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Functional Training for Initiating Joint Attention in Children with Autism

Nozomi Naoi^{*1*2}, Ritsu Tsuchiya^{*3}, Jun-ichi Yamamoto^{*1*2}, and Katsuki Nakamura^{*4}

^{*1} Department of Psychology, Keio University, 2-15-45 Mita, Minato-ku, Tokyo 108-8345,

Japan

^{*2} Japan Agency of Science and Technology, 4-1-8 Honcho, Kawaguchi, Saitama 332-0012,

Japan

^{*3} Chiba Prefecture Autism Support Center, 2-9-3 Inohana, Chuo-ku, Chiba 260-0856, Japan

^{*4} National Institute of Neuroscience, National Center of Neurology and Psychiatry, 4-1-1

Ogawa-Higashi, Kodaira, Tokyo 187-8502, Japan

Correspondence concerning this article should be addressed to Nozomi, Naoi, Department of

Psychology, Keio University, Mita Toho bldg 8F 3-1-7, Mita, Minatoku, Tokyo 108-0073,

Japan. Email: nnaoi@psy.flet.keio.ac.jp, Telephone: 81-3-5427-1156, Fax: 81-3-5427-1209.

Abstract

The present study aimed to examine the controlling variables for initiating joint attention (IJA) in three children with autism. During the baseline, target objects were presented in a location where the child could see them, but the adult could not, and the emergence of IJA was assessed. Children with autism showed some IJA skills during the baseline, but none initiated pointing. In training, the motivating operation for IJA was manipulated by using each child's preferred materials as targets of joint attention. It was found that more frequent and functional joint attention behaviors were emitted following training. The present study suggests that difficulties in IJA in children with autism could be partly explained by restricted interests in children with autism.

Key Words: children with autism, initiating joint attention, motivating operation, pointing

Functional Training For Initiating Joint Attention in Children with Autism

Joint attention is broadly defined as the coordinated and shared attention between two individuals directed at an object or event (Bakeman & Adamson, 1984; Scaife & Bruner, 1975; Tomasello, 1995). Joint attention behaviors can be divided into two classes: *Responding to Joint Attention* (RJA) bids and skills in *Initiating Joint Attention* (IJA) (Mundy, Hogan, & Doehring, 1996; Seibert, Hogan, & Mundy, 1982). RJA is a child's response to another individual's attempts at initiating joint attention, such as pointing, turning their head, or shifting their gaze. IJA can be defined as a child's use of joint attention bids, either combined or alone, including making eye contact, gaze shifting, pointing, and commenting, to initiate coordinated attention with another individual (Franco & Butterworth, 1996; Mundy, et al., 1996; Seibert, et al., 1982).

Developmentally, IJA using gaze shift and/or pointing are expected to appear around 9 to 12 months (Bakeman & Adamson, 1984). Adamson and McArthur (1995) referred to the early phase of joint attention as *Supported Joint Attention* (SJA), because during its development, joint attention between a child and a caregiver is mainly supported and maintained by the child's caregiver. (Liszkowski, Carpenter, Henning, Striano, & Tomasello,

2004; Oyabu, 2000).

After 12 months of age, infants emit gaze shifts without adult support. As development progresses, the child eventually emits various combinations of joint attention behaviors such as gaze shifting, pointing, and verbalizing (Oyabu, 2004; Seibert, Hogan, & Mundy, 1987; Tomasello, 1995).

To date, a number of studies have reported that children with autism are impaired in both RJA and IJA (Leekam, Baron-Cohen, Perrett, Milders, & Brown, 1997; Leekam, Hunnisett, & Moore, 1998; Loveland & Landry, 1986; Mundy, Sigman, & Kasari, 1994; Mundy, Sigman, Ungerer, & Sherman, 1986; Warreyn, Roeyers, Oelbrandt, & De Groote, 2005). Similar results have been found in a series of studies using the Early Social Communication Scales (ESCS; Seibert, Hogan & Mundy, 1982; Mundy, Hogan, & Doehring, 1996), a videotaped structured observation measure that allows the observer to quantify joint attention behavior. In the ESCS, IJA can be assessed in a setting such that a wind-up mechanical toy is activated in front of and out of reach of the child. Mundy, Sigman, and Kasari (1990; 1994) found that children with autism performed significantly worse on the ESCS when compared to either a typical developmental group, or a clinical control group. IJA deficits have been found to be much more severe and chronic than RJA deficits

(MacDonald, Anderson, Dube, Geckeler, Green, Holcomb, Mansfield, & Sanchez, 2006; Mundy et al., 1994; Whalen & Schreibman, 2003). It is surprising that many children with autism demonstrate IJA deficits, as they are able to use the very same behaviors, such as gaze shifting and pointing, to request an object or event.

