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Assessing and Improving Early Social Engagement in Infants

Lynn Kern Koegel, PhD[1], Anjileen K. Singh, PhD[1], Robert L. Koegel, PhD[1], Jessica R. Hollingsworth, MA[1] and Jessica Bradshaw, MA[1]

Abstract

Empirical studies have documented a variety of social abnormalities in infancy that indicate risk for later social and behavioral difficulties. There is very little research illustrating the presence of such behavioral vulnerabilities with frequent repeated measures, and the feasibility of designing interventions for improving social engagement in infants less than 1 year of age. In the context of a multiple baseline research design, three young infants, ages 4, 7, and 9 months, referred for concerns about social engagement were assessed for affect, social interest, eye contact avoidance, and response to name. In addition, the feasibility of implementing an intervention to target social behaviors was examined. Results demonstrated that (a) consistently low or erratic levels of social behavior were evident throughout the baseline assessment period, (b) these patterns could be improved with a brief intervention (a modified Pivotal Response Treatment) showing an immediate increase and stability of social engagement, and (c) social engagement remained at a stable and high level at follow-up. The results are discussed in terms of implications of early assessment and intervention for clinical populations, including infants with autism spectrum disorder.

Keywords

infants, social intervention, autism spectrum disorder, early intervention

Early social engagement is crucial in the course of typical child development and necessary for optimal social and emotional development (Sroufe, 2005). Social impairments in early infancy have been found to be predictive of social-emotional and behavior disturbances later in life (Sheinkopf, Mundy, Claussen, & Willoughby, 2004; Vaughan Van Hecke et al., 2007). For example, many studies have shown evidence for early social differences in infants at risk of developing an autism spectrum disorder (ASD) as compared with low-risk infants. These differences include decreased levels of social smiling, social initiation, orienting to name, and low eye contact (Bryson, Zwaigenbaum, et al., 2007; Landa, Holman, & Garrett-Mayer, 2007; Ozonoff et al., 2010; Zwaigenbaum, 2010), and without early intervention, can lead to later developmental, behavioral, and social difficulties (Rubin, Burgess, & Hastings, 2002; Stifter, Putnam, & Jahromi, 2008; Vaughan Van Hecke et al., 2007). In contrast, early social and behavioral patterns in typical infants are present and remain stable into the toddler and early childhood years (Guerin, Gottfried, & Thomas, 1997; Peters-Martin & Wachs, 1984).

Assessment of early behavioral patterns predictive of later clinically relevant symptoms of ASD is a complex and still growing area of research (Macari et al., 2012), but many studies have documented specific abnormalities in high-risk infants that, when analyzed at the group level, are predictive of a later diagnosis of ASD. These studies have found that following an evaluation of infants at 6 months of age, infants at risk begin to decline in their social interest, showing less eye contact and less social smiling, and exhibit less social responsiveness (Bryson, Zwaigenbaum, et al., 2007; Ozonoff et al., 2010; Rozga et al., 2010).

Although social abnormalities have been suggested to be early indicators of ASD, there is a lack of empirically validated interventions to remediate the potentially cascading effects of delayed social development and unstable social behaviors with this population in the 1st year of life (Vismara & Rogers, 2010). In contrast, research with other populations has shown that early interventions targeting social areas and parent–child dyads have been found to be effective in improving parent and infant behaviors in premature infants and infants and toddlers with developmental

[1]University of California, Santa Barbara, USA

Corresponding Author:
Lynn Kern Koegel, Koegel Autism Center, Counseling, Clinical, and School Psychology Department, Graduate School of Education, University of California, Santa Barbara, Santa Barbara, CA 93106-9490, USA.
Email: lynnk@education.ucsb.edu

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disabilities or at risk of intellectual disabilities (Wallace & Rogers, 2010). Many studies have shown that didactic interventions that teach sensitivity and responsiveness to parents of preterm and low birth weight infants have resulted in improvements in infant social and cognitive development (Gianní et al., 2006; Newnham, Milgrom, & Skouteris, 2009). The Infant Health and Development Program (Brooks-Gunn, Gross, Kraemer, Spiker, & Shapiro, 1992) found that interventions that began in the 1st year of life led to considerable cognitive and language gains at 3 years of age. Similarly, an intervention designed for infants with Down syndrome led to overall gains in cognitive and social development in the preschool years (Connolly, Morgan, Russell, & Richardson, 1980). In typically developing infants, individual differences in maternal encouragement of attention during the 1st year of life are positively correlated with differences in duration of infant focused attention (Findji, 1993; Findji, Pêcheux, & Ruel, 1993; Lawson, Parrinello, & Ruff, 1992; Pêcheux, Findji, & Ruel, 1992). Similarly, social engagement in the form of eye contact has been documented in the 1st weeks of life, and research has shown that 3-month-old infants discriminately smile to direct, but not averted, eye gaze (Hains & Muir, 1996). These didactic adult–infant interactions appear to be critical to healthy development.

