment program helped with other general or personal family problems not directly related to your child (e.g., stress, anxiety)?

Hindered More Than Helped	1	2	3	4	5	6	7	Helped Immeasurably

8. Do you feel the skills that your child is being taught in this program are relevant to his/her improvement?

Not At All	1	2	3	4	5	6	7	A Great Deal

9. I feel that using this type of program to teach my child in the **home** is

Not At All Effective	1	2	3	4	5	6	7	Very Effective

10. I feel that using this type of program to teach my child in the **community** is

Not At All Effective	1	2	3	4	5	6	7	Very Effective

11. Would you recommend this program to another parent of a child with autism?

Strongly Oppose	1	2	3	4	5	6	7	Strongly Recommend

12. My overall feeling about this treatment program for my child is

Very Negative	1	2	3	4	5	6	7	Very Positive

B. Social Initiation Training (SIT)

In this section, we would like to get an idea of how you feel about your child's participation in **only the SIT SESSIONS**. Please circle the response that is most accurate.

1. My child's ability to appropriately communicate with others is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

2. My child's ability to appropriately initiate social interactions with others is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

3. My child's ability to appropriately communicate that he/she needs help is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

4. My child's ability to appropriately get my attention is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

5. The behavior problem(s) I was originally concerned with before beginning treatment is(are) at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

6. My feelings at this time about my child's progress are that I am

Very Dissatisfied	1	2	3	4	5	6	7	Very Satisfied

7. To what degree has this treatment program helped with other general or personal family problems not directly related to your child (e.g., stress, anxiety)?

Hindered More Than Helped	1	2	3	4	5	6	7	Helped Immeasurably

8. Do you feel the skills that your child is being taught in this program are relevant to his/her improvement?

Not At All	1	2	3	4	5	6	7	A Great Deal

9. I feel that using this type of program to teach my child in the **home** is

Not At All Effective	1	2	3	4	5	6	7	Very Effective

10. I feel that using this type of program to teach my child in the **community** is

Not At All Effective	1	2	3	4	5	6	7	Very Effective

11. Would you recommend this program to another parent of a child with autism?

Strongly Oppose	1	2	3	4	5	6	7	Strongly Recommend

12. My overall feeling about this treatment program for my child is

Very Negative	1	2	3	4	5	6	7	Very Positive

C. The Overall Program (PRT and SIT)

In this section, we would like to get an idea of how you feel about your child's progress in the overall program including both **PRT and SIT SESSIONS**. Please circle the response that is most accurate.

1. My child's ability to appropriately communicate with others is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

2. My child's ability to appropriately initiate social interactions with others is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

3. My child's ability to appropriately communicate that he/she needs help is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

4. My child's ability to appropriately get my attention is at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

5. The behavior problem(s) I was originally concerned with before beginning treatment is(are) at this time

Considerably Worse	1	2	3	4	5	6	7	Greatly Improved

6. My feelings at this time about my child's progress are that I am

Very Dissatisfied	1	2	3	4	5	6	7	Very Satisfied

7. To what degree has this treatment program helped with other general or personal family problems not directly related to your child (e.g., stress, anxiety)?

Hindered More Than Helped	1	2	3	4	5	6	7	Helped Immeasurably

8. Do you feel the skills that your child is being taught in this program are relevant to his/her improvement?

Not At All	1	2	3	4	5	6	7	A Great Deal

9. I feel that using this type of program to teach my child in the **home** is

Not At All Effective	1	2	3	4	5	6	7	Very Effective

10. I feel that using this type of program to teach my child in the **community** is

Not At All Effective	1	2	3	4	5	6	7	Very Effective

11. Would you recommend this program to another parent of a child with autism?

Strongly Oppose 1 2 3 4 5 6 7 Strongly Recommend

12. My overall feeling about this treatment program for my child is

Very Negative 1 2 3 4 5 6 7 Very Positive

13. Has your child improved in any of these areas since the beginning of his/her participation in this program? (Leave blank if not applicable)

	Not At All		**Mild Improvement**		**Moderate Improvement**		**Extreme Improvement**
Verbal communication	1	2	3	4	5	6	7
Nonverbal communication	1	2	3	4	5	6	7
Receptive language	1	2	3	4	5	6	7
Expressive language	1	2	3	4	5	6	7
Getting help	1	2	3	4	5	6	7
Getting attention	1	2	3	4	5	6	7
Independence	1	2	3	4	5	6	7
Temper tantrums	1	2	3	4	5	6	7
Crying	1	2	3	4	5	6	7
Mealtimes	1	2	3	4	5	6	7

	Not At All		**Mild Improvement**		**Mod-erate Improvement**		**Extreme Improve-ment**
Playing with other children	1	2	3	4	5	6	7
Playing with sibling(s)	1	2	3	4	5	6	7
Interacting with new people	1	2	3	4	5	6	7
Being affectionate	1	2	3	4	5	6	7
Interacting with you	1	2	3	4	5	6	7
Preferring to be alone all the time	1	2	3	4	5	6	7
Inappropriate noises	1	2	3	4	5	6	7
Self stimulation	1	2	3	4	5	6	7
Eye contact	1	2	3	4	5	6	7
Gestures	1	2	3	4	5	6	7

14. If there have been any improvements, to what do you attribute those improvements?

_____My own work with the child related to this project
_____My own work with the child **not** related to this project
_____In-home Program by an outside provider
_____School
_____Maturation
_____Medication
_____Diet
_____Speech Therapy
_____Occupational Therapy
_____Pivotal Response Training (PRT)
_____Social Initiation Training (SIT)
_____This UCSD Project (both PRT and SIT)

_____Other, please list_____

If you attributed your child's improvement to more than one item, please list them in level of importance, #1 being the most important:

1._____
2._____
3._____
4._____
5._____
6._____
7._____

14. Do you feel the amount of time you bring your child to our clinic is:

____Too little?
____About Right?
____Too Much?

15. Do you feel we are committed to helping your child improve?

Not At All	1	2	3	4	5	6	7	Absolutely Committed

16. Do you feel you can talk to us about concerns, complaints, etc?

Never	1	2	3	4	5	6	7	Always

17. Do you feel we give you enough attention?

Never	1	2	3	4	5	6	7	Always

E. Overall Opinion

1. What part of this program was the most helpful to you?
_____
_____
_____
_____

2. What did you like **most** about this program?
_____
_____

_____
_____

3. What did you like **least** about this program?

_____
_____
_____
_____

4. What part of this program was **least** helpful to you?

_____
_____
_____

5. How could the program have been improved to help you more?

_____
_____
_____

6. Do you have any questions about the issues raised by this questionnaire?

_____
_____
_____

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