Although researchers have clearly demonstrated that children with autism have IJA deficits, the underlying reason for this difficulty remains unclear. Several possible mechanisms for IJA deficits in children with autism have been proposed, including the impairment of a shared attention mechanism, triadic representation, and affect sharing (Baron-Cohen, 1995; Kasari, Sigman, Mundy, & Yirmiya, 1990). However, because mechanisms such as “affect sharing” cannot be objectively observed and recorded behaviorally, it is difficult to assess and intervene in these skills in children with autism.

Recently, joint attention behaviors have been targeted directly in early intervention programs for children with autism (Kasari, Freeman, & Paparella, 2001; 2006; Whalen & Schreibman, 2003). Whalen and Schreibman (2003) examined the effects of a *naturalistic behavior modification procedure* on acquisition of both RJA and IJA in children with autism. During IJA training, gaze shifting and “protodeclarative” pointing were trained using prompts (physical, gestural and verbal) and both positive and negative reinforcement; the child was

allowed to keep a toy they were playing with when they initiated a gaze shift or pointed, but the toy was removed when the child did not initiate these behaviors. In a similar fashion, Kasari, et al. (2006) used a naturalistic milieu based approach in which prompts and positive reinforcement were used to teach gaze shifting between an adult and a toy, as well as the behaviors of showing, giving, and pointing, to demonstrate coordinated interest to children with autism.

Taken together, the above studies (Kasari et al., 2006. Whalen & Schreibman, 2003) demonstrate that behaviors such as gaze shifting between the social partner and the object, and pointing toward the object can be learned effectively, and that the targeted behaviors generalize to unstructured settings. Thus, these behaviors would eventually be controlled by more natural reinforcers such as verbal praise. However, few studies have fully examined the function of learned behaviors such as gaze shifts and pointing. Antecedent events other than the discriminative stimuli such as events or contextual variables also influence the occurrence of IJA behaviors. Behaviors related to joint attention are also used to request objects or events. In previous studies, initiation of behavior such as a gaze shift and pointing were trained by external positive or negative reinforcement, and it is possible that the child's gaze shift and pointing had imperative rather than declarative function.

To address this shortcoming, Dube, MacDonald, Mansfield, Holcomb, and Ahearn (2004) proposed that intervention targeting IJA deficits in children with autism should not focus only on the topography of the response but on its function. In their behavioral interpretive analysis of IJA, Dube et al. (2004) described discriminative and reinforcing functions of specific classes of stimuli related to IJA as summarized below.

In an environmental context, the presence of a familiar adult is recognizable as an *Establishing Operation* (EO; Michael, 1982; 1993) or *Motivating Operation* (MO; Laraway, Snyckerski, Michael, & Poling, 2003). The EO/MO increases or decreases the reinforcing value of consequences (reinforcer-establishing effect) and the frequency of behaviors previously associated with consequences (evocative effect). For example, a child seldom initiates joint attention behaviors regarding something seen from a train window to an unknown fellow passenger. Rather, the child tends to initiate joint attention with their parents.

Possible antecedents of joint attention behaviors such as a gaze shift include the onset of an “interesting event” (Dube et al., 2004). The interesting event is also recognizable as an MO. For example, a child is more likely to initiate joint attention when they look at an airplane that has suddenly appeared than when looking at furniture in the living room. Furthermore, one child may initiate joint attention more when viewing a fire engine than

when viewing an airplane, and another child may initiate joint attention more in response to the characters of an animated movie than to trains; that is, children's interests vary, and the frequency of IJA increases as the degree of interest increases.