Therefore, the purpose of this study was to explore atypical social engagement in infants referred for social concerns through a stepwise process of baseline assessments and subsequent intervention. First, repeated observations of level and stability of baseline rates of social behaviors were recorded for infants who had been referred to our Center by professionals who were concerned about the infants' social development. Subsequently, a motivational intervention was applied, based on the principles of Pivotal Response Treatment (PRT; Koegel & Koegel, 2012), to assess the feasibility of improving and stabilizing social behaviors in infants. A large body of research with preschool children has shown that PRT is an effective intervention (Koegel & Koegel, 2012) and recently PRT procedures have been shown to be effective with infants 12 months of age (Steiner, Gengoux, Klin, & Chawarska, 2012). To date, no study has targeted infants below 12 months of age. Therefore, the specific purpose of this study was to assess whether it would be possible to intervene in early infancy (less than 12 months of age) to improve social abnormalities.

Method

Participants and Setting

The first three infants below 12 months of age who were referred to our University Autism Center for social concerns were selected for inclusion in this study. Three infants aged 4, 7, and 9 months at the time of pre-assessments were referred by professionals who had previous training in identifying red flags for social deficits related to ASDs. Specifically, they were referred by developmental specialists and medical doctors who had previously participated in workshops on early identification of autism sponsored by the state-funded California First Five Autism Screening Project (First Five California Child and Families Commission). All parents had expressed concern about their child's social development, which the referring specialist/medical doctor confirmed prior to referral. The 4- and 7-month-old infants (Sarah and Daniel) had older siblings with no known disabilities, but their parents reported that the social behaviors of the infants appeared to be impaired when compared with the early social development of their older siblings and other infants. The 9-month-old (Vince) had an older brother diagnosed with autism and his parents expressed concerns about his social development indicating that he was demonstrating the same social challenges that his older brother with a diagnosis of autism had shown at that age. Specifically, at intake, all three parents reported that it was difficult to engage the infants, they lacked social responsiveness, they spent long periods of time staring into space, and they appeared to prefer to look at or play with toys over social interaction, leading to considerable concerns about the possibility of ASD.

Infant 1. Sarah was a 4-month-old European American girl whose parents were referred to our Center by her pediatrician and a neurologist for a social development evaluation. She was the family's second child and her parents sought advice from their pediatrician and a neurologist concerning her lack of social interaction. Her hearing and general health were checked prior to the start of the study and were within normal limits. Her parents reported no complications during pregnancy and Sarah was born at full term with average birth weight. No family history of any genetic disorder or mental health illness was reported.

Infant 2. Daniel was a 7-month-old Hispanic and European American boy whose parents were referred to our Center by his pediatrician for a social development evaluation. Specific reported concerns included limited social interaction and a preference for playing with objects over interacting with people. His hearing and general health were checked at the start of the study and were within normal limits. His mother reported no complications during her pregnancy and he was born at full term with average birth weight. No family history of any genetic disorder or mental health illness was reported.

Infant 3. Vince was a 9-month-old Italian American boy whose parents contacted the California First Five Autism Screening project because they were concerned about his social development, and reported limited social interaction and a preference for objects over people. The California First

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Five Project referred Vince to our Center for a social development evaluation. Vince's older brother, age 4, had been diagnosed with ASD at 3 years of age. Vince's hearing and general health were within normal limits. His mother reported no complications during her pregnancy and Vince was born at full term with average birth weight. There were no other family members with mental health or genetic disorders.

Design

A multiple baseline across participants design was used to evaluate the level and stability of social behaviors and the effects of intervention targeting social engagement. The number of baseline sessions was staggered across participants over 3 weeks for Sarah, 5 weeks for Daniel, and 7 weeks for Vince. Intervention was provided until the infants showed at least three sessions with high affect (6 weeks for Sarah, 12 weeks for Daniel, and 4 weeks for Vince). Throughout all phases of the study (baseline, intervention, and follow-up), a variety of infant toys were available and the parents playfully engaged with their infant and attempted to keep them socially engaged. Each week, 10-min probes were video recorded for later analysis of social behaviors frequently discussed in the literature relating to social difficulties and parental concerns of our participants, including a lack of response to name, poor eye contact, and low affect (described below). No clinician feedback was provided during the probe sessions.

Baseline assessment. Concern for low social engagement was determined in three stages. First, the children's parents had expressed concerns regarding a lack of social engagement. Second the children's pediatrician/developmental specialists confirmed that there was concern regarding a lack of social engagement, which resulted in a referral to our Center. Third, an intake screening was conducted at our Center, by a PhD-level staff member, which also resulted in concerns with low social engagement. Baseline sessions were then implemented with the infants to assess social behaviors, namely, the level and stability of the infants' social engagement under natural conditions. During all baseline sessions, the parents were asked to play with their children as they normally would, and to try and keep their child engaged as much as possible. No other instructions were provided. Baseline assessments were continuously evaluated for level and stability of social engagement. Consistent with other assessment approaches of social engagement and social-communicative abilities (Bryson, Zwaigenbaum, McDermott, Rombough, & Brian, 2008; Lord et al., 2000; Zwaigenbaum et al., 2006), during baseline sessions, the parents naturally provided "presses" for an infant to respond to social interaction through the use of positive affect and eye contact (Bryson et al., 2008). If all reports and assessment measures of social engagement were found to be consistently atypical (i.e., parent report, professional report, our intake assessment, objective measures of affect that were never in the positive range, frequent objective measures of avoidance of eye contact, and objective measures showing infrequent response to name), then a subsequent social intervention was implemented to assess the feasibility of rapidly altering the consistent pattern of low social engagement.

Intervention. A modified PRT was used to assess the feasibility of rapidly increasing infant motivation to engage in social interaction. Motivation is the primary focus of PRT intervention, therefore, developmentally appropriate components of PRT that have been documented to be effective with 12-month-old infants (Steiner et al., 2012), preschool-aged children, and beyond (Koegel & Koegel, 2012; Koegel, O'Dell, & Koegel, 1987) were incorporated. These components included the use of infant preferred activities, task variation, interspersal of preferred and neutral activities, and reinforcement. To increase motivation in such young infants, we relied on a classical conditioning paradigm (parent association with preferred activities) to provide contingent reinforcement during intervention sessions, rather than in the more typical operant conditioning paradigm used in PRT for toddlers and children, where reinforcement is provided contingent on a communicative response from the child. Prior to the start of intervention, recordings of baseline assessments were viewed to identify the activities in which the parents engaged with their infants. Throughout baseline, the infants exhibited low affect while engaging in most activities; however, they occasionally exhibited momentary high affect. Thus, activities could be categorized into two groups: "neutral" (the majority of the activities) or "preferred" (the occasional activities that momentarily elicited positive affect and eye contact). Specifically, "neutral" activities were defined as any activity that did not elicit eye contact, and did not elicit positive affect, such as smiling or laughing. The activities that elicited momentary eye contact and positive affect, such as smiling or laughing, were identified as "preferred." Activities were selected from the natural parent–child interactions during the baseline probes and enough preferred and age-appropriate activities were present that parents did not need suggestions for social activities, allowing them to maintain their natural and individual style of parent–infant interaction. The specific list of preferred and neutral activities for each child is shown in Table 1.

Once the list of neutral and preferred activities was individually compiled for each child, the parents were given the list. During the initial sessions, parents were asked to present only the list of preferred activities and to vary the activity frequently (approximately every 10 s) for approximately 5 to 7 min. A break was taken then, in which the parents carried the infant on a 5- to 10-min walk. The break provided an

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Table 1. Examples of Child Preferred and Neutral Activities.

Infant	Preferred social activities	Neutral social activities		
Sarah	Say "I'm gonna get you!"	Rub cheeks	Talk to infant	Touch infant's nose with clicking sound
	Make silly faces	Tickle neck	Coo at infant	
	Nibble toes and fingers	Peek-a-boo	Animal noises	Touch nose and say "beep!"
		Hugs	Tickle stomach	Blow on stomach
		Kiss hands	Say "yoohoo!"	Holding infant close then away
		Say "hi!"	Rub stomach	
Daniel	Lift up and say "whee!"	Coo at infant	Make silly faces	Nibble at fingers and toes
	Tickle	Peek-a-boo	Animal Noises	Hold infant close then away
	Raspberry lips	Hugs	Patty-cake	Blow on stomach
	Bounce in lap saying "giddy-up horsie"	Touch nose	Sing to infant	Kiss face
Vince	Lift up and say "whee!"	Peek-a-boo	Kiss face	Blow on stomach
	Nibble on toes	Patty-cake	Sing to infant	Say "Where's mama?"
	Drumming with hands	Talk to infant	Hugs	

opportunity to give the parents feedback on the implementation of the intervention without allowing the infant extended periods of time to engage in attention to objects. The break was also provided as to be sensitive to the length of time in which parent–infant dyads can remain in a positively affective and highly aroused state. Then the entire process was repeated for the remainder of the 1-hr session.

Once the infant was exhibiting high levels of affect (i.e., using eye contact and smiling) on three consecutive sets of play routines in the same session, interspersal techniques were incorporated using the neutral activities. Specifically, previously identified neutral activities were gradually incorporated into the rotation of preferred play activities. Initially, one of the neutral activities was added during each set of preferred activities. When these neutral activities, that previously elicited no social engagement, were eliciting high levels of affect on three consecutive play routines, then another neutral activity was added, and so on. This continued until all the neutral activities were added, and the session consisted of the large number and variety of typical age-appropriate activities that were occurring in the baseline condition. Thus, the activities at the end of the intervention condition were identical to the activities in the baseline period.

These intervention sessions were conducted at home for 1 hr per week in the context of a parent education model using practice-with-feedback. Advanced graduate students in clinical psychology or special education, with a specialization in autism, provided the feedback and were supervised by a PhD-level faculty member. The parents were asked to implement the intervention as often as possible and on a daily basis throughout the week and to coordinate with any additional caregivers. All parents reported to be conducting the intervention repeatedly on a daily basis.

Follow-up. The follow-up condition was conducted in the identical manner as the baseline condition, using the same activities, including those identified as "neutral" in baseline.

Dependent Measures

All the dependent measures were collected multiple times in accordance with the multiple baseline design. For each behavior, probes were collected during the first 10 min of each baseline, intervention, and follow-up session.

Percentage response to name. During each probe, it was recorded each time the infant's name was called by a parent, and it was recorded whether the infant responded or not. A response was defined by a head turn or eye gaze toward the caregiver, a nonresponse was defined as no change in the infant's head turn or eye gaze.

Throughout all baseline, intervention, and follow-up sessions, the parents made consistent and repeated attempts to secure their children's attention by calling their names. Each parent called their child's name relatively frequently, typically more than 5 or 10 times per session throughout all conditions of the experiment. It should be noted that the infant responding to his or her name was not a part of the outlined intervention, and thus improvement on this measure would be considered a collateral gain.