As well, when a child's gaze shifts between the event of interest and a familiar adult, the child might immediately be reinforced by the adult attending to the events. Dube et al. (2004) termed visual indicators that the adult is attending to the event, such as having their eyes open, *adult-attending stimuli*. In addition, adult-attending stimuli also function as discriminative stimuli, increasing the likelihood for adult-mediated interactions between the child and the adult focused on objects or events. *Adult-mediated consequences* involve the adult attending to the stimuli and producing subsequent event-related stimuli. For example, an adult looks at a picture and comments about it to the child. These adult-mediated consequences may serve to maintain IJA behaviors. Accordingly, Dube et al. (2004) proposed that IJA deficits in children with autism may result from one or more failures of a) adult-attending stimuli to function as discriminative stimuli, b) adult-attending stimuli to function as conditioned reinforcers, or c) adult-mediated interactions to function as conditioned reinforcers. In addition, they proposed the need for analysis of an interesting event as an MO. Thus, it is possible that both the reinforcing value of adult-attending stimuli

and the frequency of IJA behaviors previously associated with adult-attending stimuli would increase when the antecedent events are of heightened interest to the child.

The purpose of the present study was to examine these possible controlling variables including adult-attending stimuli, adult-mediated consequences, and events or contextual variables for functional IJA behaviors in children with autism. A functional analytic approach of joint attention based on behavioral analysis was employed in an effort to identify the mechanism underlying IJA deficits in children with autism, allowing for the development of an effective procedure for treating these deficits.

1. Method

1.1. Participants

Three Japanese children with autism (two boys and one girl) participated in the present study. All three children met the DSM-IV criteria (DSM-IV; American Psychiatric Association, 1994) for autistic disorder, diagnosed either by a pediatrician or psychologist independent of our laboratory. Prior to the study, all participants were assessed with the Kyoto Scale of Psychological Development 2001 (KSPD; Ikuzawa, Matsushita, & Nakase,

2002), a standardized scale measuring development and adaptive skills. In Japan, the KSPD is commonly administered to typically developing infants and low functioning children with autism. We used the standard scores of the Language-Sociability subscale (LS) as a measure of verbal mental age (vMA).

Ken (7 years 5 months) was enrolled in a public special education school. His KSPD (Ikuzawa et al., 2002) score yielded a vMA of 1 year 11 months. He had not produced a vocal imitation until he was 6 years old. At the time of the study he could partly imitate the experimenter's verbal model using single or multiple syllables, but he had little spontaneous or functional speech. Ken's preferred activities were watching animated children's videos and listening to children songs.

Tsutomu (4 years 11 months) was enrolled in a private nursery school and had a vMA of 3 years 5 months. He first emitted verbal responses when he was 3 years old. His expressive speech was often unclear, and he frequently produced jargon, rarely spontaneously speaking to communicate without an adult prompting him. He exhibited preferences for tropical fish, Chinese characters, animated TV characters, and flags of various nations.

Kyoko (7 years 11 months) was enrolled in a public special education school and had a vMA of 1 year 6 months. She had learned to imitate body movements, but showed no

receptive labels and had no intelligible speech. She made requests by clapping her hands twice, using picture cards, and/or vocalizing an “a” or “ba” sound, which was in her vocal repertoire. She exhibited a strong preference for certain advertisements for household goods and animated TV characters.

As evaluated by the first and third authors, all three of children were considered to be in the severe autistic range (mean 48; range: 41 to 53) according to the criteria of the Childhood Autism Rating Scale (CARS; Schopler, Reichler, & Renner, 1988).

1.2. Materials

During baseline, stimuli consisted of different hand puppets and stuffed animals (six in total) that were paired with one of two kinds of sound toys (a maraca or a baby rattle). During the training phase, stimuli consisted of each child’s preferred objects, such as animated characters, Chinese characters, and animals, depicted on posters (A4 size) with disposable wooden chopsticks (24 cm) used as a handle. These training stimuli were selected on the basis of interviews with the children’s parents and the periodic informal assessments conducted during each session.

1.3. Setting

The baseline, training phase, probe tests, and follow-up took place in a 4.5×3.5 m

room in a university-based laboratory. In the room there was a small table, two chairs, various toys, and a one-way observation mirror. The child was seated in a chair, and on the table there were preferred toys that had been previously mastered, such as a puzzle. The preferred toys were chosen using the periodic informal assessments to ensure that the child would be motivated to play with them. The first experimenter (E1) sat facing the child and the second experimenter (E2) was hidden behind a screen (0.9×1.8 m) positioned 1.5 m behind E1. During all trial types, E2 presented different stimuli to the right or left side of the screen (see Figure 1).

Fig. 1 should be inserted about here

1.4. Procedure

Before the start of the experiment, basic training in sitting still was conducted. In addition, an opportunity was provided for each child to interact with the experimenter before the experiment started. A baseline was used for assessing IJA and SJA. The presentation or removal of toys with which the child was playing was never contingent on their behavior during the IJA or SJA baseline measurement.

1.4.1. Baseline: IJA condition.

A multiple-baseline design across subjects was implemented to evaluate intervention effects. The number of baseline sessions varied from two (Ken) to four (Kyoko). During the baseline period, each child's ability to initiate joint attention was assessed by two experimenters. E1 played the role of social partner and sat on her knees facing to the child, such that she was approximately at the child's eye level, 40 cm away from them (Figure 1). The child sat in a chair and engaged in their preferred activity alone. E1 occasionally talked to the child and helped them with the activity as needed, without placing any demands on the child as they freely accessed toys. A trial began when E2, presented a stimulus to the right or left of the screen that was hiding them from view. E1 remained silent and waited approximately 10 s to determine whether the child would initiate joint attention to the presented object.

1.4.2. Baseline: SJA condition.

The child's baseline response to adult-supported joint attention episodes was assessed immediately following IJA condition. During the SJA condition, E1 repeatedly looked back and forth between the target and the child's face and pointed up to three times to attract the child's attention to the target, while talking excitedly about the target for approximately 10 s

(e.g., ‘Ah!’, ‘That’ s a rabbit!’). The child’s response to the adult-supported joint attention episodes was observed for 10 s. After 10 s had elapsed, E1 said “ bye-bye” to the target stimulus and E2 hid the stimuli behind the screen. E1 interacted with the child by smiling, giving verbal praise, and touching, regardless of the child’s behavior. Then, E1 encouraged the child to return to playing with the toy on the desk. After the child started to play with the toy, the next trial began. A total of 6 trials were presented, with 3 trials to each side, the order of which was counterbalanced.

1.4.3. Training

The setting was identical to that used during the baseline period. In training, antecedent events were manipulated and each child’s preferred materials were presented as the joint attention targets instead of the stuffed animals or hand puppets and associated sound toys presented during the baseline. E1 remained silent and waited approximately 10 s to allow the child to initiate joint attention to the presented object. However, when the child initiated a gaze shift and/or pointed within 10 s of the target presentation, E1 immediately responded to the child by repeatedly looking back and forth between the target and the child’s face, pointing to the target, and talking excitedly about the target for approximately 10 s, as in the SJA baseline. Even when the child did not initiate any joint attention behaviors, no extrinsic

(positive or negative) reinforcers (e.g. toy removal) were provided. When 10 s had elapsed, E1 responded to the child as in the SJA baseline, regardless of the child's behavior. The remaining procedures were identical to the baseline. After 10 s had elapsed, E1 said "bye-bye" to the target, which E2 hid behind the screen. E1 interacted with the child by smiling, giving verbal praise, and touching, regardless of the child's behavior, and then encouraged the child to play with the toy on the desk again. When the child started to play with the toy, the next trial began. A total of 6 trials were presented, with 3 trials to each side, the order of which was counterbalanced. When the child produced IJA behaviors within 10 s of the target presentation in 5 out of 6 trials in more than two consecutive sessions, probes trials were performed.

1.4.4. Generalization probes

During the generalization probes, there was a time delay as in the IJA baseline; E1 ignored the target for 10 s after the onset of the stimulus presentation. During Probe I (PR I), the stimuli used in the training were also presented. During Probe II (PR II), as in the baseline sessions, the stimuli from the baseline (stuffed animals and hand puppets with their associated sound toys) were presented to check for generalization to untrained, nonpreferred stimuli. Each session was composed of 3 trials each to the right and left sides in a

counterbalanced order for a total of 6 trials.

1.4.5. Two-month follow-up

A follow-up assessment was conducted two-month following the completion of the training. The setting and the procedure for the follow-up assessment were identical to PRI and PR II. During Follow-up I (FU I), each child's preferred stimuli were used as the joint attention targets. During Follow-up II (FU II), the baseline stimuli were presented. Each session was composed of 3 trials each to the right and left sides in a counterbalanced order for a total of 6 trials.