Avoidance of eye contact. Avoidance of eye contact was scored each time the parent made an attempt to initiate eye contact and the infant turned his or her face away from the parent within parent–child social interactions during the probes. Specifically, if the infant turned away within 2 s of a parent attempting to engage the child in social interaction, it was scored as avoidance of eye contact. This measure was selected rather than total duration of sustained eye contact, as it was consistent with the reported parental concerns of the infants in the study and was more sensitive to social engagement difficulties.

Affect (interest and happiness). Two measures of affect (interest and happiness) were scored during the probes. The interest measure assessed whether the infant appeared

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Table 2. General Infant Affect Rating Scales (Interest and Happiness).

Interest		
Disinterested (0–1)	Neutral interest (2–3)	Interested (4–5)
Child looks bored, uninvolved, not curious or eager to continue the activity, spends much time looking around and little time attending to activity. When child does respond, there may be a long response latency (score 0 or 1, depending on extent of disinterest)	Neither particularly interested nor disinterested. Child seems to passively accept the activity. Does not avoid but is not obviously eager to continue (score 2 or 3, depending on extent of interest).	Attends readily to activity: responds quickly and willingly. Child is alert and involved in activity (score 4 or 5, depending on level of alertness and involvement).
Happiness		
Unhappy (0–1)	Neutral (2–3)	Happy (4–5)
Cries, throws tantrum, appears to be sad, upset, or frustrated. Child seems not to be enjoying self (score 0 or 1, depending on extent of unhappiness)	Does not appear to be decidedly happy or particularly unhappy. May smile or frown occasionally but, overall, seems rather neutral in this situation (score of 2 or 3, depending on extent of happiness).	Smiles, laughs, seems to be enjoying self (score 4 or 5, depending on extent of enjoyment).

uninvolved and bored with the activity (disinterested), accepted the activity passively (neutral interest), or attended readily and willingly to the activity (interested). Similarly, the happiness measure assessed whether the infant appeared to be upset and not enjoying the activity (unhappy), passive about the activity (neutral), or appeared to be enjoying the activity (happy). Both affect measures were scored on a 6-point Likert-type scale adapted from Dunlap and Koegel (1980). The specific scoring definitions are provided in Table 2.

Fidelity of implementation. To assess whether the parents were implementing the procedures according to the prescribed condition (baseline, intervention, or follow-up), approximately 10 min of each weekly sessions were scored for Fidelity of Implementation on the following variables: using activities from the "preferred" list, appropriately interspersing neutral activities (as described above), and activity variation. We used a modified version of the Fidelity of Implementation scoring system used by Bryson, Koegel, and colleagues (2007). This consisted of 10 one-min intervals that were scored either as a "+" if the parent implemented the procedure correctly, or "–" if the parent did not implement the procedures correctly throughout the entire minute. Fidelity was considered to be met if the parent scored 80% or above in each category. Fidelity of Implementation scores, collected every week throughout the study, showed that all three infants' parents did not meet the 80% (range 10%–70%) required Fidelity of Implementation during the baseline, but did meet the 80% (range 80%–100%) criterion during all intervention sessions.

Follow-up and generalization. An additional session was video recorded for follow-up data 6 months after intervention was terminated for Sarah and 2 months after intervention was terminated for Daniel and Vince (right around each child's first birthday). During these sessions, parents were asked to play with the infant as they normally would, for 10 min. This interaction was then analyzed for the same dependent measures. In addition, a 10-min generalization probe was collected for Daniel one session prior to the end of intervention. During this probe, Daniel's 3-year-old sister played with him without any specific instructions. The probe was analyzed for all dependent measures.

Reliability

Two independent observers who had earned bachelor's degrees in psychology and were naïve to the experimental hypothesis scored reliability measures. Tapes were scored in a random order following the completion of the study. Written descriptions of the codes were provided for the reliability coders separately, but no other instruction or training was provided. Reliability measures were collected for 40% of all sessions across all conditions.

Reliability for child affect was assessed on the interest and happiness measures. Agreements were defined as both observers recording the same numerical rating. Disagreements were defined as the observers recording different numerical ratings on the measures.

On the interest measure, reliability averaged 60% for Sarah, 82% for Daniel, and 83% for Vince. On the happiness measure, reliability averaged 70% for Sarah, 91% for Daniel, and 100% for Vince. Although reliability for exact

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agreements for Sarah's ratings was relatively low, all disagreements were rated within one point of each other.

For response to name, agreements were defined as both observers recording that the infant's name was called and the infant responded by looking or not looking toward the parent who called the name. Disagreements were defined as one observer recording that the infant responded by looking at the parent and the other observer recording that the infant did not look at the parent. Reliability on response to name was 97% (range 91%–100%) for Sarah, 92% (range 70%–100%) for Daniel, and 86% for Vince (range 50%–100%).

Reliability for Fidelity of Implementation was collected on three different intervention variables. Reliability for recording Sarah's parent's correct use of interspersing neutral play activities averaged 92% (range 60%–100%), with only one of the five sessions below 100%; reliability for recording the parent's correct use of preferred play activities averaged 94% (range 70%–100%); and reliability for recording the correct use of activity variation averaged 96% (range 90%–100%). Overall reliability for Daniel's parent's correct use of interspersing neutral play activities averaged 93% (range 83%–100%), reliability for recording the use of preferred play activities averaged 91% (range 70%–100%), and reliability for recording the use of activity variation averaged 87% (range 67%–100%). For Vince, reliability recording for interspersing neutral play activities averaged 93% (range 70%–100%), using preferred play activities averaged 88% (range 60%–100%), and using activity variation was 93% (range 90%–100%).