1.5. Dependent measures and data collection

Sessions were videotaped for behavioral coding. The selection of IJA behaviors was determined by examination of the behaviors in typically developing infants (e.g. ESCS) and our exploratory study on IJA in children with autism (Naoi, 2004). The major variables of interest in this study included frequency of initiation of joint attention behaviors during 10 s after the onset of the stimulus presentation. Responses were scored if they occurred during the object presentation period.

Because we focused on the function rather than the form of joint attention behaviors, joint attention initiation was coded whenever the child emitted any of the IJA behaviors

described below.

1) Gaze shift (G): the child alternately looked from the target object to E1's eyes during the object presentation period. The child had to shift their gaze from the target to E1's eyes, and then to the target again for this to be coded. 2) Pointing (P): the child extended their arm and index finger in the direction of the target object, though this was also coded when the articulation of the index finger was not clear. Instances of pointing gestures without a referent and pointing to objects or events other than target objects, such as toys on the desk, were not counted. 3) Physical interaction (PI): the child used their hands to move the adult's body. For example, touching the adult's hand, grabbing the index finger of the adult's hand and directing it toward the target, turning the adult's face toward the target, and patting the shoulder of the adult, were all coded as PI. This response has not been included in previous studies related to joint attention. However, our exploratory study (Naoi, 2004) demonstrated that many children with autism physically use an adult's hands not only to attain objects, but also to initiate social interaction (e.g. reading picture books). 4) Vocal response (V): the child vocalized in response to the presentation of the target. Delayed echolalia and jargon unrelated to the target presentation were not coded. 5) Any combinations of 1-4: When two or more of the IJA behaviors described above were emitted simultaneously, the observed combination

was recorded (e.g. if the child shifted their gaze while pointing to the target, the response was coded as “G+P”). Successive IJA responses were coded as two distinct behaviors.

Occurrence of each IJA category was scored on a per trial basis, and the percentage of trials with any IJA behaviors, averaged across 6 trials, was calculated. The looking response to the target object was also coded when the child fixated on the target for more than 3 s to determine whether the child was observing the target during each trial. In addition, behaviors indicating positive affect, such as smiling or laughing, were also measured and analyzed as dependent variables. The percentage of trials with displays of positive affect was calculated for each session.

1.6. Social validity

To determine the social significance of the intervention, video clips of six typically developing children and the three participants with autism at the first baseline session (pre-treatment) or PR I (post-treatment) were shown to 16 undergraduate and graduate psychology students who were unfamiliar with the purpose of the study. Six typical children (3 boys and 3 were girls; aged between 18 and 42 months, mean age 29 months) were recruited from advertisements placed in local nurseries. Typically developing children were matched groupwise by ensuring that chronological age (CA) of typically developing children

roughly matched vMA of children with autism. None of the children had a history of autism or other developmental disorders. At the time of recruitment, all participants were assessed by KSPD to check that they had no physical, cognitive, or language delays. Raters were told that some of the children they were watching may have been diagnosed with autism. Eight of the psychology students rated six typically developing children and the three children with autism at pre-treatment, and the remaining 8 students rated the same six typically developing children and the three children with autism at post-treatment. The order of presentation of the video clips was random, and the raters were blinded to the conditions. Eight items (see Table 1) were rated on a 5-point Likert-type scale ranging from 1 (*disagree completely*), to 5 (*agree completely*) with 3 indicating *neither agree nor disagree*. The order of items was randomized when presented to the raters. In addition, the psychology students were asked to rate how autistic they thought each child was using a 5-point Likert-type scale ranging from 1 (*completely typical*) to 5 (*completely autistic*). A two-way of variance (ANOVA) for each item to determine differences in ratings for children with autism and typically developing children at pre- and post-treatment.

Table 1 should be inserted about here

1.7. Reliability

Inter-observer reliability was obtained for 31% of all sessions, selected randomly from the baseline, training, probes, and follow-up. The first author and an independent coder, who was blind to the experimental conditions, coded the videotaped sessions for occurrences of the child looking at the target object, IJA responses, and displays of positive affect. Cohen's kappa (the percentage agreement corrected for chance) was .95 for looking at the target, .94 for IJA responses, and .85 for displays of positive affect, with all results indicating high level of inter-rater agreement.

2. Results

Performance is shown separately for each of the three children with autism during baseline, training, probe tests, and follow-up in Figure 2.

2.1. *Baseline*

During the baseline assessment, none of the participants sufficiently initiated joint attention within 10 s of the target presentation (IJA condition). The mean percentage of trials demonstrating IJA in the baseline period averaged 33% for Ken, 4% for Kyoko and 0% for Tsutomu. Ken's response involved touching and shaking the hands of E1 (physical interaction), gaze shifting, and vocal responses. Kyoko touched the hands of E1 and made a vocal response. No children pointed or produced combinations of a gaze shift with and other simultaneous IJA behaviors. The SJA condition had the higher frequency of IJA behaviors, than was seen in the IJA condition.

As shown in Figure 3, the response of looking at the target was unstable during the baseline period for Tsutomu and Kyoko, even when the target objects were presented with sound toys. The SJA condition had the higher frequency of looking responses directed toward the target, than was seen in the IJA condition.

2.2 *Training*

With the onset of training, all participants exhibited increases in their IJA behaviors (Figure 2). During training, all three children pointed without direct training. In addition, Ken and Tsutomu emitted combinations of IJA behaviors including G+V, G+P, V+PI, V+P, and

G+V+P, without direct training.

Ken required 28 sessions and Tsutomu required 11 sessions to complete the training.

Kyoko emitted pointing without direct training; however, she did not increase her IJA responses over 5 training sessions and demonstrated an unstable IJA pattern. Thus, modeling was used to teach her to point. When she did not initiate a gaze shift and/or pointed within 10 s of the target presentation, but she looked at the target for more than 3 s or looked twice at the target within 10 s, the second experimenter who sat behind the child modeled pointing to the stimuli and made the vocal response “ah!” When the child initiated any IJA behaviors within 10 s of the target presentation, no prompt was given to the child. Kyoko subsequently met the training criterion after 7 sessions.

In addition, although percentage of trials with positive affect varied across trials, positive affect was shown relatively more frequently in training than in baseline (Figure 4).

2.3. Probe trials

In PR I, Ken demonstrated IJA behaviors in 100% of the trials, with a combination of IJA behaviors (G+V+PI) emitted for the first time. Tsutomu also demonstrated IJA behaviors in 100% of the PRI trials and emitted combinations of IJA behaviors (G+PI and G+V+P) for the first time. Kyoko was able to demonstrate IJA behaviors during 67% of the PRI trials. She

emitted a combination of V+P.

In PR II, Ken produced gaze shifts in 17% of the trials, but no other IJA responses. Tsutomu demonstrated IJA behaviors in 33% of the trials including only vocal responses. Consistent with her PR I result, Kyoko demonstrated IJA behaviors in 67% of the trials. She emitted a combination of V+P.

When compared to their responses in PR I, Ken and Tsutomu showed decreased IJA behaviors when the baseline stimuli were again presented in PR II, while Tsutomu and Kyoko showed increased IJA responses in PR II compared to their initial responses to the baseline items.

2.4. Two-month follow-up

At the two-month follow-up, Ken demonstrated IJA behaviors in 67 % of the trials including gaze shifting, vocal response, and combinations of G+V and G+V+P when the child's preferred stimuli were presented (FU I in Figure 2) and demonstrated IJA behaviors in 83 % of the trials including only gaze shifting when the child's nonpreferred baseline stimuli were presented (FU II in Figure 2). Tsutomu demonstrated IJA behaviors in 83 % of the trials including physical interaction, gaze shifting, pointing and vocal response in FU I and demonstrated IJA behaviors in 67 % of the trials including physical interaction, pointing,

vocal response, and combination of V+P in FU II. Kyoko demonstrated IJA behaviors in 50 % of the trials including pointing in FU I and demonstrated IJA behaviors in 33 % of the trials including pointing in FU II. Although all three children demonstrated decline in response to the preferred stimuli at follow-up when compared to their first performance in PR I, their IJA behaviors were maintained higher at follow-up than baseline and two of the three children showed increased IJA responses to the baseline items at follow-up.