Results

Affect

Figure 1 presents baseline, intervention, and follow-up data collected for the affect measures (happiness and interest). One rating of overall happiness and overall interest was made for each session. The figure shows that during the baseline assessments, Sarah did not exhibit positive affect. Although Sarah occasionally exhibited very brief instances of high affect in some of the sessions, there was not enough positive affect observed to influence the rater's recording of any of the intervals to result in a positive rating. However, once intervention began, ratings of Sarah's affect increased on the interest and happiness measures, with scores consistently in the high range over the past three intervention sessions. The 6-month follow-up data showed that she maintained high levels of affect on the happiness and interest measures.

Similarly, although Daniel exhibited some brief instances of positive affect, he never exhibited enough positive affect to be rated as positive in any baseline assessment intervals. However, once intervention began, his overall affect on both measures increased to a high level. Interest immediately increased and remained in the high range (4–5) for 9 of the 11 sessions. Happiness also increased to the high range during the first intervention session and stayed in the high range for 10 out of the 11 subsequent intervention sessions. High levels of interest and happiness were also exhibited in the generalization and follow-up probes.

Consistent with the other participants, although Vince did exhibit very brief instances of positive affect, he did not exhibit enough positive affect during any intervals to receive an overall positive affect score during any of the baseline sessions. Immediately after intervention began, his affect increased to the positive range and remained positive on happiness and interest throughout the intervention sessions. Affect also remained positive at the 2-month follow-up probe.

Eye Contact

Figure 2 shows the number of times per session the infants actively avoided eye contact (i.e., turned away when their parents attempted to initiate eye contact) while interacting with a caregiver. Sarah avoided eye contact repeatedly during the baseline assessments. In contrast, avoidance of eye contact decreased during intervention, and she did not exhibit any instances of eye contact avoidance during the last three sessions of intervention. Similarly, at the 6-month follow-up, she did not avoid eye contact throughout the entirety of the probe.

Daniel showed consistent instances of eye contact avoidance during each of the five baseline assessments. Once intervention was implemented, however, Daniel did not avoid eye contact for 9 out of the 11 intervention sessions. During the follow-up probe, no avoidance of eye contact was observed.

Similar to the other infants, Vince avoided eye contact throughout baseline, but this avoidance decreased rapidly once intervention began. During the follow-up probe, no avoidance of eye contact was observed.

Response to Name

Figure 3 shows the percentage of opportunities that the infants responded to their parents when they called their name, which typically occurred 5 to 10 times per session.

Sarah responded to her name an average of 10% of the time during the baseline sessions. In contrast, following intervention, she responded to her name up to 70% of the time. Response to name remained above 70% at follow-up.

Similarly, Daniel rarely responded to his name during baseline, with a range of 0% to 29%. In contrast, once intervention began, Daniel responded to his name an average of

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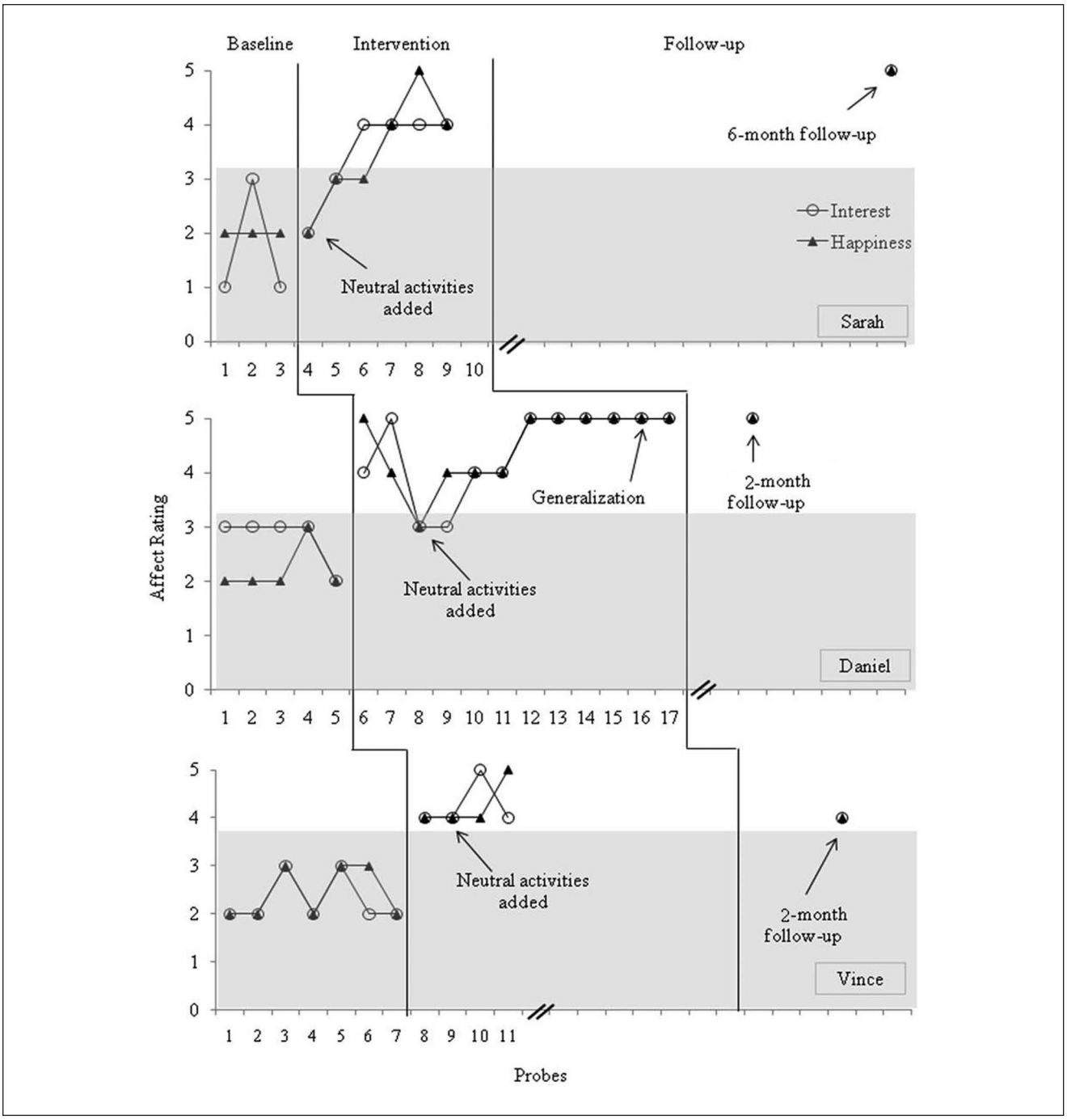