Fig. 2 should be inserted about here

Fig. 3 should be inserted about here

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2.5. Social Validity

Table 2 presents the results for the ratings designed to measure social validity. A two-way ANOVA with Group (children with autism/typically developing children) and Rater (pre/post) for each rating item revealed that significant interaction effects of Group and Rater were found for Q 1 ($F(1) = 15.98, p < 0.001$), Q2 ($F(1) = 30.84, p < 0.001$), Q3 ($F(1) = 8.10, p = 0.0051$), Q5 ($F(1) = 30.53, p < 0.001$), Q6 ($F(1) = 52.42, p < 0.001$), Q7 ($F(1) = 47.25, p < 0.001$), Q8 ($F(1) = 18.08, p < 0.001$). Post-hoc Bonferroni tests indicated that ratings of both group differed significantly at pre-treatment but not in post-treatment (Q1, Q2, Q3, Q5, Q6, and Q7, $p < 0.001$; Q3, $p < 0.01$). For scores of Q4 (The child wants to get a target object), only the main effect of Group was significant ($F(1) = 4.65, p < 0.05$) and children with autism were rated less than typically developing children. Finally, the three children with autism at post-treatment were rated as less autistic than at pre-treatment, however, post-hoc Bonferroni tests indicated that ratings of both group differed significantly at both

pre- and post-treatment (both $p < 0.001$).

Table 2 should be inserted about here

3. Discussion

The purpose of the present study was to examine the variables controlling functional IJA responses in children with autism. Prior to training, all three children diagnosed with autism showed deficient levels of IJA behaviors. The children's initial IJA responses involved touching and shaking the hands of the adult, gaze shifts between the target and the adult, and vocal responses. In addition, although this response was not included in the coding, all three children were observed using their feet to push against the experimenter. Thus, the results of the present study suggest that physical contact with the adult's body to initiate joint attention is shown in the early development of IJA skills in children with autism. By applying the treatment procedure, more frequent and higher-level joint attention behaviors emerged; all three children emitted pointing and combined IJA behaviors without direct teaching to do so.

In addition to progression of IJA behaviors described above, the level of support offered by the adult present affected the frequency of IJA behaviors. In the supported condition, the children increasingly looked at the object and initiated joint attention behaviors, as compared to the unsupported condition. This finding revealed that IJA behaviors were already part of the children's repertoires, though they did not initiate these behaviors spontaneously without the adult's support. The finding of better performance in the supported condition than in the independent condition suggested that the underlying reason for IJA deficits in at least some children with autism cannot be accounted for by the failure of adult-attending stimuli to function as discriminative stimuli and conditioned reinforcers, or the failure of adult-mediated interactions to function as conditioned reinforcers.

As noted above, all three children demonstrated an increased percentage of combined IJA behaviors. This increase was particularly evident when the time delay procedure was implemented. It is thought that children use combined IJA behaviors to increase the opportunities for adults to respond and attend to them, as compared to using only a gaze shift. However, it is quite difficult to teach these combined behaviors with physical prompting and modeling. Thus, the training procedure used in the present study is particularly noteworthy due to its effectiveness in establishing combined IJA behaviors without direct training.

Also significant was that two of the three children demonstrated a decline in IJA when untrained, rather than their preferred objects were used as stimuli. This finding suggests that IJA deficits in children with autism might be partly under the control of the MO. Typically, in previous studies assessing joint attention in children with autism, the targets have been selected by the researchers, and were sometimes unchanged throughout the experimental sessions (e.g., Carpenter, Pennington, & Rogers, 2002; Leekam, et al., 1998; MacDonald et al., 2006; Whalen & Schreibman, 2003). In these studies, it has been assumed that the targets were interesting enough for children with autism to initiate joint attention. The present results suggest that this may not have been the case. If the target object was not interesting, the antecedent variables would not function as a MO. Therefore, it appears that difficulties in producing IJA responses in children with autism can be partly explained by their restricted interests.

There is a possibility that the participated children initiated gaze shift and/or pointing more to their preferred target items than to the nonpreferred items because participated children wanted to obtain their preferred items more than the nonpreferred items, and for this reason, their seemingly “IJA behaviors” had in fact imperative function. However, the results of the social validity assessment suggested that participated children did not seem to want to

gain the target items.

The present study also assessed whether the children looked at the target in response to its appearance. A difficulty in locating the target object was observed in children with autism. This may be related to the findings that children with autism have difficulty both in engaging and disengaging attention (Harris, Courchesne, & Townsend, 1999; Landry & Bryson, 2004; Townsend & Courchesne, 1994). However, two children in the present study who had difficulty locating the target object during the baseline quickly increased their looking response to the target following treatment. This finding suggests that their failure to locate the target object might not have been caused by a narrow visual field or difficulty disengaging their attention, as their behavior was readily modified by controlling the antecedent stimuli.