Figure 1. Affect ratings for both infants.
Note. The shaded areas indicate neutral to low affect and the nonshaded areas indicates high affect.

50% of the time. Daniel maintained this level during the generalization (with his sister) and follow-up probes.

Vince responded to his name an average of 6% of the time during baseline. His response to his name increased to 48% during intervention and to 50% during the follow-up probe.

Discussion

The results of this study showed that an assessment and intervention involving repeated measures of social engagement in infants referred for social concerns revealed patterns of low and erratic social engagement during baseline

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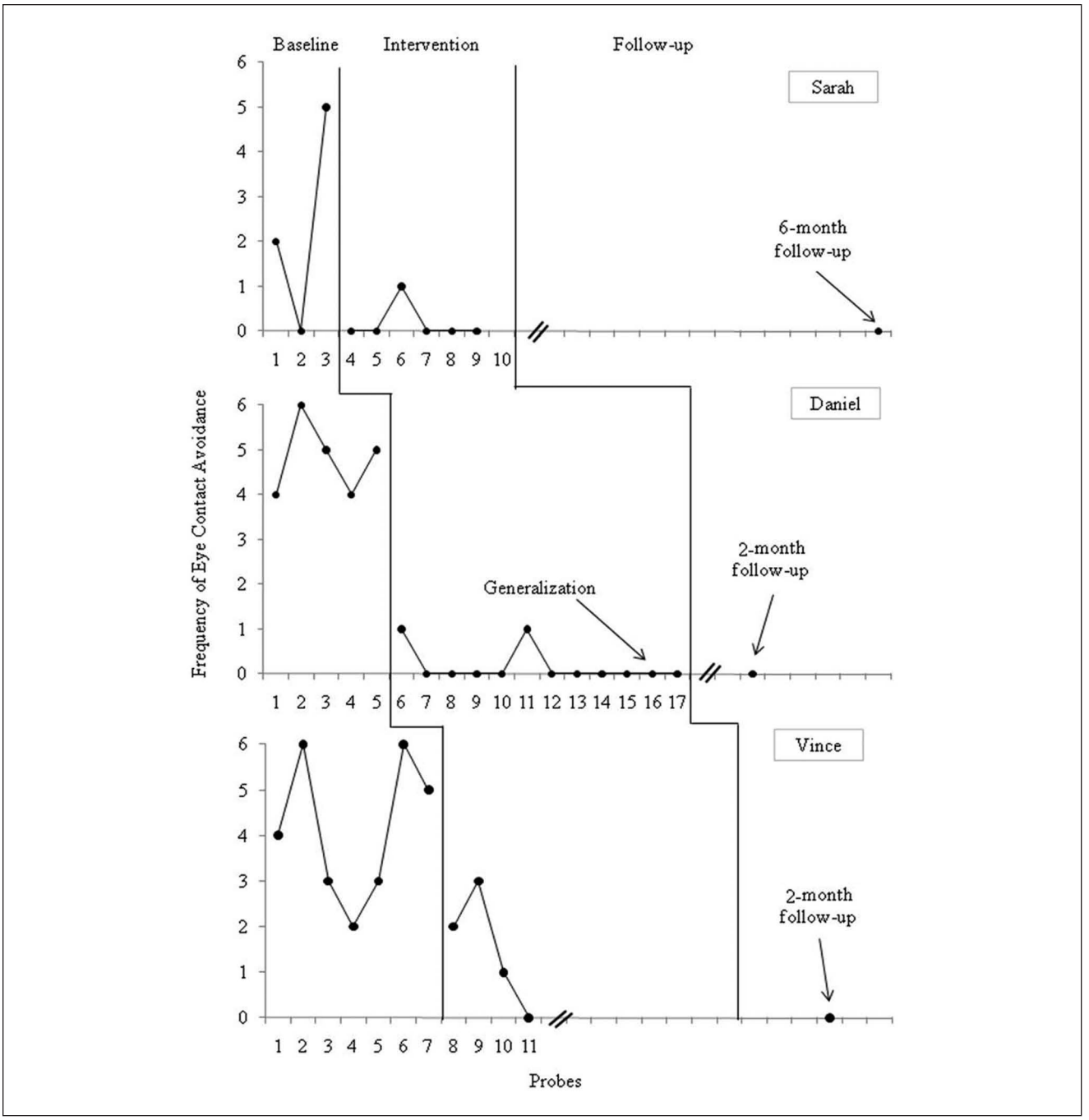