All three participants showed more IJA behaviors at two-month follow-up than during baseline, and increases in IJA behaviors in response to initial nonpreferred stimuli were observed for two of the three participants from post-treatment to follow-up. This finding suggests that first teaching IJA using child's preferred items and generalizing it to the nonpreferred items might be effective in children with autism who have restricted interest.

Establishing joint attention as a functional and a generalizable communication skill early in development should increase opportunities for children with autism to process shared

information, and therefore, it might contribute to their subsequent social and language development. Future research is needed to determine whether training aimed at increasing IJA behaviors in younger children with autism might lead to increases in other social and language skills.

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Figure Captions

Table 1. The social validity questionnaire completed by psychology students

Table 2. Results for the social validity ratings

AUT refers to children with autism and TYD refers to typically developing children. 1 = disagree completely, 2 = mostly disagree, 3 = neither agree nor disagree, 4 = mostly agree, and 5 = agree completely. Numbers within parentheses represent standard deviations. ^a Significant main effect of Group (AUT/TYD), ^b Significant main effect of Rater (pre/post), ^c Significant Group (AUT/TYD) by Rater (pre/post) interaction effect.

Figure 1. A schematic diagram of the study room showing the location of the child, the first experimenter, the screen, and the target objects.

E1: the first experimenter.

Figure 2. Each child's performance during baseline, training, and probe trials.

Data points connected by lines reflect the percentage of trials with IJA. Closed triangles represent the results of trials with nonpreferred baseline stimuli and closed circles represent trials with preferred stimuli. Open triangles represent SJA baseline results. Bars represent percentages of each IJA category and their combinations. PR: generalization probes, I: Probe I (trained stimuli & time delay), II: Probe II (untrained stimuli& time delay), FU: two-month follow-up.

Figure 3. Mean percentage of baseline, training, and probe trials with looking response

Data points connected by lines reflect the percentage of trials with looking response. Closed triangles represent the results of trials with nonpreferred baseline stimuli and closed circles represent trials with preferred stimuli. Open triangles represent SJA baseline results. PR: generalization probes, I: Probe I (trained stimuli & time delay), II: Probe II (untrained stimuli& time delay), FU: two-month follow-up.

Figure 4. Mean percentage of baseline, training, and probe trials in which positive affect was observed. Closed triangles represent the results of trials with nonpreferred baseline stimuli and closed circles represent trials with preferred stimuli. Open triangles represent SJA

baseline results. PR: generalization probes, I: Probe I (trained stimuli & time delay), II: Probe II (untrained stimuli& time delay), FU: two-month follow-up.

Figure 1

Figure 2

Figure 3

Figure 4

-
- Q1. The child is unwilling to interact with the adult
 - Q2. The child is frustrated
 - Q3. The child focused attention on a toy on the desk
 - Q4. The child wants to get a target object
 - Q5. The child enjoys watching the videos or picture cards.
 - Q6. The child communicates to the adult what she/he saw spontaneously
 - Q7. The child enjoys interaction with the adult related to the target object
 - Q8. The child wants the adult to look back to the target object
-

Table 2

	AUT		TYD	
	Pre	Post	Pre	Post
Q1 ^{*abc}	4.25(1.11)	2.21(1.14)	2.77(1.37)	2.52(1.29)
Q2 ^{*abc}	3.67(1.34)	1.67(1.01)	1.50(0.92)	1.56(1.03)
Q3 ^{*bc}	4.29(1.16)	2.96(1.27)	3.50(1.17)	3.35(1.16)
Q4 ^{*a}	1.71(1.16)	2.21(1.22)	2.52(1.24)	2.33(1.26)
Q5 ^{*abc}	2.08(1.41)	3.92(0.97)	4.02(1.08)	3.46(1.37)
Q6 ^{*abc}	1.38(0.58)	4.38(0.88)	4.08(1.38)	3.98(1.39)
Q7 ^{*abc}	1.38(0.71)	4.33(0.96)	3.88(1.30)	3.88(1.42)
Q8 ^{*abc}	1.71(1.23)	3.83(1.09)	3.23(1.36)	3.35(1.45)
Autistic ^{*ac}	4.33(0.82)	3.33(1.40)	2.02(1.12)	2.23(1.31)