Figure 2. The number of times the infant avoided eye contact during 10-min probes.

measures. Furthermore, this study illustrated that social engagement could be rapidly increased and stabilized at high levels through the use of a parent education program using motivational techniques. Specifically, components of naturalistic interventions that have previously been implemented in PRT for older infants and toddlers (Koegel, Koegel, & Surratt, 1992; Koegel, O'Dell, & Dunlap, 1988; Steiner et al., 2012; Steiner, Goldsmith, Snow, & Chawarska, 2011) also appeared to be helpful in increasing positive affect, response to name, and eye contact in infants referred for concerns about social development.

This study points to the need for further investigation related to collateral gains in response to name. That is, while response to name may not be consistent in any infant,

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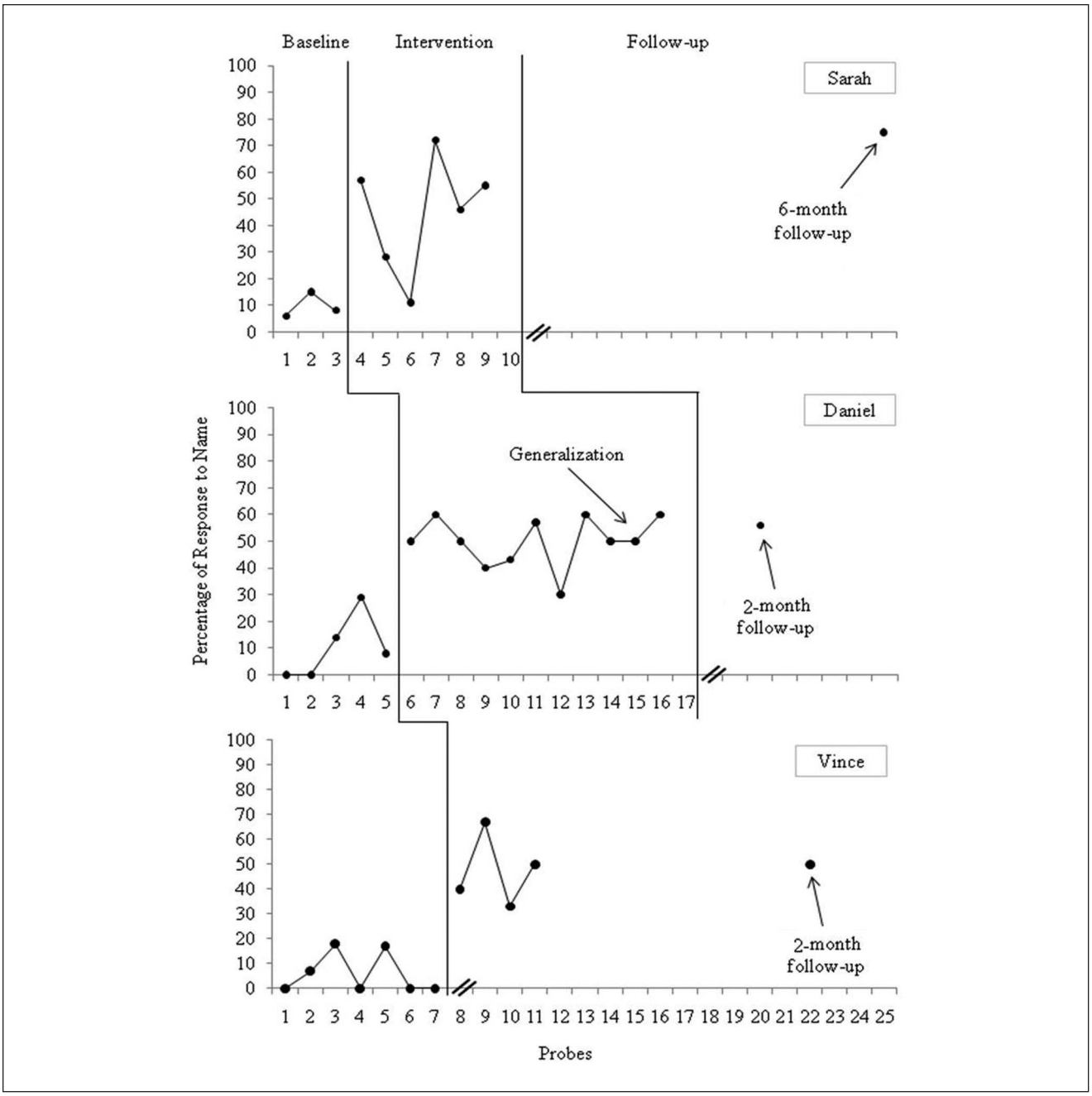


Figure 3. The percentage of opportunities the infant responded to his or her name.

especially in the first 6 months of life, the infants in this study showed extremely low levels during the baseline measures. Furthermore, the intervention produced immediate and large improvements in response to name as a collateral gain even in the youngest infant in this study during the very first intervention session. As lack of response to name is a noted early symptom in the area of autism (Nadig et al., 2007), further research in this area could potentially be very important. In contrast, typically developing infants exhibit preferential attention to social stimuli very early on, with a vast majority of typically developing infants consistently responding to their name by 6 months of age (Nadig et al., 2007). Response to name has been shown to significantly differentiate infants who develop autism and those who do not during the first year of life (Werner, Dawson, Osterling, & Dinno, 2000).

An area that also may be of particular interest relates to parent–child synchrony (Siller & Sigman, 2002) and its relationship to social interaction (Kim & Mahoney, 2004;

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Yoder & Warren, 1999). Given that infants later diagnosed with autism have weaker levels of parent–child synchrony (Yirmiya et al., 2006), the exploration of the concurrent effects of this intervention on parent–infant synchrony will be important to postulate about related long-term cognitive and social-emotional outcomes (Feldman, 2007). Parent–child synchrony literature argues that in typically developing infants, eye contact avoidance could signal the need of a break of parent–child interaction. However, given the documented vulnerability of diminished eye contact in infants and toddler with ASD, it is important not to confuse the infants' avoidance of eye contact with looking away as a signal for a change in activity. Rather, the affect associated with eye contact cues may be particularly important in discriminating typical versus atypical social disinterest. Furthermore, this intervention focused on improving maternal responsivity so that rather than ignoring infant signals, parents were taught to attend to infant cues and modify their own behavior to reengage the infant in social interaction, rather than cease the socialization all together. This area will certainly benefit from future research.

Further research will be needed to explore other mechanisms that may have resulted in the positive change in these early social behaviors. First, these infants' parents reported a pattern of asocial behavior and preference for objects over people that raised concern. During baseline, it was noted that the parents often interacted with their infants using traditional activities that most infants enjoy, yet the infants in this study, with their low levels of social engagement, did not respond to these activities. Although many typically developing children may respond favorably to any type of social interaction with a parent, it may be that infants exhibiting less than robust levels of social engagement may need modified play interactions that capitalize on their limited interests. Finally, although we did not formally collect any social validity measures, all parents reported that they enjoyed the intervention, felt that their children responded positively to the intervention, and that their infants began showing more social engagement during and following the intervention.

This study used a systematic coding scheme of social behaviors as dependent measures and did not include any standardized assessments. Standardized assessment scores in combination with meticulous behavioral coding of infant behaviors could contribute to a better understanding of baseline deficits, resultant gains, and change mechanisms. This study provides compelling preliminary evidence that suggests it might be valuable to conduct larger studies with additional behavioral variables and standardized assessment scores in addition to a large control group of typically developing infants to better understand social engagement, eye contact, and response to name in subpopulations of infants with and without social concerns.

It is also interesting to discuss the possibility of overreferrals from community providers and pediatricians as methods of early identification become part of common practice. The notion of preventive intervention as it relates to low social engagement is important. Larger studies that include a wait-list control group and typically developing control group may help elucidate the necessary components of early identification and intervention methods in infancy, especially as they relate to community practice. At this point in time, most professionals believe that intervention in infancy for at-risk infants and infants with low social engagement is important (Dawson, 2008).

This study may have implications for identification and intervention for very early signs of social disabilities, such as autism. The specific social concerns present in these infants were consistent with research reporting early signs of autism in infants less than 12 months of age. Social orienting has been hypothesized as one of the earliest social impairments in the development of autism (Dawson et al., 2004; Mundy & Neal, 2001) that could generate later deficits in attending to and processing relevant cues from the social environment (Bradshaw, Shic, & Chawarska, 2010; Chawarska, Macari, & Shic, 2012; Shic, Bradshaw, Klin, Scassellati, & Chawarska, 2011), suggesting that increasing social engagement in infancy could be pivotal in the treatment of autism. The social motivation hypothesis posits that these social orienting deficits are due to a fundamental impairment to assign reward value to social features in the environment (Dawson, 2008). In this case, if social interactions do not hold a high reward value, attention to social stimuli will consequentially decrease, leading to further impairments in language and communication. In addition, through a transactional process, parents might cease attempts to engage their child socially due to a lack of child interest, thus further decreasing the opportunities for an infant or toddler to engage in social interaction. This research seeks to address how to change this cascading developmental trajectory that could lead to a severe social impairment.

The treatment used in this study employed a strength-based positive behavior approach (Cosden, Koegel, Koegel, Greenwell, & Klein, 2006; Steiner, 2011) by taking advantage of the very limited positive social behaviors exhibited by each infant. It incorporated the procedural mechanisms in empirically validated naturalistic interventions for autism used to increase social motivation (Koegel & Koegel, 2012) into the context of positive parent–infant interactions.

Although it is rare that children are referred at such young ages, we feel these results suggest a promising research avenue for assessment and intervention for infants that exhibit early impairments in social engagement and other potential behavioral markers of ASD. Considering the significant and challenging effects having a child with a disability has on a family, additional research on very early signs and interventions in the first year of life is warranted, and is likely to yield exciting results.

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